Sun Enterprise™

3500–6500 Servers

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Sun Enterprise™ 3500–6500 Server Positioning

Product Overview

The Sun Enterprise™ server family is ideally suited for mission-critical network computing environments. Family members range from the entry-level Sun Enterprise Ultra™ 5S workgroup server up to the mainframe-class Sun Enterprise 10000 server. This document focuses on the Sun Enterprise 3500–6500 servers. These servers represent the next generation of the popular Sun Enterprise 3000–6000 servers, which have been enhanced in the following areas:

• System expandability

• Improved availability for internal disks

• Higher datacenter storage density

• Improved availability with Dynamic Reconfiguration and Alternate Pathing

• Improved investment protection for the Sun Enterprise 3500–5500 with the enhanced Gigaplane™ system interconnect

Product Line Enhancements in Sun Enterprise 3500–6500 Servers

Enhanced Gigaplane™ System Interconnect

All of the Sun Enterprise 3500–6500 servers include a revised Gigaplane system interconnect. The Sun Enterprise 3000–6000 server Gigaplane bus has a maximum speed of 84 MHz. This bus is sufficient to support the UltraSPARC™ processors running at up to 336 MHz when operating with a 4:1 processor-to-Gigaplane speed ratio. The enhanced Gigaplane system bus on the Sun Enterprise 3500–5500 servers is capable of running up to 100 MHz, delivering a throughput of 3.2 GB per second. The Gigaplane system bus must run at 100 MHz in order to support the new 400-MHz UltraSPARC processor with 4 MB of external cache, without changing the processor-to-Gigaplane speed ratio. This new 400-MHz/4-MB processor is supported on the Sun Enterprise 3500–5500. The Gigaplane on the Sun Enterprise 6500 server cannot run at 100 MHz and therefore does not support this 400-MHz/4-MB processor. The maximum Gigaplane speed on the Sun Enterprise 6500 will remain at 84 MHz. Please note, however, that a future UltraSPARC processor which runs faster than 336 MHz will be available for the Sun Enterprise 6500 as well as the Sun Enterprise 6000 servers. Please see the "System Architecture" section for further details regarding the enhanced Gigaplane system interconnect.

New System Boards

New system boards (CPU/memory boards, SBus I/O boards, Graphics I/O boards, and PCI I/O boards) are available to support the Sun Enterprise 3500–6500 servers. These boards are designed to support the enhanced Gigaplane system bus. In addition, the on-board fibre channel sockets on the Graphics I/O board have been modified to support 100-MB-per-second Fibre Channel Arbitrated Loop (FC-AL) connectivity. These systems boards may also be used in the Sun Enterprise 3000–6000 servers. Please see the "CPU/Memory Board" and "I/O Board" sections for further details.

Availability of Sun Elite3D m6 and Creator3D series 3 Graphics Support

The high-performance graphics previously available in the Ultra workstations is now available for the Sun Enterprise 3500–6500 workstations. These products address the graphics market requirements for the superworkstation to technical server segments. In Sun Enterprise servers, the product is targeted at users who need the high-performance compute, memory, I/O, and other server support features. These users need more—more graphics, more CPUs, more I/O, more disk—to get their jobs done.

New Disk Board

The 4.2-GB disk board used on the Sun Enterprise 4000–6000 servers has been replaced by an 8.4-GB disk board. This disk board may be used in the Sun Enterprise 4500–6500 servers as well as the Sun Enterprise 4000–6000 servers.

Faster CD-ROM

All of the Sun Enterprise 3500–6500 servers include a new internal Sun StorEdge™ CD32 drive. These 32X CD-ROM drives (the drive reads information 32 times as fast as a music CD) are faster than the 12X CD-ROM drives that were included with the Sun Enterprise 3000–6000 servers.

Dynamic Reconfiguration

Dynamic Reconfiguration (DR) is the ability to alter the configuration of a running system by bringing components online or taking them offline without disrupting system operation or requiring a system reboot. With the availability of Dynamic Reconfiguration, system boards can be logically and physically included into the system configuration, or logically deactivated and removed while the system is running.

Dynamic Reconfiguration for I/O boards is available for Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers with Solaris™ 2.6 Hardware: 5/98 and Dynamic Reconfiguration for CPU/memory boards is expected to be available with a future version of the Solaris Operating Environment™ in the first half of calendar year 1999. Please refer to the "Reliability, Availability, and Serviceability" section for more details on Dynamic Reconfiguration.

Alternate Pathing

Alternate Pathing (AP) is an extension of Dynamic Reconfiguration. It allows dynamic reconfiguration of the I/O boards without disrupting the network or external storage connection. Alternate Pathing increases overall system availability by maintaining crucial network and storage access for mission-critical environments. As with Dynamic Reconfiguration, the Alternate Pathing feature has previously been available on the Sun Enterprise 10000 server platform. These features are currently unavailable on any other general purpose UNIX® platform.

Alternate Pathing is available for Sun Enterprise 3000–6000 server and Sun Enterprise 3500–6500 servers with Solaris 2.6 Hardware: 5/98. Please refer to the "Reliability, Availability, and Serviceability" section for more details on Alternate Pathing.

Product Platform-Specific Enhancements

Sun Enterprise 3500 Server

- **Additional System Slot:**

  The Sun Enterprise 3500 server is an enhanced Sun Enterprise 3000 server with an additional system slot. The Sun Enterprise 3500 server supports five system boards and can, therefore, support up to eight UltraSPARC processors and 8 GB of memory, whereas the Sun Enterprise 3000 server accommodates four system boards with a maximum of six processors and 6 GB of memory. Alternatively, the additional system slot can be used to provide greater I/O connectivity.

- **Internal FC-AL Drives:**

  The Sun Enterprise 3500 server has two internal disk banks (four disks per disk bank) that support up to eight 9.1-GB FC-AL disks, each with dual port connections, while the Sun Enterprise 3000 server supports ten internal SCSI disks with a single connection. The number of internal disks supported in the Sun Enterprise 3500 server was reduced in order to provide room for the additional system slot in the rear of the server. The newer drives, however, provide greater throughput and can be configured to increase the disk redundancy when compared to the Sun Enterprise 3000 server. Please see the "Sun Enterprise 3500 System Cabinet" section for further details.

Sun Enterprise 4500 Server

The only differences from the current Sun Enterprise 4000 server are the enhanced Gigaplane system bus and the faster 32X CD-ROM mentioned in the "Product Line Enhancements" above.

Sun Enterprise 5500 Server

In addition to the faster Gigaplane system bus and 32X CD-ROM changes, the Sun Enterprise 5500 server is now housed in a taller, data center cabinet. The new cabinet is 68 inches tall, compared to 56 inches for the Sun Enterprise 5000 cabinet. The taller cabinet was designed to support additional storage devices such as an additional Sun StorEdge A5X00 array without increasing the system footprint. The width and depth of the new data center cabinet remain the same as the Sun Enterprise 5000 cabinet.

Sun Enterprise 6500 Server

As with the Sun Enterprise 5500 server, the Sun Enterprise 6500 server includes the 32X CD-ROM and is also housed in a new, 68-inch data center cabinet, compared to 56 inches for the Sun Enterprise 6000 cabinet. As indicated earlier, the Gigaplane system bus on the Sun Enterprise 6500, unlike the Sun Enterprise 3500–5500 servers, does not run faster than 84 MHz.

Key Messages

The Sun Enterprise servers offer excellent performance, reliability, availability, and serviceability (RAS), along with expandability, investment protection, and upgradability (Performance excellence can be substantiated by comparing Sun Enterprise 6500 SPECint-rate95, SPECfp_rate95, and TPC-C results to competitive systems from HP, IBM, and DEC /Compaq).

- **Performance**

  The Sun Enterprise 3500–6500 servers share a common architecture that is designed to offer balanced system performance. The systems feature outstanding integer and floating-point performance, supporting up to thirty UltraSPARC modules in the Sun Enterprise 6500 server. The system interconnect, the Gigaplane bus, delivers 2.68-GB-per-second throughput at 84 MHz and 3.2-GB-per-second at 100 MHz. High-speed networking is supported with integrated 10/100 Mb Ethernet and optional FDDI, ISDN, Token Ring, and ATM interfaces. Fast I/O capability is supported through either 64-bit/25 MHz SBus or 64-bit/66 MHz PCI channels.

- **Reliability, Availability, and Serviceability**

  Extensive RAS capabilities are among the key strengths of the Sun Enterprise 3500–6500 servers. For details on these features, see "Reliability, Availability, and Serviceability" later in this document.

- **Expandability**

  Sun Enterprise 3500–6500 servers can be expanded from small, entry-level configurations to system configurations that handle terabytes of data and thousands of users.

- **Scalability**

  Sun Enterprise 3500–6500 servers are designed as highly modular systems. Customers can easily configure these systems to meet their application requirements by using the appropriate mix of CPU/memory boards and I/O boards. In addition, as their computing or I/O performance needs increase, customers can easily increase the capability of these systems by simply adding UltraSPARC modules, memory modules, or I/O boards. The high-throughput Gigaplane system bus and I/O architecture eliminate system bottlenecks and provide balanced system performance, even in a system with the maximum number of UltraSPARC modules or I/O devices.

- **Investment Protection**

  Virtually all of the components used in the Sun Enterprise 3500–6500 servers are interchangeable. These components include CPU/memory boards, I/O boards, disk boards, UltraSPARC modules, memory modules, power/cooling modules, clock boards, and peripherals. Therefore, when upgrading to a larger system (for example, from a Sun Enterprise 4500 server to a Sun Enterprise 6500 server), customers can move these components from the existing system to the new system, protecting their investment. Even the previous-generation Sun Enterprise 3000–6000 server components can be carried over to the Sun Enterprise 3500–6500 server.

- **Upgradability**

  The modular design of the Sun Enterprise 3500–6500 servers means that upgrading to new technologies and higher performance is easy. These systems are designed to support future generations of UltraSPARC processors, disk arrays, tape devices, and networking interface cards.

Sun Enterprise 3500–6500 Server Key Facts

- Each server can support multiple processors:

Sun Enterprise 3500	Sun Enterprise 4500–5500	Sun Enterprise 6500
1–8	1–14	1–30

- The Sun Enterprise 3500–6500 servers can be ordered with 250-MHz/4-MB or 336-MHz/4-MB UltraSPARC modules.

- The Sun Enterprise 3500–5500 servers can also be ordered with the 400-MHz/4-MB UltraSPARC modules.

- 167-MHz/0.5-MB, 167-MHz/1-MB, and 250-MHz/1-MB UltraSPARC modules are supported when carried over from existing Sun Enterprise 3000–6000 systems.

- The Gigaplane system bus delivers a throughput rate of 2.68 GB per second at 84 MHz (when using the 167-MHz, 250-MHz or 336-MHz processors). This throughput rate increases to 3.2 GB per second when running at 100 MHz (when using the 400-MHz processors in the Sun Enterprise 3500–5500).

- Several boards can be installed in each server:

Sun Enterprise 3500	Sun Enterprise 4500–5500	Sun Enterprise 6500
Up to 5 boards	Up to 8 boards	Up to 16 boards

- Five types of plug-in boards are available:
    - CPU/memory board
    - SBus, Graphics, and PCI I/O boards
    - Disk board (Sun Enterprise 4500, Sun Enterprise 5500, and Sun Enterprise 6500 only)

- CPU/memory boards can support up to two UltraSPARC modules and two memory banks (up to 2 GB).

- CPU/memory boards are hot pluggable. Hot-swap software support (Dynamic Reconfiguration) will be available with an upcoming version of the Solaris 7 Operating Environment.

- The SBus I/O board with FC-AL has three SBus slots, two empty FC-AL sockets, one fast/wide SCSI port, and one 10/100-Mb-per-second Ethernet port. This board has two SBus channels.

- Graphics I/O boards contain two SBus slots, one UPA slot for a Creator3D or Sun Elite3D graphics board, two empty FC-AL sockets, one fast/wide SCSI port, and one 10/100-Mb Ethernet port. This board has one SBus channel.

- PCI I/O boards have two PCI slots, on-board fast/wide SCSI, and 10/100-Mb-per-second Ethernet. This board has two PCI-66 (66-MHz, 64-bit) channels and two standard PCI (33-MHz, 32-bit) channels.

- I/O boards are hot swappable with the Alternate Pathing and Dynamic Reconfiguration software (Solaris 2.6 Hardware: 5/98).

- The 8.4-GB disk board contains two 4.2-GB, 7200-rpm, fast/wide SCSI-2 disk drives.

- The Sun Enterprise 3500–6500 servers support redundant, hot-swappable power/cooling modules.

- The Sun Enterprise 3500–6500 servers run on the following operating environments: Solaris 2.5.1 Hardware: 11/97 (or later), Solaris 2.6 Hardware: 3/98 (or later) or the Solaris 7 Operating Environment.

- Memory options include 256 MB (8 x 32-MB modules) and 1 GB (8 x 128-MB modules).

- Floor brackets may be installed to help prevent the Sun Enterprise 3500, Sun Enterprise 5500, Sun Enterprise 6500 servers, and Sun Enterprise expansion cabinet from shifting in the event of extreme floor movement.

- The Sun Enterprise 4500 may be rack mounted into a Sun Enterprise expansion cabinet or Sun Enterprise 5500 or 6500 system cabinet.
- The Sun StorEdge A5X00 arrays, Sun StorEdge A1000/D1000 disk trays, Sun StorEdge FlexiPack removable storage trays, and Sun StorEdge Tape Libraries may be installed in the Sun Enterprise 5500 or Sun Enterprise 6500 system cabinet.

Performance Comparison

The table below illustrates the significant performance increases from the entry-level Sun Enterprise 3500 to the high-end Sun Enterprise 6500 server. (Results are based on 400-MHz, 4-MB Ecache modules for the Sun Enterprise 3500–5500 and 336-MHz, 4-MB Ecache modules for the Sun Enterprise 6500.) The SPECint-rate95, SPECfp-rate95, and LADDIS results are available at `http://www.specbench.org/results.html`.

Specifications	Sun Enterprise 3500 (8 CPUs)	Sun Enterprise 4500 (12 CPUs)	Sun Enterprise 5500 (12 CPUs)	Sun Enterprise 6500 (30 CPUs)
Processor	400 MHz/4 MB	400 MHz/4 MB		336 MHz/4 MB
Sun Microsystems relative OLTP performance (based on Solaris 7) [i]	7.92	10.72		14.74 (24 CPUs)
SPECint_rate95	1,234	1,828		3,480 (30 CPUs)
SPECfp_rate95	1,611	2,209		3,021 (30 CPUs)
LADDIS (based on Solaris 2.6)	11,681@15.8 (6 x 336 MHz CPUs)	21,192@15.7 (12 x 336 MHz CPUs)		28,993@20.4 (24 CPUs)
Linpack DP 1000 (based on Sol. 2.6)	2.95	4.50 (14 CPUs)		5.19 (30 CPUs)
Linpack DP Rmax (based on Sol. 2.6)	5.77	10.05 (14 CPUs)		17.89 (30 CPUs)

[i] Relative OLTP performance compared to an Sun Enterprise server with a single 336-MHz UltraSPARC processor with 4-MB Ecache

The following table shows a performance comparison of the SPARCserver™ 1000E, the Sun Enterprise 3000–5000, and Sun Enterprise 3500–5500 servers.

Performance Type	SPARCserver 1000E	Sun Enterprise 3000	Sun Enterprise 3500	Sun Enterprise 4000/4500/5000/ 5500
Relative CPU performance				
• integer	1 (8)	approx. 4.1 (6)	approx. 6.6 (8)	approx. 11.3 (14)
• floating point	1 (8)	approx. 5.3 (6)	approx. 8.2 (8)	approx. 12.6 (14)
System bus throughput	312 MB/sec.	• 2.68 GB/sec. @84 MHz • 3.2 GB/sec.@100 MHz[i]		
Memory latency	1200 ns	approx. 300 ns		approx. 300 ns
Networking performance	10 MB/sec.	100 MB/sec.		
I/O performance (aggregate)	• 1-to-4 SBuses, 100 MB/sec. each	• 1-to-6 SBuses, 200 MB/sec. each • 1-to-6 PCI buses, 528 MB/ sec. each	• 1-to-8 SBuses, 200 MB/sec. each • 1-to-8 PCI buses, 528 MB/sec. each	• 1-to-14 SBuses, 200 MB/sec. each • 1-to-12 PCI buses, 528 MB/ sec. each
SCSI performance	10 MB/sec.	20 MB/sec.		
Fibre channel performance	25 MB/sec.	100 MB/sec.		

[i] The Sun Enterprise 3000–5000 servers require a Gigaplane field upgrade to run the Gigaplane system bus at 100 MHz.

The following table shows a performance comparison of the SPARCcenter™ 2000E and the Sun Enterprise 6000 and 6500 servers:

Performance Type	SPARCcenter 2000E	Sun Enterprise 6000/6500
Relative CPU performance		
• integer	1 (20)	approx. 5.6 (30)
• floating point	1 (20)	approx. 7.6 (30)
System bus throughput	625 MB/sec.	• 2.68 GB/sec. @84 MHz
Memory latency	1200 ns	approx. 300 ns
Networking performance	10 MB/sec.	100 MB/sec.
I/O performance	1 to 10 SBuses, 100 MB/sec.	• 1 to 30 SBuses, 200 MB/sec. each • 1 to 12 PCI buses, 528 MB/sec. each
SCSI performance	10 MB/sec.	20 MB/sec.
Fibre channel performance	25 MB/sec.	100 MB/sec.

Product Line Summary

The Sun Enterprise family of servers is targeted at strategic markets chosen by Sun: manufacturing, finance, telecommunications, government, education, health care, retail, design automation, and oil and gas. The following pages describe how each server in the Sun Enterprise family has different characteristics and is therefore deployed in a different capacity within the target markets.

Target Markets and Users for the Sun Enterprise 3500 Server

The Sun Enterprise 3500 server is an affordable server with unprecedented power and reliability in its class. The Sun Enterprise 3500 server enables customers to deploy sophisticated business and technical applications with the kind of performance and reliability previously available only in very expensive, large-scale systems.

The Sun Enterprise 3500 server is ideal for customers who need application servers with tremendous network throughput and processing power, in addition to high reliability, availability, and serviceability. The Sun Enterprise 3500 server is also ideal for price-sensitive customers who need integrated storage or want the investment protection offered by an expandable family of servers. Typical Sun Enterprise 3500 server customers may already own a SPARCserver 20 or an entry-level SPARCserver 1000E system.

The Sun Enterprise 3500 server is recommended for running the new generation of network-based business programs, such as SAP R/3, Oracle Financials, or PeopleSoft Human Resources. The Sun Enterprise 3500 server is also recommended for use in technical environments. The Sun Enterprise 3500 server can be used for running dedicated, computation-intensive applications and high-end graphics applications, such as ECAD and MCAD.

Sun also offers the Sun HPC 3500 which combines the Sun Enterprise 3500 server with High-Performance Computing (HPC) software that allows the platform to scale in the most demanding technical and supercomputing environments.

The Sun Enterprise 3500 server is designed to be primarily a single-enclosure system; however, it does support external peripherals such as the Sun StorEdge A1000, D1000, A3500 and Sun StorEdge A5X00 products. The Sun Enterprise 3500 server should be recommended over the Sun Enterprise 450 server when the customer requires more than four CPUs and 4 GB of memory, or when the customer needs the expandability and investment protection offered by the Sun Enterprise 3500–6500 server family.

Target Markets and Users for the Sun Enterprise 4500 Server

The Sun Enterprise 4500 server is a versatile server with exceptional value and scalability for companies requiring an affordable business server with tremendous computing power, plus the ability to scale system performance and capacity as their needs grow.

The Sun Enterprise 4500 sever is ideal for customers who need an enterprise-wide application server with high reliability, availability, and serviceability. Typical Sun Enterprise 4500 server customers may already own a six-to-eight CPU SPARCserver 1000E system.

The Sun Enterprise 4500 server is recommended for running business-critical applications that support thousands of users. These applications include large departmental databases, customer-management applications, or decision-support applications.

The Sun Enterprise 4500 server is recommended over the Sun Enterprise 3500 server if the customer's I/O and CPU growth requirements go beyond the capacity of the Sun Enterprise 3500 server.

Target Markets and Users for the Sun Enterprise 5500 server

The Sun Enterprise 5500 server is a scalable and reliable datacenter server capable of running mission-critical applications, supporting thousands of users.

The Sun Enterprise 5500 server is ideal for customers who have mainframe-class system requirements. With features previously available only in proprietary fault-tolerant and mainframe systems, the Sun Enterprise 5500 server has a comprehensive set of uptime features. Typical Sun Enterprise 5500 server customers may already own a six-to-eight CPU SPARCserver 1000E system in a stacker unit or data center cabinet. Typical Sun Enterprise 5500 server customers may also have two-to-six CPU SPARCcenter 2000E systems.

The Sun Enterprise 5500 server is recommended over the Sun Enterprise 4500 server if the customer needs a rack-mount system with integrated mass storage. The Sun Enterprise 5500 server is also ergonomically better suited for a data center environment because it has easily accessible CD-ROM and tape drives and direct access to the Sun StorEdge tape library. The Sun Enterprise 5500 server also has an enhanced warranty which includes more comprehensive ServerStart℠ system installation compared to basic installation on the Sun Enterprise 4500 server.

Target Markets and Users for the Sun Enterprise 6500

The Sun Enterprise 6500 server is ideal for customers who need to build network computing applications of a size and scale that previously required mainframes. The customer receives the benefits of improved data access and flexibility even as databases grow to multiple terabytes. Typical Sun Enterprise 6500 server customers may already own large SPARCcenter 2000 systems.

The Sun Enterprise 6500 server offers more than twice the CPU and memory expandability of the Sun Enterprise 5500. The Sun Enterprise 6500 server should be recommended when the Sun Enterprise 5500 server does not offer enough expandability. The Sun Enterprise 6500 server should be recommended over the Sun Enterprise 10000 server when:

- The customer's simultaneous processing and I/O requirements can be met with one Sun Enterprise 6500 server
- The Sun Enterprise 6500 server meets the customer's availability requirements
- Customer is driven to clustering for seamless failover requirements
- Customer prefers to distribute smaller systems rather than take a centralized approach with one large system

The Sun Enterprise 6500 server should be recommended over the Sun Enterprise 5500 server when the Sun Enterprise 5500 server does not offer enough CPU and I/O growth for the customer.

Target Markets and Users for the Sun Enterprise 10000

The Sun Enterprise 10000 server is the industry's highest-performance (according to TPC-D results.), most-balanced SMP system (competitors of the Sun Enterprise 10000 do not have SMP, but NUMA or MPP). It has the highest availability in UNIX systems other than fault-tolerant systems.The Sun Enterprise 10000 server has the following high-availability features, which the competitors do not have: fault-tolerant power/cooling, dynamic reconfiguration with hot-swappable system boards, alternate pathing, dynamic domains and fail-over between internal domains. Other features employed by the Sun Enterprise 10000 server and the competitors include system service processor and clustering.

Its RAS features are comparable to mainframes. In fact, it can be configured to have no single point of hardware failure.

The Sun Enterprise 10000 server is targeted for high-end commercial and technical markets. Key applications include data warehousing, data mining, high-volume OLTP, LAN consolidation, analytics, and Internet/intranet.

The Sun Enterprise 10000 server should be recommended over the Sun Enterprise 6500 server when:

- The customer's simultaneous processing and I/O requirements cannot be met with one Sun Enterprise 6500 server

- Customer's availability requirements cannot be met by one Sun Enterprise 6500 server

- There is no reason to prefer clustered Sun Enterprise 6500 servers over one Sun Enterprise 10000 server (for example, if failover is not required)

- System administration prefers one large, centralized system (potentially split into domains) over multiple, smaller ones

Note: *See Sun Enterprise 10000 server Just the Facts for more detailed information on this product.*

Product Line Comparisons

Product	Positioning	Applications	Markets
Sun Enterprise 10000	Highest-end server for customers who require the highest performance and availability. For main-frame-class, mission-critical applications.	• Data warehousing • Data mining • High-volume OLTP • LAN consolidation • Analytics • Internet/intranet	• Financial services • Telecommunications • Government • Petroleum • Education
Sun Enterprise 6500	Highly scalable and expandable, offering performance and availability required for large-scale database applications.	• Data warehousing • Data mining • Business apps • CMS™ OLTP • NFS™ • Design automation • Analysis and simulation • Video	• Manufacturing • Finance • Telecommunications • Government • Education • Healthcare • Retail • Oil and gas • Pharmaceuticals • Chemical • Internet commerce
Sun Enterprise 5500	Affordable datacenter system designed to deliver high performance and high availability for enterprise-wide applications supporting thousands of users.		
Sun Enterprise 4500	Highly expandable yet compact system delivering high-performance scalability for department applications in a distributed network-computing environment.		
Sun Enterprise 3500	An affordable system for departmental business applications supporting up to hundreds of users in office environments. For customers that want the investment protection of an upgrade path in an expandable family of servers.	• Database server • Business apps • NFS • CMS • Graphics/imaging • Modeling, simulation analysis • Video	• Manufacturing • Finance • Telecommunications • Government • Education • Healthcare • Retail • Oil and gas • ECAD/MCAD • Internet commerce
Sun Enterprise 450	Affordable high-performance SMP network application server. Ideal for workgroups, larger web sites, branch offices or distributed enterprise applications.	• Database server • Business apps • OLTP • NFS • Internet gateway • Web mail services • Groupware	• Manufacturing • Finance • Telecommunications • Government • Education • Retail • Healthcare

Sun Enterprise™ 3500–6500 Server Positioning

Product Line Specification Summary

The following chart illustrates the specifications of the Sun Enterprise Server product line.

Specifications	Sun Enterprise 3500	Sun Enterprise 4500	Sun Enterprise 5500	Sun Enterprise 6500	Sun Enterprise 10000
Packaging	Tower/Deskside	Tabletop	Datacenter Cabinet		
Number of CPUs	1 to 8	1 to 14		1 to 30	16 to 64
CPU clock rate	250 MHz, 336 MHz, 400 MHz				
Ecache per CPU	4 MB				
Maximum memory	8 GB	14 GB		30 GB	64 GB
System bus	2.68 GB/sec.@84 MHz 3.2 GB/sec.@100 MHz [i]				10.67 GB/sec@84 MHz 12.8 GB/sec.@100MHz
Maximum SBus/PCI slots	SBus: 12 PCI: 8	SBus: 21 PCI: 12		SBus: 45 PCI: 12	64
Maximum internal disk	72.8 GB	33.6 GB	720 GB	576 GB	191 GB
Maximum total disk	> 6 TB	>10 TB	>10 TB	>20 TB	> 20 TB
Maximum number Creator3D/ Sun Elite3D m6 graphics boards	3	4		8	—
RAS features (see "Reliability, Availability, and Serviceability" section for complete RAS details)	• Hot-plug boards • Hot-swap power • Hot-swap cooling • Redundant power • ASR • Remote control • ECC-protected data paths • ECC memory • CPU power control (Solaris 2.6 Operating Environment) • Hot-swap FC-AL disks • RAID 0, 1, 5 • Hot-disk sparing				• Hot-swap boards • Fault-tolerant power • ASR • Hostview • Remote control • ECC-protected data paths • ECC memory • Dynamic domains
RAS features with Solaris 2.6 Hardware: 5/98	Dynamic Reconfiguration (Hot swap for I/O boards) Alternate Pathing				Currently available
Latest RAS and Resource Management features	Sun Enterprise SyMON™ (replaced Solstice SyMON™) Solaris Resource Manager				
Future RAS features	Dynamic Reconfiguration (Hot swap for CPU/memory boards)				Currently available

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Specifications	Sun Enterprise 3500	Sun Enterprise 4500	Sun Enterprise 5500	Sun Enterprise 6500	Sun Enterprise 10000
Operating Environment	Solaris 2.5.1 Hardware: 11/97[ii] or Solaris 2.6 Hardware: 3/98[iii] (or later) or Solaris 7				
Warranty (may vary according to geography)	One year, next day, on site 8-hour phone		One year, 4 hours, on site 4-hour phone		

[i] Sun Enterprise 6500 system bus cannot run at 100 MHz, and, therefore, does not support the 400-MHz/4-MB UltraSPARC processor.

[ii] Two patches are required for Sun Enterprise 3500–6500 servers running Solaris 2.5.1 Hardware: 11/97. Please refer to the "Solaris Operating Environment" section for details.

[iii] Although Dynamic Reconfiguration and Alternate Pathing have been available on the Sun Enterprise 10000 server when running Solaris 2.5.1 Operating Environment, a minimum of Solaris 2.6 Hardware: 5/98 is required for these features when running the Solaris 2.6 Operating Environment.

Reliability, Availability, and Serviceability

The Sun Enterprise™ 3500–6500 servers offer excellent reliability, availability, and serviceability (RAS) features. They have the most availability features in their class.

Reliability

- Passive, centerplane bus (Sun Enterprise 4000–6000 and Sun Enterprise 4500–6500 servers), or backplane bus (Sun Enterprise 3000 and Sun Enterprise 3500 server), increases mean time between failures (MTBF) of the system compared to previous-generation servers
- Simple, elegant, centerplane bus design reduces the amount of bus circuitry required, increasing the MTBF of the system
- Current-sharing power circuitry supports redundant power capability
- ECC-protected data throughout the system increases data integrity
- Parity-protected address and control signals increase the integrity of these signals

Availability

- Effective system diagnostics minimize downtime
- Multiple UltraSPARC™ modules, CPU/memory boards, and I/O boards provide redundancy
- Redundant power supplies and current-sharing power circuitry keep the system running if a power supply fails
- Enhanced Automatic System Recovery (ASR) quickly reconfigures the system around any failed components
- Dual variable-speed fans in each power/cooling module keep the system cool if one fan within a module fails
- Dual disk array host interfaces
- Dual, independent connections to FC-AL internal disks (Sun Enterprise 3500 server)
- CPU Power Control (available with the Solaris™ 2.6 Operating Environment) removes an active CPU from the system configuration and powers it off if environmental sensors detect that the processor is running too hot due to a cooling problem. This is done without any interruption to running processes and without a reboot of the server
- Remote administration control allows remote reboots and power cycling
- The Sun Enterprise SyMON™ system monitor software, which is included with the Sun Enterprise 3500–6500 servers, maximizes uptime by predicting hardware failures

- The Sun Enterprise SyMON software also provides an easy user interface and multi-system management capability

- Redundant, time-of-day clock

- Dynamic Reconfiguration of I/O boards (Solaris 2.6 Hardware: 5/98) and CPU/memory boards (future Solaris 7 Operating Environment release) allows boards to be attached to and detached from the system online, without requiring a reboot

- Alternate Pathing (Solaris 2.6 Hardware: 5/98) enables the network or storage connection to be moved from an active controller to a stand-by controller, thereby enabling Dynamic Reconfiguration of the I/O boards while preserving the network/storage connection

- Solaris Resource Manager provides the ability to allocate critical resources such as CPU and virtual memory to specific applications or users. This provides efficient utilization of resources and availability of resources for important applications - thus specific service levels can be delivered.

Serviceability

- Modular system design makes it easy to replace failed components

- Hot-swap I/O boards (Solaris 2.6 Hardware: 5/98) make it possible to perform a full hardware installation and reconfiguration without system interruption

- Hot-plug CPU/memory boards make it possible to perform the hardware installation without system interruption (CPU/memory boards will become hot-swap once Dynamic Reconfiguration becomes available with upcoming release of the Solaris 7 Operating Environment)

- Hot-swap power/cooling modules make it easy to replace failed modules or to upgrade the power and cooling capacity of the system

- Ability of Sun Enterprise SyMON software to notify a system administrator of a failure allows the system administrator to determine immediately which components have failed and need to be serviced

- Ability of Sun Enterprise SyMON software to predict memory and disk failures enables proactive hardware service and prevents hard failures

- Ability of Sun Enterprise SyMON to monitor all of the Solaris systems in the network from any desktop (UNIX®, Windows NT, Macintosh, etc)

- Improved remote administration control allows users to reboot and power cycle in a "lights out" environment

- Sun Validation Test Suite (SunVTS™) allows users to perform UNIX diagnostics

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New RAS Features

Dynamic Reconfiguration

Dynamic Reconfiguration is the ability to alter the configuration of a running system by bringing components online or taking them offline without disrupting system operation or requiring a system reboot. With the availability of Dynamic Reconfiguration, system boards can be logically and physically included in the system configuration, or logically deactivated and removed while the system is running.

This is particularly useful in mission-critical environments if a system board has failed and needs to be replaced or if new system boards need to be added to the system for additional performance and capacity.

Dynamic Reconfiguration increases system availability and flexibility by allowing the hot-swap CPU/memory and I/O board functionality that the Sun Enterprise 3000–6000 server hardware has supported from the beginning. Hot-swap functionality means that the components can be physically and logically removed or added while the system is running.

Dynamic Reconfiguration has previously been available only on the Sun Enterprise 10000 server within the Sun Enterprise server product line. This feature is currently unavailable with any other general purpose UNIX platform. Dynamic Reconfiguration includes:

- Dynamic attach: Logically (rather than physically) including I/O boards and CPU/memory boards into the system configuration and making them available for use without rebooting the system. For example, both I/O boards and CPU/memory boards can be installed and logically attached while the system is online.
- Dynamic detach: Logically (rather than physically) removing components from a configuration, including taking the components offline and powering them down, thus making them ready for physical removal.

Dynamic Reconfiguration for I/O boards is available for Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers with Solaris 2.6 Hardware: 5/98 and Dynamic Reconfiguration for CPU/memory boards is expected to be available with a future version of the Solaris 7 Operating Environment in the first half of calendar 1999. Note that Dynamic Reconfiguration for I/O boards requires Flashprom software release 3.2.14 or later.

Please refer to *Availability Features in the Sun Enterprise 3500 to Sun Enterprise 6500 Server Family— A Technical White Paper* for more information on Dynamic Reconfiguration.

Alternate Pathing

Alternate Pathing is an extension of Dynamic Reconfiguration that enhances network and external storage availability. It allows dynamic reconfiguration of the I/O boards without disrupting the network or external storage connection. For example, assume that the active Ethernet connection resides on an I/O board that needs to be removed from the system. Removal of the I/O board means that the Ethernet controller must be taken offline, however that would disconnect the network access. Alternate Pathing provides the ability to switch the logical Ethernet connection to another, stand-by Ethernet controller residing on a different I/O board, thereby enabling the I/O board with the original Ethernet connection to be removed without any disruption to the network connection.

Alternate Pathing is available for Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers with Solaris 2.6 Hardware: 5/98.

System Architecture

Overview

The Sun Enterprise™ 4500, Sun Enterprise 5500, and Sun Enterprise 6500 servers are designed around a centerplane, with system slots in both the front and rear. Each slot can accommodate either a CPU/memory, I/O, or disk board with some limitations. Almost any combination of boards is allowed, as long as the required minimum of one CPU/memory board and one I/O board is met. One I/O board must be inserted into slot 1 in order to provide the SCSI connection to the CD-ROM drive and the optional internal tape device. In addition, the Sun Enterprise 4500 and Sun Enterprise 5500 servers support a maximum of four 8.4-GB disk boards, while the Sun Enterprise 6500 server supports a maximum of two disk boards.

The Sun Enterprise 3500 server is the smallest member of the Sun Enterprise 3500–6500 server family. There is little need for a centerplane arrangement because it has only five slots,. The centerplane arrangement allows for larger configurations in less physical space. Intended as a deskside system, the Sun Enterprise 3500 server uses a traditional backplane configuration with all five boards plugged into one side of the system. The Sun Enterprise 3500 server also has internal mounting for up to eight FC-AL 3.5 x 1.6-inch (or 1.0-inch) disks along with a CD-ROM and tape drive.

Each CPU/memory board in the Sun Enterprise 3500–6500 servers supports up to two UltraSPARC™ modules and 2 GB of memory (see the "CPU/Memory Board" section for more details). SBus, Graphics, and PCI I/O boards are available for the Sun Enterprise 3500–6500 servers (see the "I/O Boards" section for more details). CPU/memory boards, I/O boards, power/cooling modules, and clock boards are interchangeable within the Sun Enterprise 3500–6500 product line. The clock board contains the keyboard and mouse port, two serial ports, time-of-day clock, and the IDPROM. The frequency of the clock, the processor clock, and the system clock are all programmable through firmware.
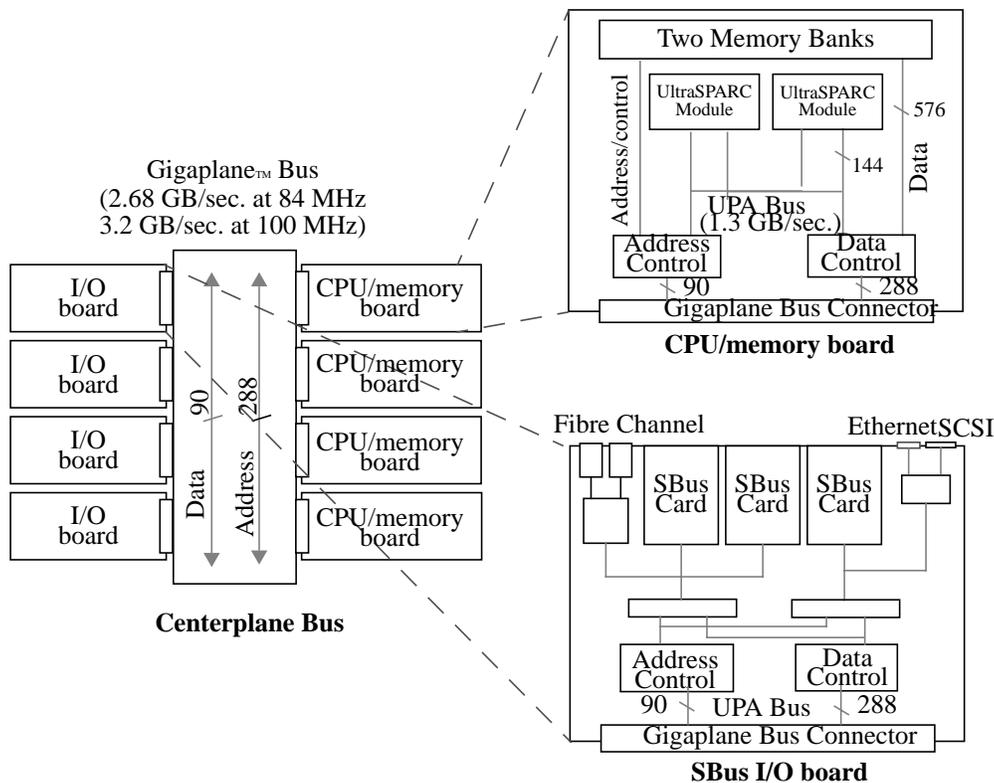
Figure 1. The Sun Enterprise 3500–6500 system bus architecture

System Bus

The system bus for the Sun Enterprise 3500–6500 servers is the Gigaplane™ system bus, a packet-switched bus. This bus has a split-transaction design with separate buses for address and data. This design provides a faster transfer rate than system buses that have the same paths for address and data.

The Gigaplane system bus has been revised from the one used in the Sun Enterprise 3000–6000 servers, which has a maximum speed of 84 MHz—sufficient to support the UltraSPARC processors running at up to 336 MHz when operating with a 4:1 processor-to-Gigaplane speed ratio. The enhanced Gigaplane system bus on the Sun Enterprise 3500–5500 servers runs at a rate of up to 100 MHz. This enables support for the new 400-MHz/4-MB UltraSPARC processor without changing the processor-to-Gigaplane speed ratio. The maximum throughput is 2.68 GB per second at 84 MHz and 3.2 GB per second at 100 MHz.

The physical length of the Gigaplane in the Sun Enterprise 6500 (and Sun Enterprise 6000) prohibits the Gigaplane from running at 100 MHz. The maximum Gigaplane speed on the Sun Enterprise 6500 will remain at 84 MHz. As a result, with a 4:1 processor-to-Gigaplane speed ratio, this new 400-MHz processor cannot be supported. A future UltraSPARC processor, with a clock speed greater than 336 MHz will be available for the Sun Enterprise 6500 as well as the Sun Enterprise 6000.

In order to realize the increased Gigaplane bus speed, the Sun Enterprise 3500–5500 servers ship with new, enhanced CPU/memory and I/O boards that are also capable of running at 100 MHz. These boards are backwards compatible and will, therefore, be supported on existing Sun Enterprise 3000–6000 systems. However, the maximum Gigaplane speed will be limited to 84 MHz, unless the Gigaplane is upgraded (see the "Upgrades" section for details).

In addition, the previous-generation of CPU/memory boards and I/O boards (84-MHz boards) are supported on the Sun Enterprise 3500–6500 servers (no factory installation). However, such systems run the Gigaplane system bus at a maximum of 84 MHz.

The previous-generation Sun Enterprise 3000–5000 systems are field upgradeable to support the enhanced Gigaplane speed of up to 100 MHz and thereby support the new 400-MHz processor. The upgrade involves system boards, UltraSPARC modules, and a base package upgrade kit. The base package upgrade kit varies among the server models and may include a new clock board, Gigaplane centerplane, and an enhanced SCSI peripheral tray for the Sun Enterprise 5000 system. In most cases, the clock board and four-slot backplane can run the Gigaplane system bus at up to 100 MHz in the Sun Enterprise 3000 server without requiring a base package upgrade (see the "Upgrades" section for details).

The Ultra™ Port Architecture (UPA) bus is used as an intermediate bus connecting CPU/memory boards and I/O boards to the Gigaplane bus. The UPA bus also runs at the same speed as the Gigaplane system bus, with a peak throughput of 1.3 GB per second at 84 MHz and 1.55 GB per second at 100 MHz.

Reducing the memory latency of the system bus was one of the primary system bus design goals. The memory latency for the Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers is approximately one-fourth the memory latency of the SPARCcenter™ 2000E system. This reduction was the result of the following design changes:

- **Separate address, data, and control signals.** In the SPARCserver™ 1000E system, the address and data shared the same bus. In the Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers, the address and data use separate buses. This allows read requests to be transmitted on the address bus at the same time data from the previous read request is being transmitted on the data bus.

- **Wider data buses.** The data buses throughout the Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers are two-to-four times wider than the data buses in the SPARCserver 1000E systems.

Data Bus	Sun Enterprise 3000–6000; Sun Enterprise 3500–6500	SPARCserver 1000E	Difference compared to SPARCserver 1000E	SPARCcenter 2000E	Difference compared to SPARCcenter 2000E
Memory data bus	576 bits	72 bits	8 times	144 bits	4 times
Data bus	288 bits	72 bits	4 times	72 bits	2 times
CPU data bus	144 bits	64 bits	2 times	64 bits	2 times

- **Faster bus.** The Gigaplane bus, which runs at 84 MHz (with the potential of running up to100 MHz), is faster than the 50-MHz XDBus™ used in the SPARCserver 1000E and SPARCcenter 2000E.

- **Enhanced arbitration cycles.** Zero cycle arbitration mode, used in certain situations, greatly reduces bus arbitration time. Additionally, by using two cycle address and data packets (versus two-to-nine cycles on the SPARCserver 1000E system), devices have much less time to wait in order to get on the bus.

- **Faster memory response.** A number of techniques are employed to get a faster response to data requests:

  – 576-bit-wide memory

  – 16-way memory interleave

  – Read bypass writes in memory controller

  – Queue bypasses for requests and data

  – Writebacks handled after miss

System Bus RAS Features

The following four attributes of the system bus architecture contribute to many of the RAS features of the Sun Enterprise 3500–6500 (and Sun Enterprise 3000–6000) servers:

- **Passive backplane system bus**. A passive backplane bus minimizes the number of active components required to control the bus. This results in a more reliable system.

- **Sturdy connectors and better board-insertion guides**. The SPARCserver 1000E has 100 pins on a connector. The Sun Enterprise 3500–6500 servers are much sturdier, with 450 pins on a connector that is only twice the size of the SPARCserver 1000E connector. The sturdier connectors, combined with better guides for board insertion, minimize the chance of the system being disabled due to bent pins from a faulty board insertion.

- **ECC-protected data paths**. All the data paths in the Sun Enterprise 3500–6500 servers are fully protected by error checking and correction (ECC), which is able to detect single-bit and double-bit errors and to correct single-bit errors.

- **Parity-protected address and data paths**. All the address and data paths in the Sun Enterprise 3500–6500 servers are protected by parity.

System Architecture

System Bus Questions and Answers

Why didn't Sun use UPA crossbar bus technology in the Sun Enterprise 3500–6500 servers as in the Ultra 1 desktop workstation?

The crossbar bus used in the Ultra 1 desktop workstation supports a maximum of four devices. The Sun Enterprise 4500 and Sun Enterprise 5500 servers have eight slots and the Sun Enterprise 6500 server has 16 slots, with multiple devices per slot. Perhaps more importantly, crossbar bus technology was not needed for the Sun Enterprise 3500–6500 system interconnect because the Gigaplane bus is fast enough to support 30 CPUs without the use of crossbar technology.

At 100 MHz, the Gigaplane bus provides 3.2 GB per second of sustained throughput making it suitable for large symmetrical multiprocessor (SMP) servers. The Gigaplane bus runs at 84 MHz, provides a throughput of 2.68 GB per second and is able to support up to 16 boards in the Sun Enterprise 6500 server. Each board contains a UPA bus that connects to the Gigaplane bus and "multiplexes" the associated component loads, such as CPU and SBus, onto a single connection to the Gigaplane bus. This design is able to support many more CPU and SBus slots than if they were connected directly to the Gigaplane bus.

Why is the Gigaplane-XB™ crossbar technology used in the Sun Enterprise 10000 server not used in the Sun Enterprise 3500–6500 servers?

The implementation of the Gigaplane-XB interconnect would have increased the cost of the system substantially. The Gigaplane-XB technology provides higher system throughput, supports more devices (64 processors) and enables partitioning (domains), which are essential in the Sun Enterprise 10000 server.

Will there be a latency penalty for memory access relative to the single-level bus implementation of the Ultra 1 desktop?

There will be some penalty, but exceptional effort has gone into minimizing this penalty. Relative to the Ultra 1 desktop, the penalty for access to the first word in a data request is five clock cycles, or 60 ns. This decreases to two clock cycles (or 24 ns) by the last word in a data request. This minimal latency penalty should be imperceptible to the user, as it was in systems based on XDBus technology.

How can the sustained data transfer rate on the Gigaplane bus be so close to the peak bandwidth?

There are two reasons why the sustained data transfer rate on the Gigaplane bus is so close to the peak bandwidth. The first is separate address and data buses. With separate address and data buses, data requests can be sent out on the address bus at the same time that data from a previous data request is on the data bus. The second is out-of-order data transmission, which allows data to be put on the data bus in a different order than requested. This helps maximize the bus usage by minimizing unused data bus bandwidth.

Why does the Sun Enterprise 3500 server have a new clock board and backplane if the Sun Enterprise 3000 server backplane is capable of running at up to 100 MHz?

The new backplane on the Sun Enterprise 3500 server is required to support the additional (fifth) system slot, not to support the faster Gigaplane speed. The new centerplane on the Sun Enterprise 4500–5500 servers is required to support the faster Gigaplane speed. The new clock board is required to support the new five-slot backplane on the Sun Enterprise 3500 server and the enhanced eight-slot and 16-slot centerplane on the Sun Enterprise 4500, Sun Enterprise 5500, and Sun Enterprise 6500 servers, respectively.

Why did Sun move from a backplane to a centerplane design (Sun Enterprise 4500–6500 servers only)?

The centerplane design allows the system to support twice as many boards for a given length of system bus. This reduced length translates into an electrically shorter bus than would be possible with a backplane. This is important because bus speed (frequency) is, in part, determined by bus length. All other things being equal, the shorter the bus, the faster it can run.

The more densely packed centerplane also allows for more compact packaging. With this configuration, the Sun Enterprise 4500 server can support eight slots with a smaller footprint than the SPARCserver 1000E system that supports four slots. Also, the Sun Enterprise 6500 server can support 16 slots in the same size data center cabinet that supports a ten-slot SPARCcenter 2000E system.

What happens if there isn't an I/O board in slot 1? Will the system be functional?

Yes, it will be fully functional, with the exception that the internal CD-ROM and tape drives will not be accessible.

Will the new, enhanced Gigaplane system bus provide increased system performance while running 250-MHz or 336-MHz UltraSPARC processors?

No, the performance benefits of the enhanced Gigaplane system bus is realized only when using processors with clock speeds in excess of 336 MHz. The Gigaplane system bus runs at up to 84 MHz when using 250-MHz or 336-MHz processors. However, the new 400-MHz UltraSPARC processor increases the speed and throughput of the Gigaplane system bus, enabling it to run at up to 100 MHz and provide a throughput rate of up to 3.2 GB per second (2.68 GB per second on the Sun Enterprise 6500 Gigaplane system bus, which is capable of running at 84 MHz.)

Does the change to the Gigaplane system bus mean that the Sun Enterprise 3500–5500 servers perform better than similarly configured Sun Enterprise 3000–5000 servers?

No. There are three component speeds that determine the speed of the server: the speed of the Gigaplane system bus, the speed of the system boards, and the speed of the UltraSPARC module. These systems use the same processors as the previous systems. Therefore the Gigaplane system bus runs at the same speed in all systems providing the same performance.

Graphics Support

Creator3D Graphics series 3 Overview

Creator3D Graphics series 3 is the latest generation of the Creator Graphics product family accelerates and supports diverse types of graphics needs ranging from 8-bit and 24-bit windowing to high-end 3-D graphics.

Creator3D Graphics series 3 is designed to match the CPU performance increase beyond the currently available CPU speeds. Series 3 accelerators have one clock for the internal graphics processing and another clock for the frame buffer enabling each part to run at maximum speed independently from each other.

Creator3D graphics has the following features:

- Full 2-D imaging and windowing acceleration, plus full 3-D acceleration
- Ideal for high-end 2-D, mid-range 3-D graphics, and solids in MCAD and MCAE, as well as high-end imaging and color publishing applications
- 24-bit true color, double-buffered up to 1280 x 1024
- 28-bit Z-buffer
- 8-bit overlay and visual planes
- Stereo display up to 960 x 680 at 112-Hz non-interlaced, double- and Z-buffered
- 15-MB 3D-RAM memory
- 1280 x 1024 at 76 Hz standard with programmable bootprom resolution
- NTSC/PAL video timings
- 128-bit DAC
- High resolution 1920 x 1200 at 70 Hz (single buffered) supporting 24-inch wide screen display

System Architecture

Sun Elite3D Graphics Overview

Sun Elite3D greatly accelerates the rendering of 3-D triangles, vectors, and texture maps over what is possible with 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 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.
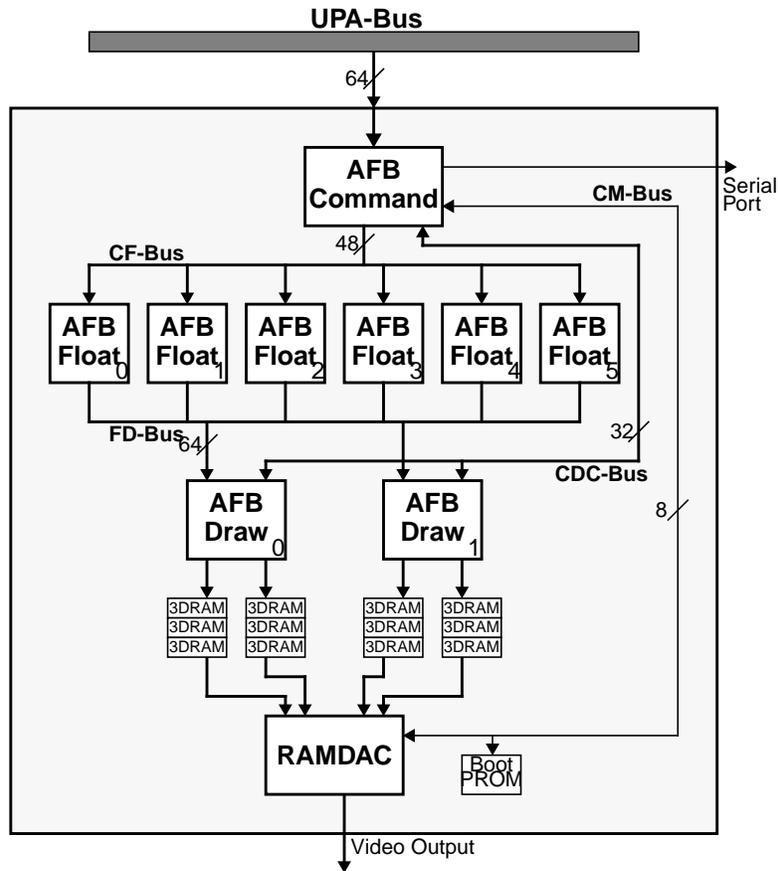
Figure 2. Sun Elite3D Chip-level Diagram

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

Sun Elite3D Features and Benefits

• **Features**	• **Benefits**
• Integrated imaging	• Can perform 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
• Alpha blending and screen door transparency	• Used to simulate transparent materials such as glass
• Line and dot anti-aliasing	• Needed in MCAD and visualization for better visual quality
• Per pixel depth-cueing	• More accurate depth-cueing or fog
• Per pixel alpha interpolation	• Greater accuracy and image quality
• 4-bit stencil support with hardware acceleration of OpenGL stencil functions	• Provide greater performance
• Accelerated lighting	• More lights can be turned on for enhanced visual Sun display without encountering large performance penalties
• Four 8-bit color maps	• For dynamic colormap segment allocation when running 8-bit window systems should eliminate color flashing problems

System Architecture

Sun microsystems

Sun Enterprise™ 3500 Server

Sun Enterprise 3500 System Cabinet
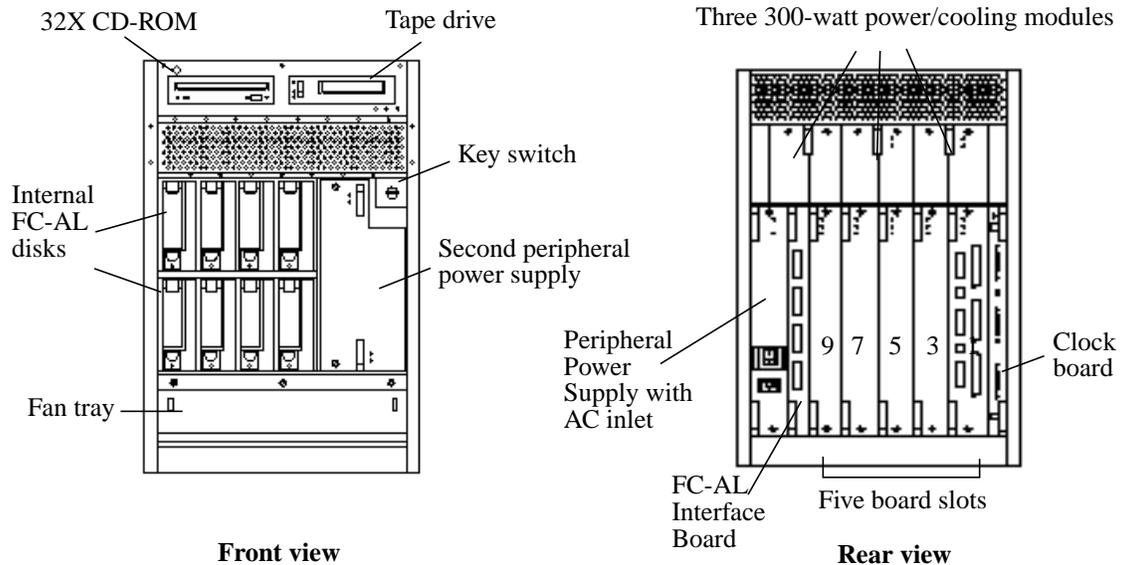
Figure 3. The Sun Enterprise™ 3500 System Cabinet

The Sun Enterprise 3500 server is a deskside tower enclosure, measuring approximately 65 cm x 43 cm x 44 cm (65 cm x 43 cm x 64 cm with the rear bumper and cable organizer which protects the cables.) In addition to the enhanced Gigaplane system bus, which runs up to 100 MHz and supports the fifth system slot, the Sun Enterprise 3500 server also features a 32X CD-ROM drive and improved disk availability with Fibre Channel Arbitrated Loop (FC-AL) internal disk drives. Despite the expansion of system slots and the changes to the internal disks, the Sun Enterprise 3500 server maintains the footprint, compact overall dimensions and power supply redundancy of the Sun Enterprise 3000 server.

Features

- A hinged door, covering the lower three-quarters of the cabinet, offers easy access to internal disk drives and the key switch.

- Two built-in disk banks hold up to eight internal hot-swap FC-AL disk drives. This is fewer than the ten SCSI disk drives offered with the Sun Enterprise 3000 server. The newer drives, however, can be configured to provide better disk availability (please see the "Sun Enterprise 3500 Internal Disk Drives" section for details on the FC-AL disks).

- A Fibre-Channel Interface board is located in a dedicated slot, between the fifth system board slot and the peripheral power supply. This board serves as the interface between the FC-AL drives and the first I/O board (please see the "Sun Enterprise 3500 Internal Disk Drives" section for details regarding the Fibre-Channel Interface board).

- A Sun StorEdge™ CD32 drive is installed in the upper left of the cabinet.

- An optional tape drive may be installed to the right of the CD-ROM drive. The tape drive can be a 4-mm, 8-mm, or one-quarter-inch tape drive.

- The key switch is located behind the door in the upper-right corner.

- There are five slots in the bottom portion of the cabinet for CPU/memory boards and I/O boards. The slots are numbered 1, 3, 5, 7, and 9 from right to left.

- The Sun Enterprise 3500 server comes with at least one power/cooling module located above slots 1 and 3. If a second power/cooling module is required, it would fit above slots 5 and 7, to the left of the first power/cooling module.

- A fan tray above the peripheral power supply is also included in an entry configuration.

- A third power/cooling module can be used for redundant power in a system with three or more boards. To install the third power/cooling module, the existing fan tray, located to the left of the second power/cooling module, must be removed. The third power/cooling module fits into this slot.

- In addition to three power/cooling modules, a second peripheral power supply is required for full N+1 power supply redundancy in a five-board Sun Enterprise 3500 server configuration.

- The first peripheral power supply is located in the lower left of the cabinet rear. A spot for the second, optional peripheral power supply is located in the lower right of the Sun Enterprise 3500 cabinet front. This second peripheral power supply is located in the rear of the Sun Enterprise 3000 system cabinet. It was redesigned and moved to the front of the Sun Enterprise 3500 system cabinet in order to provide space for the additional system slot.

- The second peripheral power supply on the Sun Enterprise 3500 server is now 195 watts, instead of the 184 watts peripheral power supply used on the Sun Enterprise 3000 server.

- The clock board is located in the lower right, next to board slot 1. The clock board has its own slot and does not use any of the five slots for the CPU/memory or I/O boards.

- A cable organizer is included with the Sun Enterprise 3500 server base package. This will protect the 2-meter fibre channel cable (used for connecting to the internal FC-AL disk drives) from excessive bending, thereby maintaining optimum fibre channel performance.

Sun Enterprise 3500 Internal Disk Drives

Internal FC-AL Drives

The Sun Enterprise 3500 server has two internal disk banks (four disks per disk bank), which support up to eight 9.1-GB FC-AL disks with optional dual-port connections, while the Sun Enterprise 3000 server supports ten internal SCSI disks with a single connection. The number of internal disks supported in the Sun Enterprise 3500 server was reduced in order to provide room for the additional system slot in the rear of the server. The inclusion of the fifth system slot in the back of the cabinet required that the optional second peripheral power supply be redesigned and moved to the front of the cabinet, resulting in less space in the front of the cabinet for disk drives.

The newer drives, however, can be configured to provide better disk availability than that offered by the Sun Enterprise 3000 server. In the Sun Enterprise 3000 server, all ten disk drives are connected to a single SCSI channel. The Sun Enterprise 3500 server eliminates this single point of failure. Each of the two disk banks can have one or two FC-AL loops connected to the installed drives for a total of up to four loops. Dual-loop configurations provide a highly-available, redundant hardware configuration.

Because the two banks are independent, a full configuration of eight disk drives requires a minimum of two loops: one for each bank of four drives. On the other hand, a minimum configuration requires only one FC-AL connection for up to four disk drives.

The new FC-AL drives in the Sun Enterprise 3500 server still provide the hot-swap capability offered with the internal SCSI drives on the Sun Enterprise 3000 server.

Both Solstice DiskSuite™ and VERITAS/Sun Enterprise Volume Manager™ are supported disk management software for the internal FC-AL drives.

VERITAS/Sun Enterprise Volume Manager releases 2.3, 2.4, 2.5 and 2.6 are supported with the Solaris™ 2.5.1 Operating Environment. VERITAS/Sun Enterprise Volume Manager releases 2.4, 2.5 and 2.6 are supported with the Solaris 2.6 Operating Environment. Patches are associated with all of these releases. VERITAS/Sun Enterprise Volume Manager is not currently supported with the Solaris 7 Operating Environment.

Solstice DiskSuite version 4.1 is supported on both Solaris 2.5.1 and Solaris2.6. Solstice DiskSuite version 4.2 is supported on both Solaris 2.6 and the Solaris 7 Operating Environment.

Note: *A license is needed to install Sun Enterprise Volume Manager. An additional license is needed to enable advanced Sun Enterprise Volume Manager capabilities such as RAID 5.*

Fibre Channel Interface Board

This is a new board, designed to provide connectivity to the internal FC-AL disk drives in the Sun Enterprise 3500 server. The internal FC-AL disk drives support up to four FC-AL loops. Each of the four potential FC-AL loops corresponds to one of four GBICs on the FC-AL Interface board.

The FC-AL board comes with two GBIC modules and one 2-meter fibre channel cable to establish one loop (connection). One GBIC module is installed on the FC-AL Interface board and, typically, the other is installed on the I/O board (or SBus card) leaving three empty FC-AL sockets on the FC-AL Interface board. Each additional loop requires two additional GBIC modules and one 2-meter fibre channel cable. The GBIC modules on the FC-AL Interface board are exactly the same as those used in the Sun StorEdge A5X00 arrays, FC-AL SBus Host Adapter, and on the SBus I/O board.

The Sun Enterprise 3500 server can be ordered without internal disk drives. Any of the bootable Sun StorEdge disk products (such as the Sun StorEdge UniPack, MultiPack, D1000, A3500, and A5X00 products) can be used as a boot device for a Sun Enterprise 3500 server without internal disk drives. Such a configuration does not require an FC-AL Interface board.

The individual FC-AL connections on the FC-AL Interface board are logically independent. The components do get their power through a single connection. However, the power to the FC-AL Interface board comes from the backplane which is supported by redundant power supplies. Therefore the design has practically no single point of failure.

GBIC
Modules
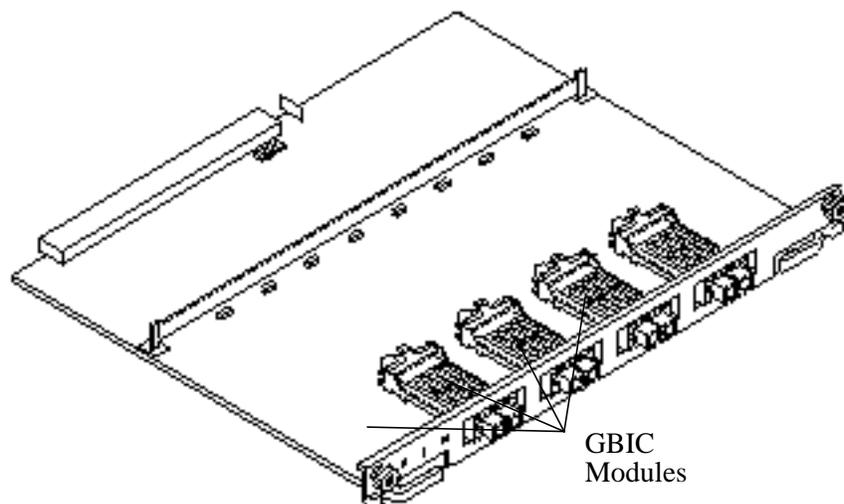
Figure 4. FC-AL Interface board

Sun Enterprise 3500 Server Questions and Answers

Is the FC-AL drive supported in the Sun Enterprise 3500 server the same as the FC-AL drive supported in the Sun StorEdge A5X00 disk array?

Yes, the same FC-AL drives are supported in both the StorEdge A5X00 and the Sun Enterprise 3500.

What is the purpose of the cable organizer?

The cable organizer, which is shipped with all Sun Enterprise 3500 servers, attaches easily to the rear bumper on the Sun Enterprise 3500 server. Fiber cables that connect the GBICs on the FC-AL Interface board and the GBICs on the I/O boards should be routed through the cable organizer in a "figure eight" pattern. This will keep the cables out of the way and secure so that they are less likely to be inadvertently detached from the system. The cable organizer also provides that the fibre channel cables are not bent beyond their supported bend radius, preventing the cables from crimping and damage; it also provides mounting for the power cord restrainer that comes installed on the rear bumper.

Can the GBIC sockets be used on the FC-AL Interface board to connect (daisy-chain) Sun StorEdge A5X00 disk arrays to the Sun Enterprise 3500 server?

No, the GBIC sockets on the FC-AL Interface board can only be used to connect the internal FC-AL drives of the Sun Enterprise 3500 server. Sun StorEdge A5X00 systems must be connected to FC-AL sockets on system I/O boards, through the on-board sockets or through SBus Host Adapters.

Is the Sun Enterprise 3500 FC-AL Interface Board orderable in a factory configuration?

The Sun Enterprise 3500 FC-AL Interface board can be ordered either as factory configured or standalone.

Can pairs of FC-AL sockets support both the Sun Enterprise 3500 server internal disks and Sun StorEdge A5X00 system?

Yes. The SBus I/O board and the Graphics I/O board both come with a pair of on-board 100-MB-per-second FC-AL sockets. In addition, both types of boards support an SBus host adapter that has a pair of 100-MB-per-second FC-AL sockets. Each of these pairs of sockets can support the internal disk drives in the Sun Enterprise 3500 server and/or the Sun StorEdge A5X00 array. They can be split up so that one supports one type of device while the other socket supports a different type of device.

For example, if one of the two on-board FC-AL sockets is being used as the connection to the internal drives in the Sun Enterprise 3500 server, its matching empty socket *can* be used to connect a Sun StorEdge A5X00 disk array.

Is the LUXADM disk administration facility supported with the Sun Enterprise 3500 internal disk drives?

Yes, a specific set of LUXADM commands are supported currently and more will be added in the first half of calendar year 1999. The following commands are currently supported on both Solaris 2.5.1, Solaris 2.6 and the Solaris 7 Operating Environment: luxadm inquiry, stop, start, -e forcelip, -e rdls, set_boot_dev.

Why is there a new second peripheral power supply?

When the second peripheral power supply was moved to the front of the Sun Enterprise 3500 server, it had to be redesigned to fit its new space. When this second peripheral power supply is not used, a thermal protection module is inserted in its place. This light-weight component can be recognized by the warning labels on it and should *not* be discarded. It should only be removed when a second peripheral power supply is installed.

As the internal disk drives are no longer SCSI, can the on-board SCSI connection be used on the first I/O board in the Sun Enterprise 3500 server?

Yes. This connection may be used to connect certain SCSI devices as long as the total SCSI length (including the connection to the tape and internal CD to the Sun Enterprise 3500 server) does not exceed SCSI specifications (6 meters). The internal SCSI bus length is 1.56 meters. This means that up to two Sun StorEdge UniPacks or one Sun StorEdge MultiPack (with six drives or fewer) may be daisy chained from the on-board SCSI port located on the first I/O board of the Sun Enterprise 3500 server.

Sun Enterprise™ 4500 Server

Sun Enterprise 4500 System Enclosure
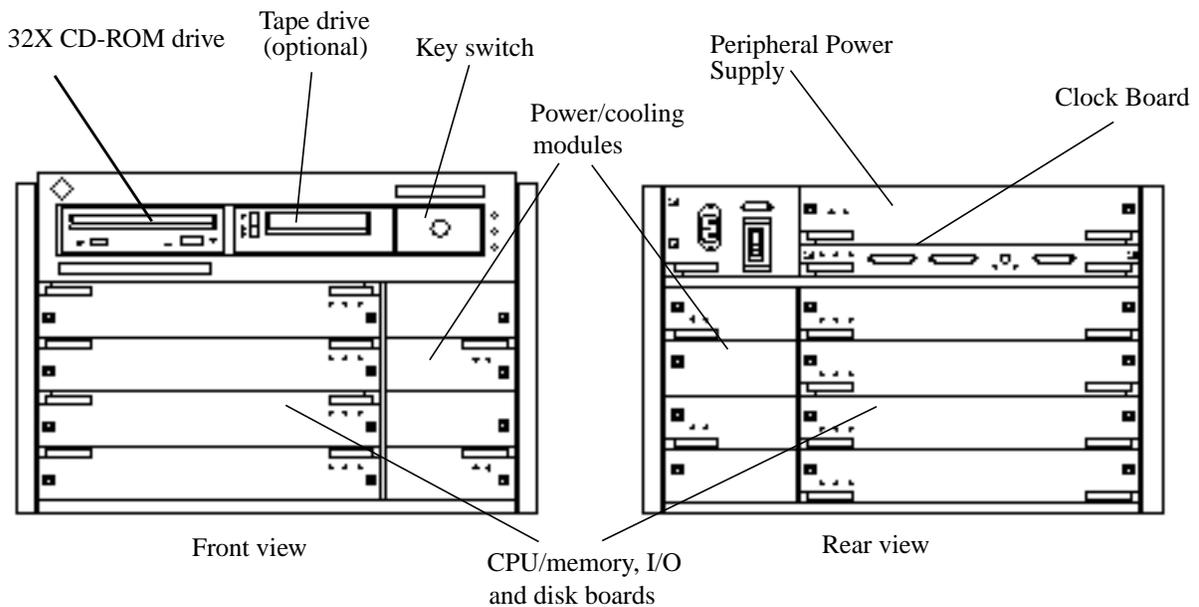
Figure 5. The Sun Enterprise™ 4500 System Enclosure

The Sun Enterprise 4500 server package is a tabletop enclosure, which is identical to the Sun Enterprise 4000 server and similar in size to the external package of the SPARCserver™ 1000E system. In addition to the enhanced Gigaplane™ system bus, the Sun Enterprise 4500 server also has a faster 32X CD-ROM, compared to the 12X CD-ROM used in the Sun Enterprise 4000 server. The Sun Enterprise 4500 server also includes a power cord locking module that prevents the power cord from being accidentally removed from the system.

- Inside the enclosure is an eight-slot card cage for CPU/memory, I/O, or disk boards, allowing four boards to be installed from the front of the cabinet and four boards to be installed from the rear. Typically, the I/O boards and disk boards are installed from the rear for ease of cabling.

- In the card cage, next to the board slots, are slots for the power/cooling modules. Up to four power/cooling modules can be installed, two from the front and two from the rear. Power/cooling modules must be installed adjacent to CPU/memory, I/O, and disk boards.

- The peripheral power supply is located at the top rear of the card cage.

- The Sun StorEdge™ CD32 drive is located at the upper left front of the enclosure. Next to the SunCD™ 32 is a slot for an optional half-height tape device. The tape device can be a 4-mm, 8-mm, or one-quarter-inch tape drive. Next to the slot for the optional tape device are the key switch and system LEDs.

- The clock board is located in the card cage below the peripheral power supply. The clock board has its own slot and does not use one of the eight board slots for the CPU/memory, I/O, or disk boards.

Sun Enterprise™ 5500 Server

Sun Enterprise 5500 System Cabinet
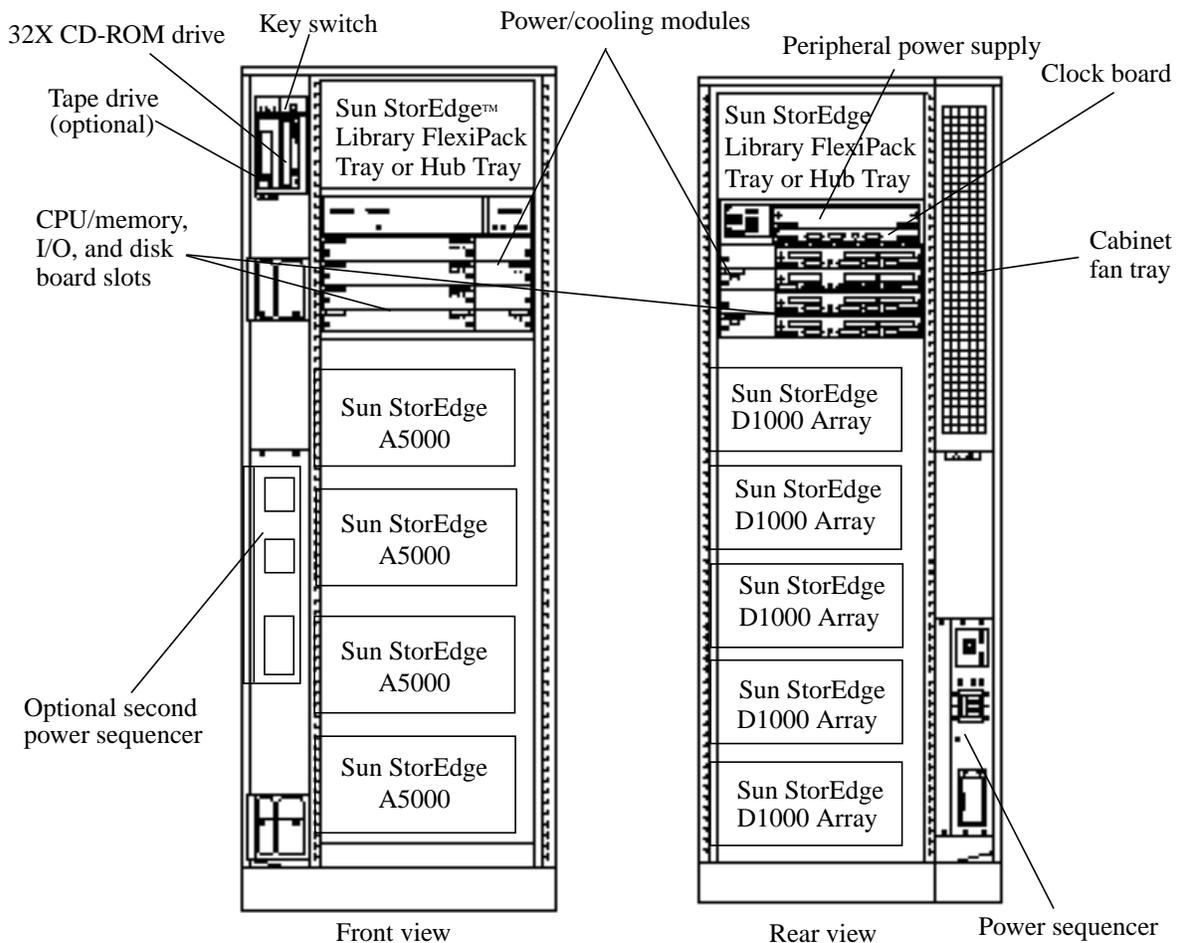
Figure 6. The Sun Enterprise™ 5500 System Cabinet

The Sun Enterprise 5500 system enclosure is a 68-inch data-center cabinet, 12 inches taller than both the Sun Enterprise 5000 system cabinet as well as the SPARCcenter™ 2000E system cabinet. In addition to the enhanced Gigaplane™ system bus, the Sun Enterprise 5500 server also has a faster 32X CD-ROM, compared to the 12X CD-ROM used in the Sun Enterprise 5000 server. The fan tray that supports the internal SCSI devices (internal tape and CD) in the Sun Enterprise 5500 server has also been modified to enable support for new, higher performing tape devices.

- Inside the cabinet is an eight-slot card cage for CPU/memory, I/O, or disk boards, allowing four boards to be installed from the front of the cabinet and four boards to be installed from the rear. Typically, the I/O boards and disk boards will be installed from the rear for ease of cabling.

- In the card cage, next to the board slots, are slots for the power/cooling modules. Up to four power/cooling modules can be installed, two from the front and two from the rear. Power/cooling modules must be installed adjacent to CPU/memory, I/O, and disk boards.

- The peripheral power supply is located at the top rear of the card cage.

- The clock board is located in the card cage below the peripheral power supply. The clock board has its own slot and does not use one of the eight board slots for the CPU/memory, I/O, or disk boards.

- The cabinet fan tray contains four fans that blow hot air out the rear of the cabinet.

- An optional Sun StorEdge™ FlexiPack removable storage tray, Sun StorEdge Tape Library, or FC-AL hub tray (supporting two hubs) can be installed above the card cage. The FC-AL hub tray can also be installed below the card cage in the Sun Enterprise 5500 server in all cases, except maximum configurations, with four Sun StorEdge A5X00 arrays.

- The following devices can be installed in the system cabinet below the card cage:
    - Up to four Sun StorEdge A5X00 disk arrays
    - Up to five Sun StorEdge A1000/D1000 arrays
    - Up to two Sun Enterprise 4000 or Sun Enterprise 4500 servers (using the rack-mount rails for Sun Enterprise 4000 or Sun Enterprise 4500 server)

Note: *The SPARCstorage™ Array Model 100 series subsystems and the Sun StorEdge RSM™ disk trays are still supported in the Sun Enterprise 5500 system cabinet, however they are no longer orderable. The Sun Enterprise 5500 system cabinet can support up to four SPARCstorage Array Model 100 series subsystems or up to six StorEdge RSM disk trays.*

- A hinged door covering the lower four-fifths of the cabinet offers easy access to internal components.

- A Sun StorEdge CD32 drive is installed in the upper left front of the system cabinet. Next to the SunCD™ 32 is a slot for an optional half-height tape device. The tape device can be a 4-mm, 8-mm, or one-quarter-inch tape drive. Next to the slot for the optional, half-height tape device are the key switch and system LEDs. The SunCD 32 CD-ROM, the optional tape device, and the key switch are mounted behind a separate, small door.

- The top panel does not have a hinged door. The upper right front of the system cabinet will either have a bezel for the Sun StorEdge FlexiPack removable storage tray or Sun StorEdge Tape Library, or a blank panel when no peripherals are installed above the card cage.

- Customers who wish to include two or more Sun StorEdge A5X00 arrays in the Sun Enterprise 5500 system cabinet must also order the Sun StorEdge A5000 screen door, which provides additional electro-magnetic interference shielding.

- A 9-inch air baffle is required when three Sun StorEdge A5X00 arrays are installed in a Sun Enterprise 5500 system cabinet.

- An optional, second power sequencer is offered to provide a second power source for configurations where the aggregate power requirements of the devices exceed the power provided by a single power sequencer. The second power sequencer also provides a second power source for storage devices that support dual power inlets.

- When the Second Power Sequencer is ordered for installation in the system cabinets (Sun Enterprise 5500 and Sun Enterprise 6500 servers), the second sequencer mounting brackets for Sun Enterprise 5500 and 6500 servers must also be ordered.

- For additional details regarding rackmounting devices in the Sun Enterprise 5500 system cabinet please see the Sun Enterprise 5500 ordering flowchart at http://edss.corp/flowcharts/E5500.new.html

Sun Enterprise 6500 System Cabinet

CD-ROM drive · Key switch · Power/cooling modules · Peripheral power supply · Clock board

Tape drive (optional)

Sun StorEdge™ Library FlexiPack Tray or Hub Tray

Sun StorEdge Library FlexiPack Tray or Hub Tray

Cabinet fan tray

CPU/memory and I/O board slots

Sun StorEdge A5000

Sun StorEdge D1000 Array

Sun StorEdge A5000

Sun StorEdge D1000 Array

Optional second power sequencer

Sun StorEdge D1000 Array

Sun StorEdge A5000

Sun StorEdge D1000 Array

Power sequencer

Front view · Rear view
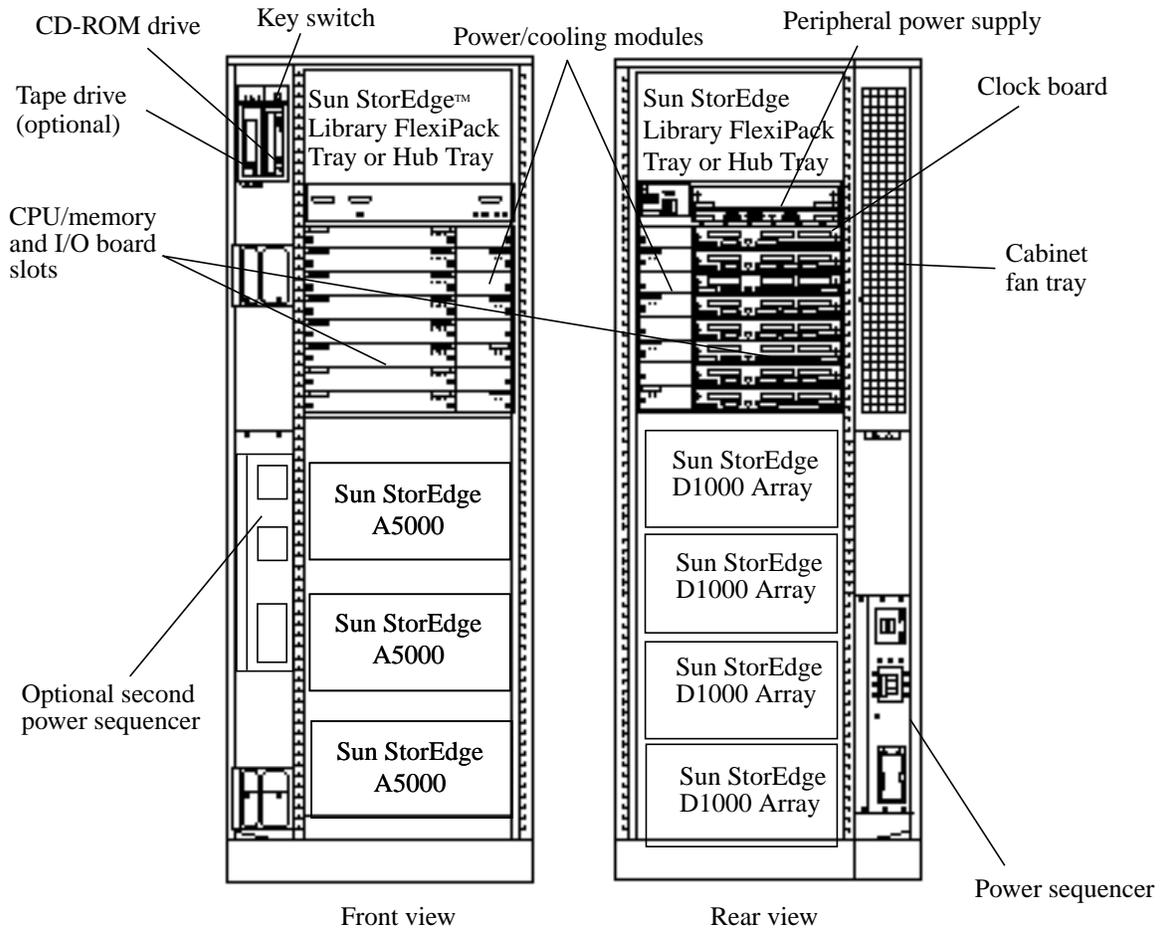
Figure 7. The Sun Enterprise™ 6500 System Cabinet

The Sun Enterprise 6500 system enclosure is a 68-inch tall data-center cabinet, 12 inches taller than both the Sun Enterprise 6000 cabinet and the SPARCcenter™ 2000E cabinet. The Sun Enterprise 6500 server also has a faster 32X CD-ROM, compared to the 12X CD-ROM used in the Sun Enterprise 6000 server. The fan tray that supports the internal SCSI devices (internal tape and CD) in the Sun Enterprise 6500 server has also been modified to enable support for new, higher-performing tape devices.

- Inside the cabinet is a 16-slot card cage for CPU/memory boards, I/O boards and disk boards, allowing eight boards to be installed from the front of the cabinet and eight boards to be installed from the rear of the cabinet. Typically, the I/O boards are installed from the rear for ease of cabling.

- The physical length of the 16-slot Gigaplane system bus in the Sun Enterprise 6500 server limits the maximum speed of the system interconnect. Therefore the Sun Enterprise 6500 server runs the Gigaplane system bus at a maximum of 84 MHz with 16 slots.

- In the card cage, next to the board slots, are slots for the power/cooling modules. Up to eight power/cooling modules can be installed, four from the front and four from the rear. Power/cooling modules must be installed adjacent to CPU/memory and I/O boards.

- The peripheral power supply is located at the top rear of the card cage. The clock board is located in the card cage below the peripheral power supply. The clock board has its own slot and does not use one of the 16-board slots for the CPU/memory or I/O boards.

- The cabinet fan tray contains four fans that blow hot air out the rear of the cabinet.

- An optional Sun StorEdge FlexiPack removable storage tray, Sun StorEdge Tape Library or FC-AL hub tray (supporting two hubs) can be installed above the card cage. The hub tray can also be installed below the card cage in the Sun Enterprise 6500 server in all cases except maximum configurations, with three Sun StorEdge A5X00 arrays.

- The following storage devices can be installed in the system cabinet below the card cage:
  – Up to three Sun StorEdge A5X00 disk arrays
  – Up to four Sun StorEdge A1000/D1000 arrays
  – Up to two Sun Enterprise 4000 or Sun Enterprise 4500 servers (using the rack-mount rails for Sun Enterprise 4000 or Sun Enterprise 4500 servers)

Note: *The SPARCstorage™ Array Model 100 series subsystems and Sun StorEdge RSM™ trays are still supported in the Sun Enterprise 6500 system cabinet, however they are no longer orderable. The Sun Enterprise 6500 system cabinet can support up to three SPARCstorage Array Model 100 series subsystems or up to five StorEdge RSM disk trays.*

- A hinged door covering the lower three-quarters of the cabinet offers easy access to internal components.

- A Sun StorEdge CD32 drive is installed in the upper left front of the system cabinet. Next to the SunCD™ 32 is a slot for an optional half-height tape device. The tape device can be a 4-mm, 8-mm, or one-quarter-inch tape drive. Above the slot for the optional half-height tape device is the key switch. The SunCD 32 CD-ROM, the optional tape device, and the key switch are mounted behind a separate, small door.

- The top panel does not have a hinged door as on the SPARCcenter 2000E. The upper right front of the system cabinet will have either a bezel for the Sun StorEdge FlexiPack removable storage tray or Sun StorEdge Tape Library, or a blank panel when no peripherals are installed above the card cage.

- Customers who wish to include two or more Sun StorEdge A5X00 arrays in the Sun Enterprise 6500 system cabinet must also order the Sun StorEdge A5000 screen door, which provides additional electro-magnetic interference shielding.

- A 9-inch air baffle is required when two Sun StorEdge A5X00 arrays are installed in a Sun Enterprise 6500 system cabinet.

- An optional, second power sequencer is offered to provide a second power source for configurations where the aggregate power requirements of the devices exceed the power provided by a single power sequencer. The second power sequencer also provides a second power source for storage devices that support dual power inlets.

- When the Second Power Sequencer is ordered for installation in the system cabinets (Sun Enterprise 5500 and Sun Enterprise 6500 servers), the second sequencer mounting brackets for Sun Sun Enterprise 5500 and 6500 servers must also be ordered.

- For additional details regarding rackmounting devices in the Sun Enterprise 6500 system cabinet please see the Sun Enterprise 6500 ordering flowchart at http://edss.corp/flowcharts/E6500.new.html

Sun Enterprise Expansion Cabinet

Figure 8. The Sun Enterprise™ Expansion Cabinet

The 68-inch Sun Enterprise expansion cabinet is primarily used to rack mount Sun Enterprise 4000 and Sun Enterprise 4500 servers and is ordered without factory-installed devices. This data center cabinet is similar in look and size to the Sun Enterprise 5500 and Sun Enterprise 6500 system cabinets.

This section describes the features of the new 68-inch Sun Enterprise expansion cabinet. Refer to the *Sun Enterprise 3000–6000 Just the Facts* document for details regarding the 56-inch expansion cabinet.

Each expansion cabinet includes a cable for connecting the expansion cabinet to a system cabinet. The cable allows control and status information to be transferred between the expansion cabinet and the system cabinet (see "Expansion Cabinet Cooling" for more details). Multiple expansion cabinets can be daisy-chained to the system cabinet.

- The following devices may be installed in an expansion cabinet:
    - Sun Enterprise 4000 and Sun Enterprise 4500 servers
    - Sun StorEdge™ A5X00 disk arrays
    - Sun StorEdge A1000/D1000 arrays
    - Sun StorEdge FlexiPack removable storage trays
    - Sun StorEdge Tape Library
- The expansion cabinet has a full-height hinged door, offering easy access.
- Sun Enterprise cabinet floor brackets may be installed to help prevent the cabinet from shifting in cases of extreme floor movement.

Expansion Cabinet Capacity

- A maximum of six Sun StorEdge A5X00 arrays and two FC-AL hub trays (supporting two hubs each) can be installed in an expansion cabinet, offering up to 1.2 TB of storage (with the StorEdge A5200 array).

- A maximum of eight Sun StorEdge A1000/D1000 arrays are supported per cabinet (a second power sequencer is required if more than four A1000/D1000 arrays are installed in the expansion cabinet).

- A maximum of two Sun StorEdge FlexiPack removable storage trays are supported per expansion cabinet; a maximum of five Sun StorEdge FlexiPack removable storage trays are supported per system.

- Up to four tape devices are supported per Sun StorEdge FlexiPack removable storage tray.

- A maximum of four Sun StorEdge Tape Libraries are supported per expansion cabinet.

- Expansion cabinets with Sun StorEdge FlexiPack removable storage trays or Sun StorEdge Tape Libraries must be adjacent to the system cabinet. This is required because the maximum length of the single-ended SCSI cable is 6 meters.

- Customers who wish to include two or more Sun StorEdge A5X00 arrays in the Sun Enterprise expansion cabinet must also order the Sun StorEdge A5000 screen door, which provides additional electro-magnetic interference shielding.

- A 9-inch air baffle is required when five Sun StorEdge A5X00 arrays are installed in a Sun Enterprise expansion cabinet

- An optional, second power sequencer is offered to provide a second power source for configurations where the aggregate power requirements of the devices exceed the power provided by a single power sequencer. The second power sequencer also provides a second power source for storage devices that support dual power inlets. The Expansion cabinet comes with mounting brackets already installed so no Second Sequencer mounting brackets need be ordered.

Note: *Please note that the SPARCstorage™ Array model 100 series subsystems, model 200 series controllers and Sun StorEdge RSM™ trays are supported in the 68-inch Sun Enterprise expansion cabinet system cabinet, however they are no longer orderable. The Sun Enterprise expansion cabinet can support a maximum of seven SPARCstorage Array Model 100 Series disk arrays or a maximum of ten StorEdge RSM disk trays (an expansion cabinet with 8 or more RSM disk trays requires the second power sequencer).*

- Up to four Sun Enterprise 4000 or Sun Enterprise 4500 servers may be mounted in a Sun Enterprise expansion cabinet (using the rack-mount rails for the Sun Enterprise 4000 or Sun Enterprise 4500 server). An expansion cabinet with four Sun Enterprise 4000 or Sun Enterprise 4500 systems requires the second power sequencer.

  – The following combinations of rack-mounted devices are supported with *one* Sun Enterprise 4500 server in the Sun Enterprise expansion cabinet:

    – Five Sun StorEdge A5X00 arrays with one hub tray (supporting two hubs)
    – Up to six Sun StorEdge A1000/D1000 arrays (a second power sequencer is required if more than four Sun StorEdge A1000/D1000 arrays are installed in the expansion cabinet).
    – Up to eight Sun StorEdge RSM disk trays (an expansion cabinet with eight or more Sun StorEdge RSM disk trays requires the second power sequencer).
    – Up to five SPARCstorage Array Model 100 Series

  – The following combinations of rack-mounted devices are supported with *two* Sun Enterprise 4500 servers in the Sun Enterprise expansion cabinet:

    – Three Sun StorEdge A5X00 arrays with one hub tray (supporting two hubs)
    – Up to four Sun StorEdge A1000/D1000 arrays

- – Up to five Sun StorEdge RSM disk trays
- – Up to three SPARCstorage Array Model 100 Series
  - – The following combinations of rack-mounted devices are supported with *three* Sun Enterprise 4500 servers in the Sun Enterprise expansion cabinet:
    - – Exactly three Sun Enterprise 4X00 systems (no other devices in the cabinet) require one 9-inch air baffle (X9622A) and two 6-inch air baffles (X9625A).
    - – Three Sun Enterprise 4X00 systems and one Sun StorEdge A5X00 array (or one SPARCstorage Array Model 100) require two 6-inch baffles (X9625A).
    - – Three Sun Enterprise 4X00 systems and two Sun StorEdge A5X00 arrays (or two SPARCstorage Arrays Model 100) require no baffles
    - – Three Sun Enterprise 4X00 systems and any other devices (Sun StorEdge RSM tray, Sun StorEdge A1000/D1000 array, etc) in any quantity requires no baffles

  No additional devices can be mounted in the 68-inch Sun Enterprise expansion cabinet with four Sun Enterprise 4X00 servers. One 6-inch are baffle (X9625A) is required when four Sun Enterprise 4500 system chassis are installed in a Sun Enterprise expansion cabinet. A second power sequencer is also required with four Sun Enterprise 4X00 systems in a 68-inch Expansion Cabinet.

- • For additional details regarding rackmounting devices in the Sun Enterprise expansion cabinet please see the 68-inch Sun Enterprise expansion cabinet ordering flowchart at http://edss.corp/flowcharts/E4X00rack.html.

Expansion Cabinet Cooling

- • Each expansion cabinet has one cabinet fan tray that includes four fans supported by two power supplies. Each power supply supports two fans.

- • The expansion cabinet features redundant cooling. If a power supply fails, two fans stop running and two fans continue to operate, providing enough cooling to keep the devices in the expansion cabinet cool.

- • Expansion cabinets can be controlled by the Sun Enterprise 4500–6500 server and can send status information to the system cabinet, through a connection between the expansion cabinets and the system cabinet. Specifically, the connection supports the following:

  - – When a cabinet fan tray fails in an expansion cabinet, the Sun Enterprise 4500–6500 server is notified of this failure. A system administrator monitoring the Sun Enterprise 4500–6500 server status will be able to see when a cabinet fan tray fails in an expansion cabinet.

  - – The system administrator is able to turn off the Sun Enterprise 4500–6500 server and all expansion cabinets connected to the Sun Enterprise 4500 server with either the Sun Enterprise 4500–6500 server key switch or through a software command.

Sun Enterprise™ Expansion Cabinet

Expansion Cabinet Questions and Answers

What is the difference between the 56-inch and 68-inch Sun Enterprise expansion cabinet?

Basically the only difference is the height of the cabinet. One more 12-inch door panel was added to increase the height to 68 inches. Additional space allows more devices in the cabinet, which in turn requires more power. Therefore an optional, second power sequencer is offered. As mentioned earlier, if two or more Sun StorEdge A5X00 arrays are to be installed in the Sun Enterprise expansion cabinet the customer must also order the Sun StorEdge A5000 front screen door, which provides additional electro-magnetic interference shielding.

Can the peripherals in an existing SPARCcenter™ expansion cabinet be migrated and moved to the new Sun Enterprise expansion cabinet?

Yes, the peripheral devices in the SPARCcenter expansion cabinet can be migrated to the Sun Enterprise expansion cabinet. The only device supported in the SPARCcenter expansion cabinet that is not supported in the Sun Enterprise expansion cabinet is the half-inch tape drive.

Sun Enterprise™ Expansion Cabinet

CPU/Memory Board

Figure 9. CPU/memory board

CPU/memory boards connect to the Gigaplane™ bus. On the CPU/memory boards, the Ultra™ Port Architecture (UPA) bus connects the Gigaplane bus to the two UltraSPARC™ modules and two memory banks.

- The latest CPU/memory board (2602A)is capable of running at up to 100-MHz Gigaplane speed.
- Each CPU/memory board can support zero, one, or two UltraSPARC modules. CPU/memory boards with no UltraSPARC modules can be added to systems requiring more memory capacity.
- The Sun Enterprise™ 3500–5500 servers support 167-MHz, 250-MHz, 336-MHz and 400-MHz UltraSPARC modules.
- The Sun Enterprise 6500 server support 167-MHz, 250-MHz and 336-MHz UltraSPARC modules.
- The CPU/memory board has two banks of 60-ns, 3.3-V memory modules. Each memory bank consists of eight memory modules. Two types of memory options are available: 256 MB (8 x 32-MB memory modules), and 1 GB (8 x 128-MB memory modules).
- Each CPU/memory board supports up to 2 GB of memory.
- The CPU/memory boards have temperature sensors located under the UltraSPARC modules that control the fan speed in the adjacent power/cooling module and allow the actual temperature of individual boards to be monitored through the Sun Enterprise SyMON™ software.
- With a system design that supports multiple CPU/memory boards, a failure of a single UltraSPARC module or memory module will result in a temporary interruption of system operation while the system reboots itself around the failed component.
- The part number for the new, 100 MHz-capable CPU/memory boards is 2602A. This CPU/memory board includes two empty CPU slots, two empty memory banks, no processors, and no memory.

Note: *The 84 MHz-capable CPU/memory boards (2600A and 2601A) have been transitioned off of the price list.CPU/memoryoryory Board*

CPU/Memory Board Questions and Answers

Why did Sun change from using a single system board that included everything in the SPARCserver 1000/2000 (CPU, memory, and I/O) to offering two types of boards, CPU/memory boards and I/O boards with the Sun Enterprise 3X00–6X00 servers?

There are many advantages gained by offering separate CPU/memory boards and I/O boards. The primary advantage is configuration flexibility. With one system board, a customer who wants to increase memory capacity must purchase an entire system board. With separate CPU/memory and I/O boards, customers can purchase only what they need. If they want to add additional memory, they purchase a CPU/memory board. This allows customers to configure systems as computing engines or I/O engines, which are not only less expensive, but also offer much higher performance, since they can configure more CPUs (and memory) or more I/O bandwidth, depending upon their application needs.

Another reason is design flexibility. With separate CPU/memory and I/O boards, Sun can make modifications to each type of board independently. For example, Sun can upgrade the Fibre Channel Interface on the I/O board and not affect the CPU/memory board. Sun also recently introduced the new, PCI I/O board. Ultimately, this allows Sun to bring out new CPU/memory and I/O board modifications, as well as new technologies, more quickly.

In addition, because the I/O board has much more functionality than before, one I/O board in the Sun Enterprise 4500 server has the same I/O capability as two system boards in the SPARCserver 1000E. This means Sun offers greater CPU, memory, and I/O expandability in these systems by offering separate CPU/memory and I/O boards.

Can the UltraSPARC modules be inserted and removed by anyone?

No. Only qualified personnel should insert and remove UltraSPARC modules.

Why did Sun go to a new UltraSPARC module connector?

The new connector is more reliable than the type of connector used in the SPARCserver 1000E. Also, the previous connectors did not provide the number of pins required for the new modules.

Are there any special requirements for upgrading to the 250-MHz/4-MB or 336-MHz/4-MB UltraSPARC modules?

Yes, the 250-MHz and 336-MHz modules with 4 MB of external cache should be installed on either the 2601A or the latest CPU/memory board (2602A) which replaced the 2601A. Although the 250-MHz/4-MB and 336-MHz/4-MB modules will function and are supported on the original CPU/memory board (2600A) only 2 MB of Ecache will be used per module.

What is the software requirement for the 336-MHz modules?

The 336-MHz UltraSPARC module requires the Solaris™ 2.5.1 Operating Environment or later releases. It also requires Sun Enterprise Flashprom Update 3.2.12 or later.

Can the newer 100 MHz-capable CPU/memory boards be used in Sun Enterprise 3000–6000 servers?

Yes. The previous 84-MHz CPU/memory boards are being transitioned off the price list and these new CPU/memory boards are compatible with existing Sun Enterprise 3000–6000 servers. There is no problem mixing these CPU/memory boards in a Sun Enterprise 3000–6000 server that already uses the previous boards.

CPU/Memory Board

February 1999

CPU/Memory Board Questions and Answers

Why did Sun change from using a single system board that included everything in the SPARCserver 1000/2000 (CPU, memory, and I/O) to offering two types of boards, CPU/memory boards and I/O boards with the Sun Enterprise 3X00–6X00 servers?

There are many advantages gained by offering separate CPU/memory boards and I/O boards. The primary advantage is configuration flexibility. With one system board, a customer who wants to increase memory capacity must purchase an entire system board. With separate CPU/memory and I/O boards, customers can purchase only what they need. If they want to add additional memory, they purchase a CPU/memory board. This allows customers to configure systems as computing engines or I/O engines, which are not only less expensive, but also offer much higher performance, since they can configure more CPUs (and memory) or more I/O bandwidth, depending upon their application needs.

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In addition, because the I/O board has much more functionality than before, one I/O board in the Sun Enterprise 4500 server has the same I/O capability as two system boards in the SPARCserver 1000E. This means Sun offers greater CPU, memory, and I/O expandability in these systems by offering separate CPU/memory and I/O boards.

Can the UltraSPARC modules be inserted and removed by anyone?

No. Only qualified personnel should insert and remove UltraSPARC modules.

Why did Sun go to a new UltraSPARC module connector?

The new connector is more reliable than the type of connector used in the SPARCserver 1000E. Also, the previous connectors did not provide the number of pins required for the new modules.

Are there any special requirements for upgrading to the 250-MHz/4-MB or 336-MHz/4-MB UltraSPARC modules?

Yes, the 250-MHz and 336-MHz modules with 4 MB of external cache should be installed on either the 2601A or the latest CPU/memory board (2602A) which replaced the 2601A. Although the 250-MHz/4-MB and 336-MHz/4-MB modules will function and are supported on the original CPU/memory board (2600A) only 2 MB of Ecache will be used per module.

What is the software requirement for the 336-MHz modules?

The 336-MHz UltraSPARC module requires the Solaris™ 2.5.1 Operating Environment or later releases. It also requires Sun Enterprise Flashprom Update 3.2.12 or later.

Can the newer 100 MHz-capable CPU/memory boards be used in Sun Enterprise 3000–6000 servers?

Yes. The previous 84-MHz CPU/memory boards are being transitioned off the price list and these new CPU/memory boards are compatible with existing Sun Enterprise 3000–6000 servers. There is no problem mixing these CPU/memory boards in a Sun Enterprise 3000–6000 server that already uses the previous boards.

CPU/Memory Board

February 1999

Is there any new hardware or software required to support the 400-MHz module in the Sun Enterprise 3X00–5X00 servers?

Yes, the 400-MHz modules will require Ultra Sun Enterprise Flashprom update 3.2.18 or above. Other than the Flashprom version, no new hardware or software is required from what is being shipped currently in the Sun Enterprise 3500–5500 servers.

They will run in existing Sun Enterprise 3000–5000 servers if they have the following:

- 100-MHz capable CPU/memory and I/O boards (2602A, 2612A, 2622A, 2632A)
- An upgraded 100-MHz capable Gigaplane in the Sun Enterprise 4000 and 5000 (Sun Enterprise 3000 excluded as mentioned above.) See "Upgrades" section for details regarding system board and Gigaplane upgrades.
- Ultra Sun Enterprise Flashprom update 3.2.18 or above.
- 100-MHz clock board (manufacturing part number 501-4946) which is required to support 100-MHz Gigaplane. A100-MHz clock board upgrade is available (part number UG-ENT-100MHCLOCKB

The clock board in the latest Sun Enterprise 3000 and Gigaplane in all Sun Enterprise 3000 servers are already 100-MHz capable so in most cases only the system boards need to be upgraded in order to support the 400-MHz/4-MB modules. Only original Sun Enterprise 3000 base packages need to have the clock board upgraded. This is because the original clock board in Sun Enterprise 3000 base package did not support any modules above 167-MHz and therefore needs to be upgraded to support 400-MHz modules. Base packages with order numbers "E3001" and "E3002"do not need to have the clock board upgraded because they shipped with a second generation clock board which supported modules above 167-MHz.

Is the 400-MHz/4-MB UltraSPARC module supported in a system with any 84-MHz system boards (2600A, 2601A, 2610A, 2611A, 2620A, or 2630A)?

No, the 400-MHz/4-MB UltraSPARC module is not supported in a system with any 84-MHz system boards due to the fact that it runs at a 4:1 CPU-to-Gigaplane speed ratio and requires the Gigaplane (and associated system boards) to run at 100-MHz.

What CPU modules are supported in the Sun Enterprise 3500–6500 servers?

The Sun Enterprise 3500–5500 servers can be ordered with factory-configured 250-MHz/4-MB, 336-MHz/4-MB or 400-MHz/4-MB UltraSPARC modules. The Sun Enterprise 6500 can be factory-configured with either 250-MHz/4MB or 336-MHz/4-MB UltraSPARC modules. The 250-MHz/1-MB, 167-MHz/1-MB, and 167-MHz/0.5-MB UltraSPARC Modules are also supported, but they not available as factory-configured options.

Note: *Customers with 167-MH UltraSPARC modules who wish to migrate their modules to Sun Enterprise 3500–6500 servers might require a PROM upgrade as the minimum PROM level supported is 3.2.10*

Why isn't the 400-MHz/4-MB UltraSPARC module supported in the Sun Enterprise 6500 & 6000 Servers?

The 400-MHz/4-MB module requires the Gigaplane to run at 100-MHz. The Sun Enterprise 6000 and 6500 cannot support running the Gigaplane at 100-MHz due to the physical length of the bus.

Will the 400-MHz/4-MB module ever be supported in the Sun Enterprise 6000 and 6500 Servers?

No, the 400-MHz/4-MB module will never be supported in the Sun Enterprise 6000 and 6500 Servers.

Will there be a faster than 336-MHz UltraSPARC module available for the Sun Enterprise 6000 and 6500 Servers?

Yes, there will be a future module available that will run faster than 336-MHz and will not require the Gigaplane, I/O boards, or 2601A/2602A CPU/memory boards to be upgraded (2600A CPU/memory boards will need to be upgraded). Up to 30 of these future modules will be supported in a single system and all 16 Gigaplane slots will be usable.

Is it necessary to upgrade the Gigaplane in order to support faster than 336-MHz modules in the Sun Enterprise 3000–5000 servers?

At this time yes, but in the future there will be a new module available that will run at faster than 336-MHz speeds and will not require the Gigaplane, I/O boards, or 2601A/2602A CPU/memory boards to be upgraded (2600A CPU/memory boards will need to be upgraded).

Will an Sun Enterprise 3500–5500 system support a mixture of different processor speeds (for example, 336-MHz and 400-MHz)?

Mixing 167-MHz, 250-MHz modules, 336-MHz modules, or 400-MHz modules in a single system is not supported. Mixing same frequency modules with different external cache is supported as long as all modules on a single CPU/memory Board have the same size external cache.

Memory Subsystem

Memory Subsystem

The memory in the Sun Enterprise™ 3000–6000 and Sun Enterprise 3500–6500 servers is located on the CPU/memory boards. Up to 2 GB of RAM can be installed on each CPU/memory board. The memory subsystem in Sun Enterprise 3500–6500 servers is designed to offer fast, reliable data access.

- The memory controller manages two banks of memory on each CPU/memory board. Each bank of memory consists of eight standard JEDEC memory module modules, implemented in 3.3-V CMOS.

- The memory banks on the CPU/memory boards are very "wide." Each bank can deliver 512 bits (64 bytes) in a single cycle, meaning that a 64-byte cache miss can be supplied in one memory cycle. This results in faster memory subsystem performance.

- Sun Enterprise 3500–6500 servers support up to 16-way memory interleave. Extensive interleave is required to support the high memory access rates possible in systems with many UltraSPARC™ modules.

- Interleaved memory banks can be different sizes, which is an improvement from the memory interleaving scheme used in the SPARCserver™ 1000E and SPARCcenter™ 2000E systems.

Memory Interleaving

Memory interleaving helps increase memory subsystem performance by reducing the probability of "hot spots" or contention in a few memory banks by spreading access to multiple memory banks. In a two-way interleaved system, the first cacheline is supplied by bank 0 while the second is supplied by bank 1. The size and extent of interleave is arranged so that a single typical request is satisfied by one bank. This permits memory requests to be fulfilled with a minimum amount of contention from other UltraSPARC modules.

Interleaved memory on Sun Enterprise 3500–6500 systems is considerably more important than on previous-generation systems because the UltraSPARC modules generate requests faster and the bandwidth of a single bank of memory is a smaller fraction of the Gigaplane™ bus bandwidth.

Configuring Memory for Best Performance

Configuring the memory for optimal system performance is easier than doing so for the SPARCserver 1000E and SPARCcenter 2000E systems because the memory interleave algorithm used for Sun Enterprise 3500–6500 server is much more flexible. Here are some general guidelines that should be used as a starting point in configuring a memory subsystem:

- Each UltraSPARC module should have at least 128 MB of RAM.

- Spread the amount of memory equally among the available banks. If there are one 1024-MB bank and one 256-MB bank, 80 percent (1024 x 100 / (1024 + 256)) of all accesses on average will go to the 1024-MB bank and the bandwidth available will be limited by that bank, even though the 256-MB bank has the same available bandwidth. If most of the memory is in a few big banks, the interleaving of those big banks is more important than the interleaving of the other banks.

- In general, it is better to have more banks of smaller size than a smaller number of bigger banks.

- Fill up one bank on every board before filling the second bank on any board.

- If there are some boards with both banks filled and some boards with only one bank, the smaller banks must be put on the boards with two banks; the bigger banks must be kept on boards with only one bank.

Memory Subsystem Questions and Answers

What is the difference between the memory interleaving in the Sun Enterprise 3500–6500 servers and the memory interleaving in the SPARCserver 1000E system?

The SPARCserver 1000E system used a simple interleaving system that produced up to eight-way interleave. Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers have an improved design with fewer restrictions on the interleave configuration. They can support up to 16-way interleave and these interleaved memory banks can also be different sizes. The previous-generation systems interleaved memory only when memory banks were the same size. This meant that a SPARCserver 1000E system with two 32-MB banks and two 256-MB banks would use a two-way interleave between the 32-MB banks and two-way interleave between the 256-MB banks.

A similarly configured Sun Enterprise 3500–6500 server can use four-way interleave on the two 256-MB banks when combined with the first 256 MB of the 1-GB banks, and two-way interleave on the remaining memory. This permits considerably higher memory subsystem performance.

Why can't the memory modules from the SPARCcenter 2000E or SPARCserver 1000E be used in Sun Enterprise 3500–6500 servers? The Ultra™ 1 systems use the memory modules from the previous generation of desktops.

Sun Enterprise 3500–6500 server architecture requires 3.3-volt memory modules. All of Sun's previous generation memory modules were 5 volt. In addition, the desktop memory modules are too tall for the CPU/memory board spacing. The JEDEC memory modules fit both the form factor and voltage requirements.

Does the use of industry-standard memory modules mean that customers can buy off-the-shelf memory modules for use in Sun Enterprise 3500–6500 servers?

Yes, as long as the memory modules are the correct size (density), form, and voltage. However, Sun cannot guarantee that memory modules from third-party vendors will operate properly in Sun Enterprise 3500–6500 servers. Sun does not support third-party memory options.

Do Sun Enterprise 3500–6500 servers need more memory per processor compared to the SPARCcenter 2000E and SPARCserver 1000E systems? If so, why and how much?

Yes. With the SPARCcenter 2000E system, the general rule is that each processor should have at least 64 MB of RAM. With Sun Enterprise 3500–6500 servers, the general rule is that each processor should have at least 128 MB of RAM. The reason is that the UltraSPARC modules in the Sun Enterprise 3500–6500 servers are much higher performance than the CPU modules in the SPARCcenter 2000E system, so they require more memory for a balanced system.

How can one tell what interleave factor a Sun Enterprise 3500–6500 server is using?

Use `prtdiag(1M)`, located in the `/usr/platform/sun4u/sbin` directory.

Memory Subsystem

Just the Facts

February 1999

I/O Boards

Overview

Most of the I/O connectivity for Sun Enterprise™ 3000–6000 and Sun Enterprise 3500–6500 servers is supported through I/O boards. Three types of I/O boards—SBus, Graphics, and PCI—offer a wide range of I/O connectivity.

One of the significant improvements over the I/O subsystem in the SPARCserver™ 1000E and SPARCcenter™ 2000E systems is the use of dual SBus channels on each SBus I/O board. In these previous-generation servers, each system board had one 32-bit SBus channel, offering a maximum I/O bandwidth of 100 MB per second per system board. With dual 64-bit SBus channels on each SBus I/O board, the maximum bandwidth in a Sun Enterprise 3500–6500 server is 400 MB per second per board.

The SBus and Graphics I/O boards also provide 100 MB per second Fibre Channel Arbitrated Loop (FC-AL) connectivity.

The PCI I/O board has two PCI-66 channels and two standard 33-MHz PCI channels. The PCI I/O board has two PCI slots, 20-MB-per-second fast-wide SCSI, and 10/100-Mb-per-second Ethernet. The Ultra™ Port Architecture (UPA) interface that connects the PCI I/O board to the Gigaplane™ system bus has a throughput of 668 MB per second. Thus, the PCI I/O board throughput is 668 MB per second.

The I/O boards also offer environmental monitoring. The I/O boards have temperature sensors, allowing the actual temperature of individual boards to be monitored through the Sun Enterprise SyMON™ software.

I/O boards connect to the Gigaplane bus (see I/O board diagrams on following pages).

- On the SBus I/O board, the UPA bus connects the Gigaplane bus to two SBus channels, which connect the various I/O ports to the UPA bus.

- On the graphics I/O board, the UPA bus connects the Gigaplane bus to one SBus channel and one UPA slot for a graphics card (Creator or Creator3D).

- On the PCI I/O board, the UPA interface connects the Gigaplane bus to two PCI-66 channels and two standard PCI channels.

Sun Enterprise 3500–6500 servers can be PCI- or SBus-only systems. Up to four PCI I/O boards are supported per Sun Enterprise 3500 system and up to six PCI I/O boards are supported per Sun Enterprise 4500–6500 system. Mixed PCI and SBus systems are also supported.

I/O boards are hot-swappable, with the Dynamic Reconfiguration software enhancement provided with Solaris™ 2.6 Hardware: 5/98. This means new I/O boards can be installed and logically configured into the system while the system is online, or I/O boards that have been deconfigured from the system can be removed while the system is online. See the "Reliability, Availability, and Serviceability" section for more details.

I/O Boards
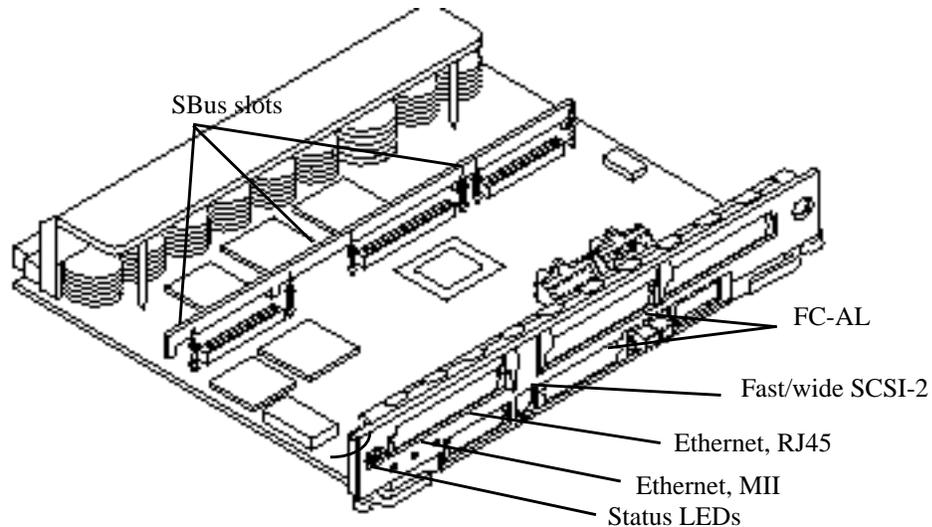
SBus I/O Board

Figure 10. SBus I/O board

SBus I/O board features:

- The latest SBus I/O board (2612A) is capable of running at up to 100-MHz Gigaplane speed
- One on-board, 10/100-Mb-per-second Ethernet port (twisted pair and MII connector)
- One 20-MB-per-second, fast/wide SCSI-2 port
- Two empty 100-MB-per-second FC-AL sockets for GBIC modules
- Three 64-bit SBus slots running at 25 MHz
- Two 64-bit SBus channels, offering a peak throughput of 400 MB per second
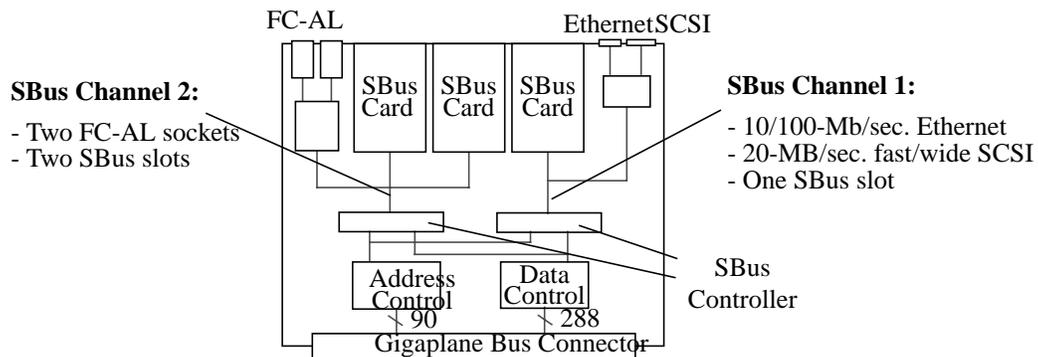
Figure 11. S/Bus I/O Block Diagram

Note: *The 84 MHz-capable SBus I/O boards (2610A and 2611A) have been transitioned off of the price list.*

In order to populate the FC-AL sockets on the newer SBus I/O boards (2611A and 2612A) and enable connectivity to a Sun StorEdge™ A5X00 array, order one or two GBIC modules (6731A).

Graphics I/O Board
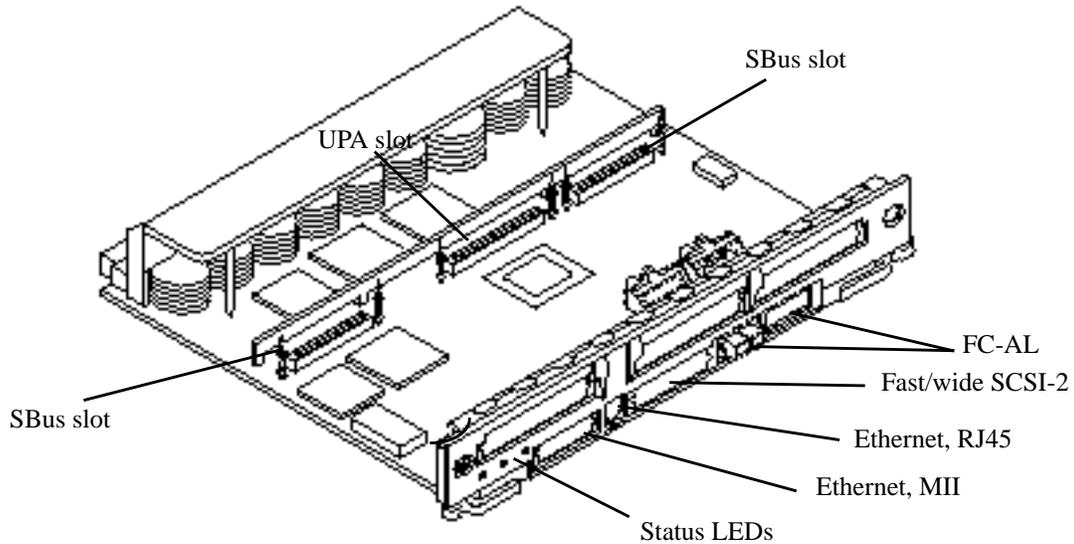
Figure 12. Graphics I/O board

The graphics I/O board, as shown, includes the following features:

- The latest Graphics I/O board (2622A) is capable of running at up to 100-MHz Gigaplane speed

- One on-board, 10/100-Mb-per-second Ethernet port (twisted pair and MII connector)

- One 20-MB-per-second, fast/wide SCSI-2 port

- Two empty 100-MB-per-second FC-AL sockets for GBIC modules

- Two 64-bit SBus slots running at 25 MHz

- One UPA slot for a Creator3D series 3 or Sun Elite3D m6 graphics board

- One 64-bit SBus channel, offering 200-MB-per-second data transfer
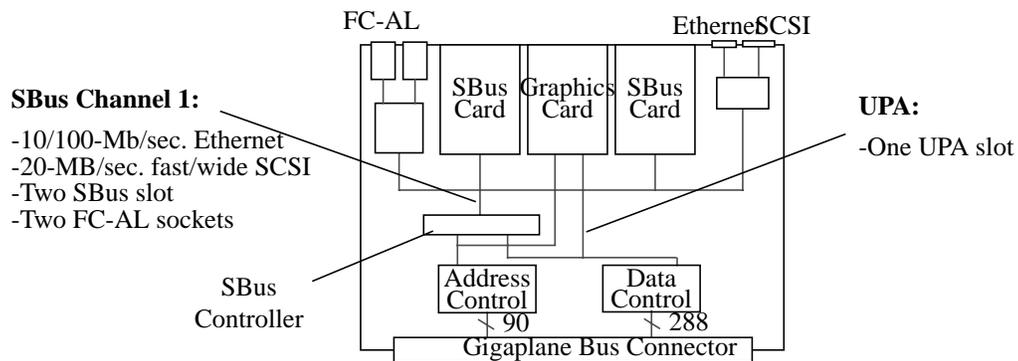
Figure 13. Graphics I/O Board Block Diagram

Note: *The 84 MHz-capable Graphics I/O board (2620A) has transitioned off of the price list.*

Graphics Frame Buffers Supported

The Graphics I/O board can support both Creator3D series 3 and Sun Elite3D m6 frame buffers in the horizontal form factor. As shown in the table below, the Sun Enterprise 3500–6500 servers can support multiple board configurations.

System	Maximum Number of Creator3D series 3 or Sun Elite3D m6 Frame Buffers	Maximum Number of CPUs
Sun Enterprise 3500 Sun Elite3D (5 slots)	3	4
Sun Enterprise 4500 Sun Elite3D (6 slots)		
• Configuration 1	1	10
• Configuration 2	2	8
• Configuration 3	3	6
• Configuration 4	4	4
Sun Enterprise 6500 Sun Elite3D (16 slots)		
• Configuration 1	1	30
• Configuration 2	2	28
• Configuration 3	3	26
• Configuration 4	4	24
• Configuration 5	5	22
• Configuration 6	6	20
• Configuration 7	7	18
• Configuration 8	8	16

I/O Boards

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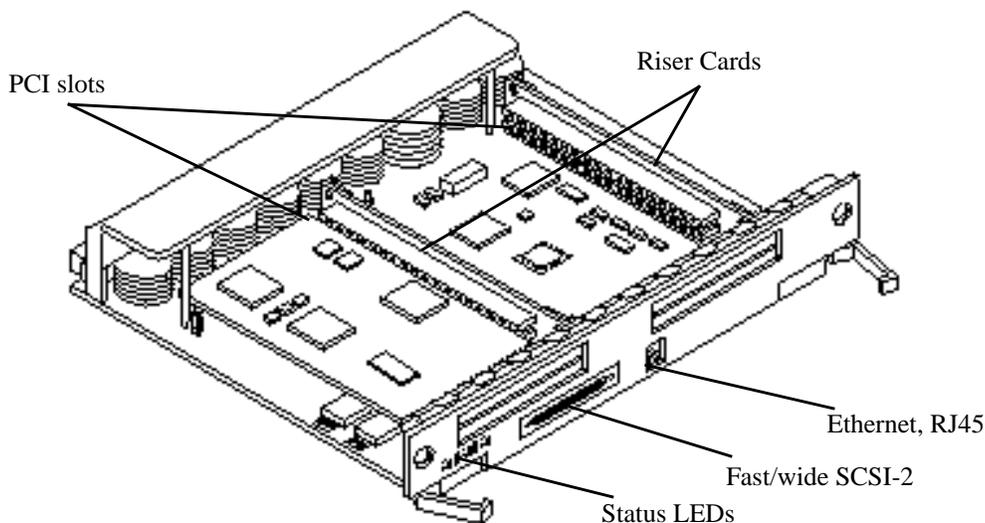
PCI I/O Board

Figure 14. PCI I/O board

The PCI I/O board, as shown, includes the following features:

- The latest PCI I/O board (2632A) is capable of running at up to 100-MHz Gigaplane speed
- One on-board 10/100-Mb-per-second Ethernet port (twisted pair)
- One 20-MB-per-second, fast/wide SCSI-2 port
- Two 64-bit PCI slots running at 66 MHz (also supports 33 MHz)
- Two 64-bit PCI channels, each offering 528-MB-per-second data transfer
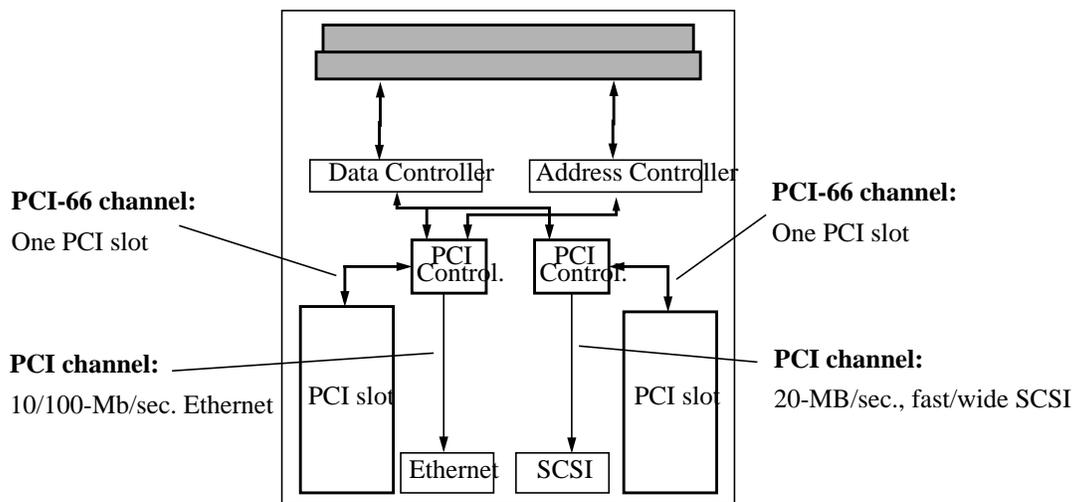
Figure 15. PCI I/O Board Block Diagram

Note: *The 84 MHz-capable PCI I/O board (2630A) has transitioned off of the price list.*

I/O Boards Questions and Answers

Are the 32-bit SBus cards supported on the SPARCcenter 2000E and SPARCserver 1000E systems also supported on Sun Enterprise 3500–6500 servers?

Yes.

Does the graphics I/O board also support the TurboGX™ graphics card?

Yes. Both the Graphics I/O board and the SBus I/O board support the TurboGX graphics card.

Do dual-wide SBus cards work with the SBus I/O board or graphics I/O board?

One dual-wide SBus card will fit on an SBus I/O board. Only single-wide SBus cards will work with the Graphics I/O board.

What type of PCI cards can be used in the Sun Enterprise 3500–6500 servers?

Sun supports 3.3-volt or 5.0-volt PCI short cards (4.200 x 6.875 inches).

What PCI card speeds are supported in the Sun Enterprise 3500–6500 servers?

The PCI slots accept either 66-MHz or 33-MHz PCI cards. They can be either 64-bit or 32-bit cards.

Does Sun support (service) third-party PCI cards?

No. Sun does not support (service) third-party PCI cards. However, Sun has been working with third-party independent hardware vendors to ensure a robust supply of cards for Sun platforms. PCI cards that have been verified by Sun to operate properly on Sun platforms are subject to stringent testing. A list of these third-party PCI cards can be found at URL `http://www.sun.com/sunready/vendors.html`.

What is included with the PCI I/O board?

The board comes with two 5.0-volt riser cards preinstalled. The PCI card plugs into the riser card. The PCI I/O board also comes with two 3.3-volt riser cards. If your PCI card is 3.3-volt, then a 5.0-volt riser card must be removed and a 3.3-volt riser card must be installed.

Do PCI cards on the same PCI I/O board have to be the same voltage?

No. There may be one 5.0-volt card and one 3.3-volt card on the same PCI I/O board. It must be ascertained that the appropriate riser card for each PCI card are being used.

Are there any software requirements for the PCI I/O board?

Yes. The PCI I/O board requires Solaris 2.5.1. Hardware: 4/97 or higher. The CPU/memory boards must also have at least OpenBoot™ PROM software, version 3.2.8 or later.

Can the new 100 MHz-capable I/O boards be used in Sun Enterprise 3000–6000 servers?

Yes. The previous 84-MHz I/O boards are being transitioned off the price list and these new I/O boards are compatible with existing Sun Enterprise 3000–6000 servers. There is no problem mixing these I/O boards in a Sun Enterprise 3000–6000 server that already uses the previous boards.

Does the Sun Enterprise 3500–6500 server family support SBus-only and mixed I/O board configurations?

Yes. However, a PCI-only configuration in a Sun Enterprise 3500 server does not provide a way to connect the internal FC-AL disk drives. This is because the PCI I/O board does not have on-board FC-AL sockets and currently there is no PCI FC-AL card available. So, to be able to use the internal disk drives in the Sun Enterprise 3500, there must be at least one SBus I/O or one Graphics I/O board installed.

Are there plans to add on-board FC-AL sockets to the PCI I/O board?

No, there is not enough physical space on the board to accommodate on-board FC-AL sockets.

I/O Boards

Power and Cooling

The Sun Enterprise™ 3500–6500 servers offer a highly flexible, highly reliable power and cooling environment. With an N+1 system configuration (where N is the minimum number of power supplies required), Sun Enterprise 3500–6500 servers offer redundant power, using power/cooling modules that are hot swappable. This offers customers a system that will almost never fail due to a power supply or a fan failure.

System cabinet

Power/cooling module
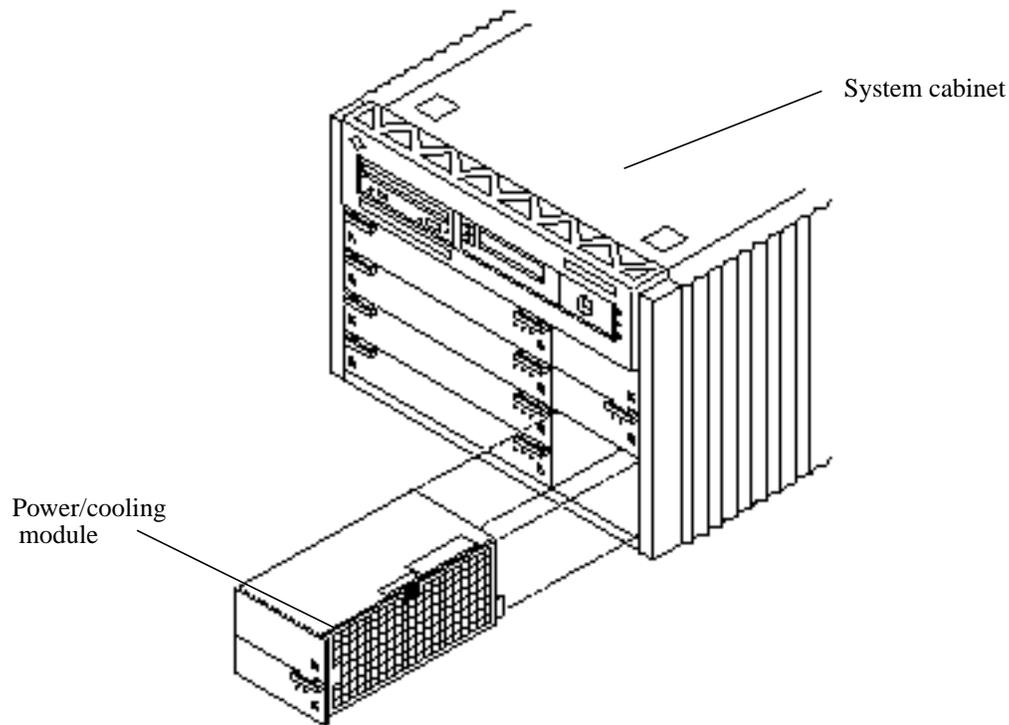
Figure 16. The Sun Enterprise 4500 Server Hot-swappable Power/Cooling Module

Power Circuitry

There are two different types of power supplies in Sun Enterprise 3500–6500 servers: power/cooling modules and peripheral power supplies.

- Power/cooling modules contain a 300-watt power supply and two variable-speed fans. The number of power/cooling modules installed in a system depends on the system configuration.

- One power/cooling module is required for every two adjacent boards on each side of the centerplane.

- The Sun Enterprise 3500 server supports a maximum of three power/cooling modules.

- The Sun Enterprise 4500 and Sun Enterprise 5500 servers support a maximum of four power/cooling modules.

- The Sun Enterprise 6500 server supports a maximum of eight power/cooling modules.

- Power from the power/cooling modules is distributed throughout the system using current-sharing circuitry, so that if the power supply in one power/cooling module fails, power from the other power/cooling modules keeps the system running (if the system is configured for redundant power).

- To configure a system *without* redundant power, the system must have $x/2$ power/cooling modules, where x is the number of CPU/memory, I/O and disk boards (round up to the nearest whole number).

- To configure a system *with* redundant power, the system must have $(x/2 + 1)$ power/cooling modules, where x is the number of CPU/memory, I/O and disk boards (round up to the nearest whole number). However all of the Sun Enterprise 3500–6500 server platforms are able to provide redundant power for maximum board configurations with only $x/2$ power/cooling modules, therefore providing the following exceptions to the $x/2 + 1$ rules:

  – When configuring the Sun Enterprise 3500 server, the $x/2+1$ configuration rule implies that a Sun Enterprise 3500 system with five boards would require four power/cooling modules ($5/2 + 1 = 4$). But there are only three power/cooling module slots. In order to resolve this issue, each power/cooling module is able to supply slightly more power than is required, so a Sun Enterprise 3500 server with five boards can operate on two power/cooling modules plus a second peripheral power supply. Thus, a second peripheral power supply is required for full N+1 power supply redundancy in a five-board Sun Enterprise 3500 server configuration.

  – Similarly, a Sun Enterprise 6500 system with 16 boards would require nine power/cooling modules ($16/2 + 1 = 9$). But there are only eight power/cooling module slots. Each power/cooling module is able to supply slightly more power than is required, so a Sun Enterprise 6500 server with 16 boards can operate on seven power/cooling modules.

  – Sun Enterprise 4500 and Sun Enterprise 5500 servers with eight boards are able to run on three power supplies, so only four power supplies are required for redundancy. The peripheral power supply is connected to the same power circuitry as the power/cooling modules, providing the additional power required for redundancy. Note that there are some limitations with regard to power supply redundancy with certain configurations of the Sun Enterprise 4500 and 5500 when using the 400-MHz processor. See the "Power and Cooling Questions and Answers" section for more details.

- The power/cooling module is hot swappable. Therefore, if a power supply fails, the power/cooling module can be replaced (assuming the system is configured for power/cooling redundancy) while the system is running without any adverse effects to the system.

- The Sun Enterprise 4500–6500 servers have one peripheral power supply. The peripheral power supply is hot pluggable but not redundant in these platforms.

- The Sun Enterprise 3500 server supports a second, hot-swappable, peripheral power supply. The peripheral power supply provides power for the internal SCSI devices and the FC-AL internal disk drives, as well as additional power for the system boards. If the primary peripheral power supply fails, the system continues to run, but the internal SCSI devices are not functional unless the system has a second peripheral power supply. The primary peripheral power supply includes the AC inlet so it is not hot swappable. Only the second peripheral power supply is hot swappable.

Power and Cooling

System Cooling

Sun Enterprise 3500–6500 servers have multiple power/cooling modules for cooling the CPU/memory, I/O, and disk boards (Sun Enterprise 4500–6500 server only), and one set of dual fans to cool the AC distribution assembly, clock board, and peripherals.

- The power/cooling modules include a power supply and two variable-speed fans.

- With dual, variable-speed fans, if one fan fails, the other fan speeds up to increase its cooling capacity.

- The power/cooling module is hot swappable. Therefore, if a fan fails, the power/cooling module can be replaced (assuming the system is configured for power/cooling redundancy) while the system is running without any adverse effects to the system.

- The fans within a power/cooling module are powered by all the power supplies in the system through current sharing. With this design, if a power supply fails, the fans within that power/cooling module continue to run.

- Variable-speed fans minimize system noise.

- The Sun Enterprise 5500 and Sun Enterprise 6500 system cabinets includes one cabinet fan tray. The cabinet fan tray includes four fans supported by two power supplies. Each power supply supports two fans. The cabinet fan tray in the system cabinet directs the hot air from the card cage and peripheral devices out the rear of the cabinet.

- Each Sun Enterprise expansion cabinet also contains one cabinet fan tray. The cabinet fan tray in an expansion cabinet can be connected to the system cabinet so that the Sun Enterprise SyMON™ software is able to detect the failure of a cabinet fan tray in an expansion cabinet. The cabinet fan tray is not hot pluggable.

Power and Cooling Questions and Answers

If a fully configured, eight-board Sun Enterprise 4500 server can operate on three power/cooling modules, can an identically configured eight-board Sun Enterprise 6500 server also operate with three power/cooling modules?

No. In the Sun Enterprise 4500 server, the peripheral power supply and the power/cooling modules are connected to the same power circuit. Therefore, if one power/cooling module fails, power from the other three power/cooling modules plus power from the peripheral power supply provide enough power to run the system. This allows eight boards to be powered by three power/cooling modules.

However, in the Sun Enterprise 6500 server, the peripheral power supply and power/cooling modules have different power circuits. Therefore, if one power/cooling module fails, the only power available is from the three remaining power/cooling modules, which is not enough to support the systems.

Are there any limitations in regard to power supply redundancy (N+1) associated with the 400-MHz/4-MB UltraSPARC™ module?

Yes, 100-MHz Gigaplane™ capable 8-slot systems (Sun Enterprise 4500, 5500, and Sun Enterprise 4000 and 5000 servers with upgraded 100-MHz Gigaplane) have an N+1 power limitation. These systems do not support N+1 power if the system has seven CPU/memory boards installed (even with four power/cooling modules installed). N+1 power is supported in any other configurations of these systems assuming the correct number of power/cooling modules are installed. The N+1 power limitation is due to the fact that the 100-MHz system speed consumes more power than the 84-MHz system speed that we currently run at. The increased power consumption does not leave enough spare power to continue running a system with seven CPU/memory boards installed if one of the power/cooling modules fails.

Do fully configured Sun Enterprise 4500 or 5500 servers with twelve 400-MHz/4-MB modules, six CPU/memory boards, two I/O boards, and four power/cooling modules have N+1 power?

Yes, the N+1 power limitation is applicable only when the configuration includes seven CPU/memory boards.

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System Management

System Diagnostics

There are three types of system diagnostics tools available for the Sun Enterprise™ 3000–6000 and Sun Enterprise 3500–6500 servers: the Sun Validation Test Suite (SunVTS™), Automatic System Recovery, and Remote Administration Control.

SunVTS™

SunVTS is the replacement product for SunDiag™ diagnostics tool. Like SunDiag, SunVTS is run at the UNIX® level and is designed to exercise the entire system. It supports either a graphical user interface (GUI) or TTY user interface, and provides error and information logging. The key features of SunVTS are:

- **UNIX-level diagnostics**

  System tests execute UNIX code under the Solaris Operating Environment™.

- **Automatic system probing**

  The system configuration is displayed through the user interface.

- **Two user interfaces**

  Both a graphical user interface and a character-based interface are available. The SunVTS kernel is cleanly separable from the user interface, such that multiple user interfaces can communicate with the same SunVTS kernel. The character-based interface permits the writing of shell scripts to control SunVTS.

- **Application programming interface (API)**

  The API provides a defined interface into the SunVTS kernel from other processes, as well as the user interfaces. A SunVTS execution could be initiated in a `cron`-like fashion, with no direct user interface at all.

- **Advanced configuration and execution control**

  Tests can be grouped together based on user requirements, with fine-grained execution control for status and logging information.

Automatic System Recovery

Automatic System Recovery operates the same way in Sun Enterprise 3500–6500 servers as in the Sun Enterprise 3000–6000 and SPARCcenter™ 2000E systems. Automatic System Recovery allows Sun Enterprise 3500–6500 servers to recover after a component, such as a UltraSPARC™ module, CPU/memory board, memory module, or I/O board fails. Upon failure, the system reboots. While rebooting, Automatic System Recovery tests system components and identifies the failed component; the system reboots around the failed component.

System Management

Sun microsystems

Automatic System Recovery is driven by power-on self-test (POST) software. The POST software in Sun Enterprise 3500–6500 systems includes two significant changes from the POST used in the SPARCcenter 2000E:

- **Uses a flash EPROM**

  Flash EPROM makes it simple to update the OpenBoot™ PROM software in the field. New PROM code can be installed from a CD-ROM while the system is running.

- **Uses a configurable rule-based expert system**

  A configurable rule-base expert system allows the user to customize the boot/diagnostic control flow.

Remote Administration Control

The Remote Administration Control feature on Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 servers allows a user to reboot, power cycle, or perform extensive operating system debugging through one of the serial ports (serial port A only). A special serial processor on the system clock board scans the input for system commands.

This remote console functionality allows for true "lights out" management of a system, giving system administrators more flexibility in point of management and control. This also enhances the serviceability aspect of the systems by providing a method of retrieving the system state on "hung" systems.

Remote control can be disabled by putting the key switch in the "secure" position.

System Management
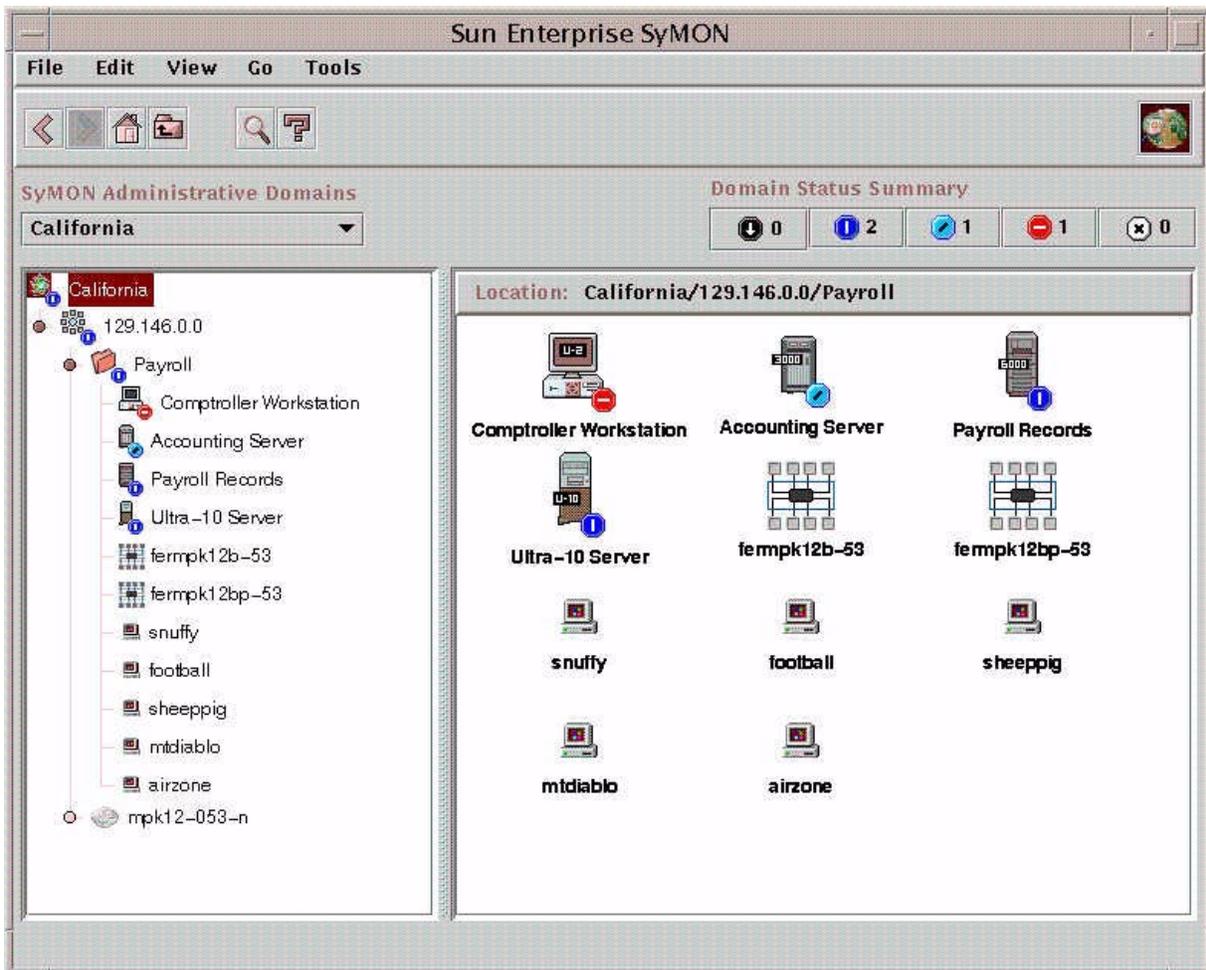
Figure 17. Sun Enterprise SyMON™

Key Features

Sun Enterprise SyMON software is Sun's next-generation enterprise system management tool for Sun Enterprise™ 3500–6500 servers. Designed to support Sun systems, Sun Enterprise SyMON technology provides a platform upon which the enterprise can base its administrative and management operations to help ensure all systems and the services they provide are highly available. A powerful tool for managing the enterprise network, the Sun Enterprise SyMON product enables system administrators to perform remote system configuration, monitor performance, and isolate hardware and software faults all through an easy-to-use graphical user interface.

Key features of Sun Enterprise SyMON software include:

- Common management platform, scalable from a single system to thousands of server and desktop systems
- Single point of management, enabling effective use of administrative resources
- Proactive and automated management of complex and common administrative tasks, reducing the likelihood for costly errors and helping to ensure availability

- Configuration flexibility, enabling Sun Enterprise SyMON technology to be configured out of the box to best fit the needs of the environment, as well providing easy customization for new rules, scripts, actions, etc.

- Extensible agent architecture, enabling administrators to add functionality and management features with ease

- Dynamic agents, enabling functionality to be extended asynchronously

- Active configuration management controls, providing a secure interface for remote dynamic reconfiguration capabilities and helping to ensure availability

- Single event model, enabling information to be shared with multiple consoles or users with ease

- Multiple system support, enabling administrators to monitor and manage all Solaris™ systems remotely

- Predictive failure analysis, enabling administrators to predict potential memory and disk hardware failures on a statistical basis, thereby enhancing decision making and increasing availability

- Health monitoring, a sophisticated set of heuristics that incorporates a large body of administrative knowledge, including an intelligent rules-based health monitor that correlates metrics and gives suggested steps for resolution, resulting in simplified administration

- Log-file scanning, enabling administrators to search and parse logs and registers for a particular status—the foundation for application health monitoring

- Logical element grouping, enabling the grouping of Sun systems by geographical location, server role, administrative responsibility, etc. The status of the individual systems are summarized by the group, as events and alarms are issued to each system

- Hierarchy and topology viewer, a central management application that displays the hierarchy and a topology map of all the objects that are being managed

- Automatic discovery of Sun systems, including IP address, subnet address, hostnames, and OIDs to identify specific types of systems, as well as parametric scheduling

- Physical viewer, displaying photo-realistic images of hardware components and pointing to components with an associated event, enabling administrators unfamiliar with a particular Sun platform to quickly determine which components need to be replaced

- Logical viewer, presenting a tree hierarchy of the managed host or domain, including all hardware and operating system components. If an event is associated with a particular component, the logical viewer will identify its exact location within the hierarchy

- Event and alarm management, providing administrators with the information they need when they need it

- Enterprise-wide security measures, such as authentication, data integrity, and access control lists for management of data and active management functions

- Real-time performance analysis, enabling administrators to isolate potential and existing bottlenecks

- Standard interfaces and protocols, enabling integration with third-party management tools, including Tivoli and Computer Associates, thereby providing a complete enterprise management solution

- Full SNMP connectivity, enabling information to be shared with other enterprise management tools

- GUI using Java™ technology, providing heterogeneous GUI support, a common "look-and-feel" for all Sun Enterprise SyMON applications, and the flexibility to manage the enterprise from any platform using Java technology, thereby increasing administrator efficiency

Sun Enterprise SyMON™

Sun Enterprise SyMON software can be extended through the use of sophisticated add-on products to provide additional functionality:

- Trend analysis and historical data storage, supporting system performance analysis, configuration fault analysis, system sizing, and long term capacity planning and forecasting efforts

- Host application and database fault management, increasing data and service availability through integration with third-party products like BMC PATROL

- Firmware and patch management, providing administrators with the ability to upgrade systems when needed with the addition of Sun Enterprise Configuration and Service Tracker

- On-line diagnostics, enabling hardware and software problems to be predicted, detected, isolated, and resolved, thereby increasing system and service availability with the addition of Sun Enterprise Diag Tool

Sun Enterprise SyMON 2.0 Compatibility

The Sun Enterprise SyMON 2.0 software platform supports all systems running Solaris 2.5.1, 2.6 and Solaris 7 Operating Environments.

Hardware-dependent configuration management functions support includes:

- Sun Ultra™ 1, Ultra 2, Ultra 5, Ultra 10, Ultra 30, Ultra 60 and Ultra 450 workstations

- Sun Enterprise 3X00, Sun Enterprise 4X00, Sun Enterprise 5X00, and Sun Enterprise 6X00 servers

- SPARCserver™ 1000 and SPARCserver 1000E servers

- SPARCcenter™ 2000 and SPARCcenter 2000E servers

Additional hardware-dependent configuration management function support will be available from the Sun Enterprise SyMON web site (www.sun.com/products/symon) after version 2.0 ships. These platforms include, but are not limited to: Sun Enterprise 150, Sun Enterprise 250, Sun Enterprise 450, and Sun Enterprise 10000 servers, and the Sun StorEdge™ A5X00 array.

Sun Enterprise SyMON Licensing/Usage

Sun Enterprise SyMON 2.0 software is available off the web free-of-charge to manage an individual server or desktop (www.sun.com/products/symon). A right-to-use license is required to manage additional servers or desktops/network devices from one Sun Enterprise SyMON server layer.

Sun Enterprise SyMON™

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Sun Enterprise SyMON System Monitor Questions and Answers

How is Sun Enterprise SyMON different from previous versions?

Sun Enterprise SyMON is a major new release compared to the existing release. It provides several new and enhanced features such as:

- Multiple system support: Administrators can remotely monitor and manage all the Solaris systems in their environments and have the ability to define Sun systems by geography, server role, administrative responsibility, etc.

- Heterogeneous GUI support (Java technology-based GUI): the Java technology UI in Sun Enterprise SyMON allows administrators to have the flexibility to manage from a Java platform and be more efficient through the use of a easy-to-use interface.

- Enhanced event/alarm management: Sun Enterprise SyMON has state-of-the-art event management capabilities that enables cooperative management between multiple system administrators.

- Logical element grouping: ability to group multiple managed systems into one managed entity. Allows IT-organization to map individual managed components into groups related to applications and business processes.

- Active configuration management controls: Sun Enterprise SyMON is a secure interface for remote dynamic reconfiguration capabilities (dynamic attach/detach, etc).

- Application monitoring capabilities: Sun Enterprise SyMON can monitor health and performance of application processes, monitor and act upon error log entries, monitor application files and monitor directory statistics.

- State-of-the-art standard interfaces such as SNMPv2c, SNMPv2usec, and SNMPv1 for interoperability, end-to-end security, and efficient data transfer.

- Integration with major system management platform vendors such as Tivoli and Computer Associates: Sun Enterprise SyMON integrates with the major commercial system and network management platforms to ensure an enterprise solution.

Does Sun Enterprise SyMON integrate with Computer Associates Unicenter TNG, Tivoli TMS, and Hewlett-Packard OpenView?

Sun Enterprise SyMON can send SNMP traps to any SNMP-compliant management platform. For the near future, Sun is working closely with the leading Sun Enterprise Management vendors to provide a tightly integrated solution.

Is Sun Enterprise SyMON 2.x compatible with Solstice SyMON™ 1.x?

Sun Enterprise SyMON 2.0 is not backward compatible with Solstice SyMON 1.x

Sun Enterprise SyMON™

The Solaris Operating Environment™

The Sun Enterprise 3500–6500 servers run on an industry-leading enterprise operating environment, Solaris™. The Sun Enterprise 3500–6500 servers require Solaris 2.5.1 Hardware: 11/97 with two patches: 104595-03 (or later) and 104594-01 (or later). In addition, patch number 105310-04 (or later), which is an FC-AL patch, is highly recommended. The Sun Enterprise 3500–6500 servers can also run Solaris 2.6 Hardware: 3/98 and the Solaris 7 Operating Environment with no required patches. However, patch number 105375-04 (or later), an FC-AL patch, is highly recommended for both releases.

The Solaris product line is the premier software environment for network computing, delivering unparalleled scalability and performance. Designed for IT professionals, line of business managers, Internet Service Providers and power desktop users, the Solaris software environment safely delivers information to anyone, any time, any place, on anything including PCs, workstations, and all other Internet devices.

Unlike other operating environments, Solaris delivers what companies require today and anticipates the innovation they will require tomorrow. Solaris is reliable, scalable, easy to administer, fast, safe, Year-2000 and Euro compliant, and unleashes the full power of SPARC™ processor- and Intel-based computers.

The Solaris Operating Environment contains the base level functionality required for all systems. It includes a rock solid, scalable 32-bit and 64-bit kernel; standards-based networking; platform support for both SPARC and Intel; and Java™ support. These technologies provide the foundation for building and deploying enterprise class systems for multi-vendor, multi-client workgroup environments and for highly available data center environments.

The strengths of the Solaris Operating Environment lie in enterprise-class reliability, scalability and performance. The Solaris 7 Operating Environment extends these strengths.

Features

Along with the features available in the Solaris 2.5.1 and 2.6 Operating Environment, the Solaris 7 Operating Environment includes support for several new features and capabilities listed below.

RAS Features

- Dynamic Reconfiguration—support for hot-swap I/O boards on Sun Enterprise 3000–6000 and Sun Enterprise 3500–6500 systems
- UFS Logging—logs changes to the UFS files system before updates are applied to the UFS
- Year 2000 compliance—no errors result when moving from date 12/31/99 to 1/1/00 or from 2/29/00 to 3/1/00
- System Crash Dump Utility Enhancement—faster capture of system data and the ability to dump data to a specified dump partition at time of system crash while also using less disk space
- Traceroute Utility—traces the route of an IP packet to an Internet host
- New system commands: pgrep(1) and pkill(1)—replaces combination of ps, grep, egrep, awk, and kill
- UNIX® 98 and UNIX 95 branding—complies with industry standards specification

Performance Enhancements

- Complete 64-bit Operating Environment—process addressing beyond 4-GB, 32-bit barrier; supports 64-bit data types, and 64-bit logical and arithmetic operations
- Improved Poll System Call—system call for querying files
- TCP SACK—selective packet acknowledgment
- SCSI Driver—support for shared disk SCSI driver

Scalability Enhancements

- 64-bit Computing—64-bit virtual addressing, more file descriptors, processes and more available sockets
- Open Sockets—15,000 times as many open sockets available to applications
- Light Weight Processes—support for up to 10 million times more light weight processes
- File Descriptors—support for 15 million times as many file descriptors

Ease-of-use Features

- CDE Administration Enhancements—process manager, perfmeter, system info monitor
- CDE Productivity Enhancements—file finder, customizable graphical front panel and workspace menu, address manager, and text and voice post-it notes
- Printing Enhancements—enhanced font management
- 64-bit and AnswerBook™ Installation—menu-based selection of 64-bit or 32-bit environment, and AnswerBook
- Netscape™ 4.05 Communicator—Netscape e-mail, HTML editor, and browser
- AnswerBook Enhancements—Web browser interface for on-line AnswerBook documentation, man pages are now available in SGML format; can now be run directly from the CD
- man utility displays SGML format in addition to nroff format

Global Language Support Enhancements

- Expanded Unicode Support—support for Unicode 2.1 standard
- Expanded Native Language Support—support for up to 37 languages and 95 locales
- Complex Text Format—support for bidirectional, composite, and context sensitive text
- Euro Currency—support for Euro currency symbol
- More locale selections—English and European versions combined on a single CD
- Fully Globalized—All localized versions share a single global binary

Security and Stability Features

- Generic Security Services—Modified remote procedure call (RPC) based on standard GSS-API
- NIS+ Extended Security—Diffie Helman key extended from 192 bits to 640 or 1024
- Directory Naming Service(DNS)—Berkeley Internet Name Daemon (BIND) upgraded to version 8.1.2. Control Lists.
- Sendmail—Upgraded to version 8.9
- 32-bit Compatibility—all existing 32-bit applications run without modification.
- Single source base for all platforms—all platforms developed from one source tree

Options

Disk Options

The preferred disk solution for the Sun Enterprise™ 3500–6500 servers depends on the server model as well as the customer's environment. The following is a summary of the disk options available.:

Server	Disk Option
Sun Enterprise 3500	• Internal 9.1-GB, 3.5-inch FC-AL, disk drive(s) • Sun StorEdge™ A1000/D1000, Sun StorEdge A3500, Sun StorEdge A5X00, and Sun StorEdge A7000 disk arrays • Sun StorEdge UniPack, MultiPack, FlexiPack • Sun StorEdge Tape Library
Sun Enterprise 4500	• Internal 8.4-GB disk board • Sun StorEdge A1000/D1000, Sun StorEdge A3500, Sun StorEdge A5X00, and Sun StorEdge A7000 disk arrays • Sun StorEdge UniPack, MultiPack, FlexiPack • Sun StorEdge Tape Library
Sun Enterprise 5500	• Internal, 8.4-GB disk board • Sun StorEdge A1000/D1000, Sun StorEdge A3500, Sun StorEdge A5X00, and Sun StorEdge A7000 disk arrays • Sun StorEdge FlexiPack removable storage tray • Sun StorEdge Tape Library
Sun Enterprise 6500	• Internal, 8.4-GB disk board • Sun StorEdge A1000/D1000, Sun StorEdge A3500, Sun StorEdge A5X00, and Sun StorEdge A7000 disk arrays • Sun StorEdge FlexiPack removable storage tray • Sun StorEdge Tape Library

Keep in mind that the above list is not a complete listing. For example, a Sun Enterprise 3500 server may also boot from external disk drives, but the internal FC-AL disk drives is the most commonly chosen option. Also note that the SPARCstorage™ Array Models 100 and 200 are still supported with the above platforms, although they are no longer factory-configurable.

The disk board is designed to be used only as a system disk in the Sun Enterprise 4500–6500 server. Its capacity is not large enough for anything else. It also does not make sense to use several system slots for internal capacity in these systems. External disk options can also be used as system disks.

Refer to the *Sun Enterprise 3500–6500 Servers System Options* document for a list of supported disk options. For Sun Enterprise 3500–6500 servers with certain internal disk options, the Solstice JumpStart™ Boot Image software may be factory installed at no charge. The Solstice JumpStart software may be installed on the following disk storage products:

• Internal FC-AL disk drives on the Sun Enterprise 3500 server

• 8.4-GB disk board in the Sun Enterprise 4500, Sun Enterprise 5500, and Sun Enterprise 6500 servers

The Solstice JumpStart software is not supported with the Sun StorEdge A5X00 array

Upgrades

Sun offers customers a variety of flexible upgrade paths to the Sun Enterprise™ 3500–6500 servers that protect their investment. Customers can choose among full-system, chassis only, Gigaplane™ system bus, CPU, board and memory upgrades. To protect customers' investments, Sun upgrades allow customers to carry forward as many components as possible to a Sun Enterprise 3500, Sun Enterprise 4500, Sun Enterprise 5500 or Sun Enterprise 6500 server.

Sun-to-Sun Upgrades (Trade ins) to the Sun Enterprise Server Family

TO: FROM:	Sun Enterprise 3500	Sun Enterprise 4500	Sun Enterprise 5500	Sun Enterprise 6500
Full System Workgroup Server	Yes	No	No	No
Full System Sun 3X0/4X0	Yes	Yes	No	No
Full System Sun 6X0/SS1000	Yes	Yes	Yes	No
Full System Sun SC2000	No	Yes	Yes	Yes
Intra-Family Chassis Upgrade from Sun Enterprise 3000 or Sun Enterprise 3500	No	Yes	Yes	No
Intra-Family Chassis Upgrade from Sun Enterprise 4000 or Sun Enterprise 4500	No	No	No	Yes
Intra-Family Chassis Upgrade from Sun Enterprise 5000 or Sun Enterprise 5500	No	No	No	Yes
Gigaplane Field Upgrade	N/A	Yes	Yes	No
CPU/Memory Board Upgrades	Yes	Yes	Yes	Yes
I/O Board Upgrades	Yes	Yes	Yes	Yes
CPU Module Upgrades	Yes	Yes	Yes	Yes
Memory Upgrade	Yes	Yes	Yes	Yes

Competitive Upgrades (Trade ins) to the Sun Enterprise Server Family

Existing investments in other hardware not by Sun can be preserved by upgrading to Sun Enterprise 3500–6500 systems through competitive upgrades.

TO: FROM:	Sun Enterprise 3500	Sun Enterprise 4500	Sun Enterprise 5500	Sun Enterprise 6500
Server System	Yes	Yes	Yes	Yes
CPU Boards	Yes	Yes	Yes	Yes
CPU Modules	Yes	Yes	Yes	Yes

Upgrades to the Sun Enterprise 3500 and Sun Enterprise 4500 Servers

The following system upgrades are available for Sun Enterprise 3500 and 4500 servers:

- Full-system upgrade from workgroup servers
- Full-system upgrade from the older-generation Sun servers
- Full-system upgrade from qualified competitive servers
- Chassis upgrade from Sun Enterprise 3000 to the Sun Enterprise 3500 or Sun Enterprise 4500 servers
- Gigaplane field upgrade for Sun Enterprise 4000 servers

Full-System Upgrades

The full-system upgrades to the Sun Enterprise 3500 server include the chassis, a power/cooling module, one CPU/memory board, and two CPU modules. The chassis upgrades to the Sun Enterprise 4500 server includes the chassis, clock board, and CD. The full-system upgrades are intended to be used in conjunction with the CPU/memory board and UltraSPARC™ module upgrades, and other options to provide a method of upgrading a range of sizes of Sun and competitive systems. This allows Sun to offer excellent value for large and small servers

Note: *The Return Material Authorization Kit (no-charge part number UG-RMA) is **required** to be ordered with any factory-installed system or component upgrade. This part number will ship return material information..*

Order	Receive	Return
Workgroup Server Full-System Upgrade to two-CPU Sun Enterprise 3500 Base		
UG-WRKGP-E3500-C52 (250/4) UG-WRKGP-E3500-C62 (336/4) UG-WRKGP-E3500-C72 (400/4)	Server base package: one CPU/memory board, and two CPU modules, one Power/Cooling Mod.	Chassis, system board, primary memory board, and internal peripherals
Workgroup Server Full-System Upgrades to four-CPU Sun Enterprise 3500 Base (*Note*: Transition Announced 1/99)		
UG-WRKGP-E3500-C54 (250/4) UG-WRKGP-E3500-C64 (336/4)	Server base package: two CPU/memory board, and four CPU modules and one Power/Cooling modules	Chassis, system board, primary memory board, and internal peripherals
Sun-3™/Sun-4™ or SPARCserver™ 6X0MP Desksides and SPARCserver 1000 Full-System Upgrade to two-CPU Sun Enterprise 3500 Base		
UG-SUNSV-E3500-C52 (250/4) UG-SUNSV-E3500-C62 (336/4) UG-SUNSV-E3500-C72 (400/4)	Server base package: chassis, one CPU/memory board, and two CPU modules, one Power/Cooling module	Chassis, system board (except SPARCcenter™ 1000E, see system board upgrade below), primary memory board, and internal peripherals
Sun-3/Sun-4 /6X0MP Desksides and SPARCserver 1000 Full-System Upgrade to four-CPU Sun Enterprise 3500 base (*Note*: Transition Announced 1/99)		
UG-SUNSV-E3500-C54 (250/4) UG-SUNSV-E3500-C64 (336/4)	Server base package: two CPU/memory boards, four CPU modules, and one power/cooling modules	Chassis, system board (except SPARCcenter 1000, see system board upgrade below), primary memory board, and internal peripherals

Order	Receive	Return
Competitive Full-System Upgrade to two-CPU Sun Enterprise 3500 base		
CU-E3500-C52 (250/4) CU-E3500-C62 (336/4) CU-E3500-C72 (400/4)	Server base package: chassis, one CPU/memory board, and two CPU modules	Chassis, system board, primary memory board, and internal peripherals
Competitive Full-System Upgrade to four-CPU Sun Enterprise 3500 base (*Note*: Transition Announced 1/99)		
CU-E3500-C54 (250/4) CU-E3500-C64 (336/4)	Server base package: two CPU/memory boards, four CPU modules, and one power/cooling modules	Chassis, system board, primary memory board, and internal peripherals
Sun-3/Sun-4 or SPARCserver 6X0MP Desksides SPARCserver 1000 Full System or SPARCcenter 2000 Upgrade		
UG-SUNSV-E4500	Server base package: chassis, clock board, CD, two power/cooling modules, one CPU/memory board, and one SBus I/O board	Chassis, system board, (except SPARCcenter 1000 and 2000, see system board upgrade below) primary memory board, and internal peripherals
Competitive Full-System Upgrade to Sun Enterprise 4500 Base		
CU-E4500	Server base package: chassis, clock board, CD, two power/cooling modules, one CPU/memory board, and one SBus I/O board	Chassis, system board, primary memory board, and internal peripherals

Upgrades

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Intra-Family Chassis Upgrades

Sun Enterprise 3000 Component Migration

The following is a summary table detailing which components will or will not migrate when upgrading from the Sun Enterprise 3000 server to Sun Enterprise 3500, 4500, or 5500 server:

FROM:	TO:	
Sun Enterprise 3000	**Sun Enterprise 3500**	**Sun Enterprise 4500/5500**
Internal Disk	No	No
Memory	Yes	Yes
CPU Module*	Yes	Yes
I/O Boards*	Yes	Yes
CPU/memory Board*	Yes	Yes
Power/Cooling Modules	Yes	Yes
Internal Tape Drive	Yes	Yes
Peripheral Power Supply with AC Inlet	Yes	No
Fan Tray (Above Peripheral Power Supply Only)	Yes	No
* Migrate these boards/modules only if current speed is to be maintained. Migrating 167-MHz modules might require a PROM upgrade as the minimum PROM level supported is 3.2.10. (See product announcement for details on downloading the patch for a PROM level upgrade).		

While the Sun Enterprise 3000 server internal disks are not compatible in the Sun Enterprise 3500–6500 server family, an upgrade (trade in) offering is available. See product announcement for details.

Order	Receive	Return
Sun Enterprise 3000-to-Sun Enterprise 3500 Intra-family Upgrade		
UG-E3000-E3500	Sun Enterprise 3500 system enclosure with clock board, CD, card cage, one board filler panel for power/cooling module	Sun Enterprise 3000 system enclosure, clock board, CD, card cage, fan tray (under disks)
Sun Enterprise 3000-to-Sun Enterprise 4500 Intra-family Upgrade		
UG-E3000-E4500	Sun Enterprise 4500 system enclosure with clock board, CD, card cage, one peripheral power supply, and one power/cooling module, four board filler panels	Sun Enterprise 3000 system enclosure, clock board, CD, card cage, and peripheral power supplies, fan tray
Sun Enterprise 3000-to-Sun Enterprise 5500 Intra-family Upgrade		
UG-E3000-E5500	Sun Enterprise 5500 rack system enclosure with clock board, CD, card cage, one peripheral power supply, and one power/cooling module, four board filler panels	Sun Enterprise 3000 system enclosure, clock board, CD, card cage, and peripheral power supplies

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Sun Enterprise 3500 Component Migration

The following is a summary table detailing which components will or will not migrate when upgrading from the Sun Enterprise 3500 server to an Sun Enterprise 4500 or Sun Enterprise 5500 server:

FROM:	TO:	
Sun Enterprise 3500	**Sun Enterprise 4500**	**Sun Enterprise 5500**
Internal Disk	No	No
Clock board	Yes	Yes
CD	Yes	Yes
Memory	Yes	Yes
CPU Module	Yes	Yes
I/O Boards	Yes	Yes
CPU/Memory Board	Yes	Yes
Power/Cooling Modules	Yes	Yes
Internal Tape Drive	Yes	Yes
Peripheral Power Supplies	No	No
IB Board	No	No

While the Sun Enterprise 3500 server internal disks are not compatible in the Sun Enterprise 4500 or Sun Enterprise 5500 servers, an upgrade (trade-in) offering is available. See product announcement for details.

Order	Receive	Return
Sun Enterprise 3500-to-Sun Enterprise 4500 Intra-family Upgrade:		
UG-E3500-E4500	Sun Enterprise 4500 system enclosure with card cage, one peripheral power supply, and one power/cooling module	Sun Enterprise 3500 system enclosure, card cage, and peripheral power supplies
Sun Enterprise 3500-to-Sun Enterprise 5500 Intra-family Upgrade:		
UG-E3500-E5500	Sun Enterprise 5500 rack system enclosure with card cage, one peripheral power supply, and one power/cooling module	Sun Enterprise 3500 system enclosure, card cage, and peripheral power supplies
Sun Enterprise 4000-to-Sun Enterprise 4500 Gigaplane Upgrade:		
UG-E4000-100GIGPLN	100-MHz-capable centerplane, 100-MHz-capable clockboard, 32X SunCD™, Sun Enterprise 4500 nameplate	Sun Enterprise 4000 centerplane, SunCD, clockboard, nameplate

Upgrades

Upgrades to the Sun Enterprise 5500 and Sun Enterprise 6500 Servers

The following system upgrades are available for Sun Enterprise 5500 and Sun Enterprise 6500 servers:

- Full-system upgrade from Sun SPARCserver 6X0MP Desksides, SPARCserver 1000 and SPARCcenter 2000 servers
- System board upgrades for the SPARCserver 1000 and SPARCcenter 2000 servers
- Full-system upgrade from qualified competitive servers
- Intra-Family chassis upgrades: Sun Enterprise 3000–5500, Sun Enterprise 3500–5500, Sun Enterprise 4500–6500, and Sun Enterprise 5500–6500
- Inter-Family chassis upgrades: Sun Enterprise 4000–6500
- Gigaplane field upgrade: Sun Enterprise 5000

Full-System Upgrades

The full-system upgrades include the chassis, and, two power/cooling modules, one CPU/memory board, and one SBus I/O board with FC-AL. The full-system upgrades are intended to be used in conjunction with the system board upgrades and other Sun Enterprise server options to provide a method of upgrading a range of sizes of SPARCserver 1000E and SPARCcenter 2000E servers. This allows Sun to offer excellent value for large and small SPARCserver 1000E and SPARCcenter 2000E servers in the installed base.

Order	Receive	Return
SPARCserver 6X0MP Deskside, SPARCserver 1000 or SPARCcenter 2000 System Upgrade:		
UG-SUNSV-E5500	Server base package: Rack enclosure, chassis, clock board, CD, two power/cooling modules, one CPU/memory board, and one SBus I/O board	Chassis, CPU board, primary memory board, and internal peripheral
SPARCcenter 2000E System Upgrade:		
UGS2000-E6500	Server base package: Rack enclosure, chassis, clock board, CD, two power/cooling modules, one CPU/memory board, and one SBus I/O board	Chassis, CPU board, primary memory board, and internal peripheral
Competitive Full-System Upgrade:		
CU-E5500 CU-E6500	Server base package: Rack enclosure, chassis, clock board, CD, two power/cooling modules, one CPU/memory board, and one SBus I/O board	Chassis, CPU board, primary memory board, and internal peripheral

Sun Enterprise 5500 and Sun Enterprise 6500 Intra-Family Upgrade

Sun Enterprise 4000 Component Migration

The following is a summary table detailing which components will migrate when upgrading from the Sun Enterprise 4000 to an Sun Enterprise 6500 server:

FROM Sun Enterprise 4000:	TO Sun Enterprise 6500:
Memory	Yes
CPU Module*	Yes
I/O Boards*	Yes
CPU/Memory Board*	Yes
Power/Cooling Modules	Yes
Internal Tape Drive	Yes
Peripheral Power Supplies	Yes
Optional Disk Board	Yes
* Migrate these boards/modules only if current speed is to be maintained. Migrating 167-MHz modules might require a PROM upgrade as the minimum PROM level supported is 3.2.10. (See product announcement for details on downloading the patch for a PROM level upgrade).	

Order	Receive	Return
Sun Enterprise 4000-to-Sun Enterprise 6500 Intra-family Upgrade:		
UG-E4000-E6500	**Sun Enterprise 6500 rack** system enclosure with clock board, CD, and card cage	Sun Enterprise 4000 system enclosure, clock board, CD, and card cage

Sun Enterprise 4500 Component Migration

The following is a summary table detailing which components will migrate when upgrading from the Sun Enterprise 4500 to an Sun Enterprise 6500 server:

FROM Sun Enterprise 4000:	TO Sun Enterprise 6500:
Memory	Yes
CPU Module	Yes
I/O Boards	Yes
CPU/Memory Board	Yes
Power/Cooling Modules	Yes
Internal Tape Drive	Yes
Peripheral Power Supplies	Yes
Optional Disk Board	Yes

Order	Receive	Return
Sun Enterprise 4500-to-Sun Enterprise 6500 Intra-family Upgrade:		
UG-E4500-E6500	Sun Enterprise 6500 rack system enclosure and card cage	Sun Enterprise 4500 system enclosure, and card cage

Upgrades

Sun Enterprise 5000 Component Migration

The following is a summary table detailing which components will migrate when upgrading from the Sun Enterprise 5000 to an Sun Enterprise 6500 server:

FROM Sun Enterprise 5000:	TO Sun Enterprise 6500:
Memory	Yes
CPU Module*	Yes
I/O Boards*	Yes
CPU/Memory Board*	Yes
Power/Cooling Modules	Yes
Internal Tape Drive	Yes
Peripheral Power Supplies	Yes
Optional Disk Board	Yes

* Migrate these boards/modules only if current speed is to be maintained. Migrating 167-MHz modules might require a PROM upgrade as the minimum PROM level supported is 3.2.10. (See product announcement for details on downloading the patch for a PROM level upgrade).

Order	Receive	Return
Sun Enterprise 5000-to-Sun Enterprise 6500 Intra-family Upgrade:		
UG-E5000-E6500	Sun Enterprise 6500 rack system enclosure with clock board, CD and card cage	Sun Enterprise 5000 system enclosure, clock board, CD and card cage
Sun Enterprise 5000 Gigaplane Upgrade:		
UG-E5000-100GIGPLN	100-MHz-capable centerplane, 100-MHz-capable clockboard, 32xSunCD, CD tray assembly	Sun Enterprise 5000 centerplane, SunCD, clockboard, tray assembly

Sun Enterprise 5500 Component Migration

The following is a summary table detailing which components will migrate when upgrading from the Sun Enterprise 5500 to an Sun Enterprise 6500 server:

FROM Sun Enterprise 5500:	TO Sun Enterprise 6500:
Memory	Yes
CPU Module	Yes
I/O Boards	Yes
CPU/Memory Board	Yes
Power/Cooling Modules	Yes
Internal Tape Drive	Yes
Peripheral Power Supplies	Yes
Optional Disk Board	Yes

Order	Receive	Return
Sun Enterprise 5500-to-Sun Enterprise 6500 Intra-family Upgrade:		
UG-E5500-E6500	Sun Enterprise 6500 rack system enclosure with and card cage	Sun Enterprise 5500 system enclosure, and card cage

Upgrades

CPU Module, Board, and Memory Upgrades

The following processor module, board and memory upgrades are common to all Sun Enterprise 3500–6500 systems:

- UltraSPARC CPU module upgrades
- System board upgrades from existing Sun Enterprise 3000–6000 compatible boards. Also, board upgrades for customers with Sun SPARCserver 1000E or SPARCcenter 2000E systems
- Sun memory upgrade

UltraSPARC module upgrades from 167-MHz and 250-MHz UltraSPARC modules are available for field installation or, if ordered with an Intra-Family chassis upgrade, can be installed at the factory.

System board upgrades from Sun Enterprise 3000–6000 systems are shipped separately for field installation only.

System board upgrades and UltraSPARC module upgrades from pre-UltraSPARC processor systems or competitive systems are factory configured and intended to be used in conjunction with chassis upgrades.

Memory upgrades are shipped separately for field installation only.

Note: *The Return Material Authorization Kit (no-charge part number UG-RMA) is **required** to be ordered with any factory-installed system or component upgrade. This part number will ship return material information.*

Order	Receive	Return
UltraSPARC Module Upgrade, Field Installed:		
	UltraSPARC Processor module:	
UG-M2510-M2550	250-MHz, 4-MB Ecache	167-MHz, 512-KB or 1-MB Ecache
UG-M2530-2560	336-MHz, 4-MB Ecache	250-MHz, 1-MB or 4-MB Ecache
UG-M2510-M2560	336-MHz, 4-MB Ecache	167-MHz, 512-KB or 1-MB Ecache
UG-M2510-M2570	400-MHz, 4-MB Ecache	167-MHz, 512-KB or 1-MB Ecache
UG-M2550-M2570	400-MHz, 4-MB Ecache	250-MHz, 1-MB or 4-MB Ecache
UG-M2560-M2570	400-MHz, 4-MB Ecache	336-MHz, 4-MB Ecache
UltraSPARC Module Upgrade, Factory Installed:		
	UltraSPARC Processor module:	
UG-M2550,	250-MHz, 4-MB Ecache	SuperSPARC™ processor module
CU-M2550	250-MHz, 4-MB Ecache	Qualified competitive CPU module
UGFA-M2530-M2560	336-MHz, 4-MB Ecache	250-MHz, 1-MB or 4-MB Ecache
UGFA-M2510-M2560	336-MHz, 4-MB Ecache	167-MHz, 512-KB or 1-MB Ecache
UG-M2560	336-MHz, 4-MB Ecache	SuperSPARC processor module
CU-M2560	336-MHz, 4-MB Ecache	Qualified competitive CPU module
UGFA-M2510-M2570	400-MHz, 4-MB Ecache	167-MHz, 512-KB or 1-MB Ecache
UGFA-M2550-M2570	400-MHz, 4-MB Ecache	250-MHz, 1-MB or 4-MB Ecache
UGFA-M2560-M2570	400-MHz, 4-MB Ecache	336-MHz, 4-MB Ecache
UG-M2570	400-MHz, 4-MB Ecache	SuperSPARC processor module
CU-M2570	400-MHz, 4-MB Ecache	Qualified competitive CPU module

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Order	Receive	Return
CPU/Memory Board Upgrades:		
UGFA-SB260X-2602	CPU/memory board that supports 100-MHz centerplane; factory installed	One 2600 or 2601 CPU/memory board
UGSB260X-2602	CPU/memory board that supports 100-MHz centerplane; field installed	One 2600 or 2601 CPU/memory board
CU-2602	CPU/memory board that supports 100-MHz centerplane; factory installed	A qualified competitive system board
UGSB1000-X-256M-C	100 MHz-compatible CPU/memory board with 256 MB of RAM; factory installed	SPARCserver 1000 system board
UGSB1000-X-1GB-C	100 MHz-compatible CPU/memory board with1 GB of RAM; factory installed	SPARCserver 1000 system board
UGSB2000-X-0M-C	100 MHz-compatible CPU/memory board, no memory; factory installed	SPARCserver 1000 or SPARCserver 2000 system board
UGSB2000-X-256M-C	100 MHz-compatible CPU/memory board with 256 MB of RAM; factory installed	SPARCcenter 2000 system board
UGSB2000-X-1GB-C	100 MHz-compatible CPU/memory board with 1 GB of RAM; factory installed	SPARCcenter 2000 system board
I/O Board Upgrades:		
UGFA-SB261X-2612	Sbus I/O board that supports 100-MHz centerplane; factory install	One 2610 or 2611 Sbus I/O board
UGSB261X-2612	Sbus I/O board that supports 100-MHz centerplane; field installed	One 2610 or 2611 Sbus I/O board
UGFA-SB262X-2622	Graphics I/O board that supports 100-MHz centerplane; factory install	One 262x Graphics I/O board
UGSB262X-2622	Graphics I/O board that supports 100-MHz centerplane; field install	One 262x Graphics I/O board
UGFA-SB263X-2632	PCI I/O board that supports 100-MHz centerplane; factory install	One 263x PCI I/O board
UGSB263X-2632	PCI I/O board that supports 100-MHz centerplane; field install	One 263x PCI I/O board
UGSB261X-2632	PCI I/O board that supports 100-MHz centerplane; field install	One 261x SBus I/O board
Sun Enterprise Server Memory Upgrades:		
UGFA-MEM256-MEM1GB	1 GB of memory; factory installed	One 256-MB memory module (7022A)
UG-MEM256-MEM1GB	1 GB of memory; field installed	One 256-MB memory module (7022A)

Upgrades

![Sun microsystems logo]

Configuration Guidelines

All upgrades to Sun Enterprise 3500–6500 servers require Solaris™ 2.5.1 Hardware: 11/97 with two patches: 104595-03 (or later) and 104594-01 (or later). In addition, patch number 105310-04, which is an FC-AL patch, is highly recommended. The Sun Enterprise 3500–6500 servers can also run Solaris 2.6 Hardware: 3/98 with no required patches. However, patch number 105375-04, an FC-AL patch, is highly recommended.

Note: *The Return Material Authorization Kit (no-charge part number UG-RMA) is **required** to be ordered with any factory-installed system or component upgrade. This part number will ship return material information*

Configtool now supports Intra-Family Upgrades. A declaration of the compatible components that will be migrated is required when configuring a Intra-Family Upgrade. Configtool now has the ability to assess *existing* components when determining a valid configuration.

Upgrades

Upgrades Questions and Answers

Why is the Return Material Authorization kit (no-charge part number UG-RMA) required for all Sun Enterprise 3500–6500 upgrades?

Ordering part number UG-RMA will ship a Return Material Authorization kit to the customer who is trading in a server. This kit houses the terms and conditions of the upgrade.

Is there any hardware or software required to support the 400-MHz/4-MB module in the Sun Enterprise 3X00 through 5X00 servers?

The 400-MHz/4-MB modules will require Sun Enterprise Flashprom update 3.2.18 or above. Other than the Flashprom version, no new hardware or software is required from what is being shipped currently in the Sun Enterprise 3500 through 5500 servers. They will run in existing Sun Enterprise 3000 through 5000 servers if they have the following:

- Sun Enterprise Flashprom update 3.2.18 or above
- 100-MHz clock board which is required to support 100-MHz Gigaplane

   The Sun Enterprise 3000 clock board and Gigaplane are already 100-MHz capable, so, in most cases, only the system boards need to be upgraded in order to support the 400-MHz/4-MB modules. Only original Sun Enterprise 3000 base packages need to have the clock board upgraded. This is because the original clock board in Sun Enterprise 3000 base package did not support any modules above 167 MHz and, therefore, needs to be upgraded to support 400-MHz/4-MB modules. Sun Enterprise "3001" and "3002"base packages do not need to have the clock board upgraded because they shipped with a second-generation clock board that supported modules above 167 MHz.

   A 100-MHz clock board upgrade is also available (part number UG-ENT-100MHCLOCKB).

- 100-MHz capable CPU/memory and I/O boards (2602A, 2612A, 2622A, and 2632A)

   See the previous upgrade pages for a list of available 100-MHz CPU/memory and I/O board upgrades.

- An upgraded 100-MHz capable Gigaplane in the Sun Enterprise 4000 and 5000

Is the 400-MHz/4-MB UltraSPARC module supported in a system with any 84-MHz system boards?

No, the 400-MHz/4-MB UltraSPARC module is not supported in a system with any 84-MHz system boards, due to the fact that it runs at a 4:1 CPU-to-Gigaplane speed ratio and requires the Gigaplane (and associated system boards) to run at 100 MHz.

Why isn't the 400-MHz/4-MB UltraSPARC module supported in the Sun Enterprise 6500 and 6000 servers?

The 400-MHz/4-MB module requires the Gigaplane to run at 100-MHz. The Sun Enterprise 6500 and 6000 servers cannot support running the Gigaplane at 100-MHz due to the physical length of the bus.

Will there be a faster-than-336-MHz UltraSPARC module available for the Sun Enterprise 6500 and 6000 servers?

Yes, there will be a module available that will run faster than 336-MHz and will not require the Gigaplane, I/O boards, or 2601A/2602A CPU/memory boards to be upgraded (2600A CPU/memory boards will need to be upgraded). Up to 30 of these future modules will be supported and all sixteen Gigaplane slots will be able to be utilized.

Will the 400-MHz/4-MB module ever be supported in the Sun Enterprise 6500 and 6000 Servers?

No, the 400-MHz/4-MB module will never be supported in the Sun Enterprise 6500 and 6000 Servers.

Is it necessary to upgrade the Gigaplane in order to support faster-than 336-MHz modules in the Sun Enterprise 3000 through 5000 servers?

At this time yes, but in the future there will be a new module available that will run at faster-than-336-MHz speeds and will not require the Gigaplane, I/O boards, or 2601A/2602A CPU/memory boards to be upgraded (2600A CPU/memory boards will need to be upgraded).

What is the benefit of the enhanced Gigaplane system bus and system boards?

Sun provides investment protection for near term performance growth requirements on the Sun Enterprise 4000 and Sun Enterprise 5000. Offering this Gigaplane upgrade enables customers to use the faster 400-MHz/4-MB processors. All system boards in the Sun Enterprise 4000/Sun Enterprise 5000 must be upgraded to be 100 MHz-compatible to take advantage of the Gigaplane upgrade.

Why does Sun have new system boards?

The new system boards are capable of supporting the faster (over 84 MHz) Gigaplane speeds. In addition, the Graphics I/O board has been modified: the pair of on-board, 25-MB-per second fiber channel sockets has been replaced by a pair of on-board, 100-MB-per-second FC-AL sockets. These new FC-AL sockets provide on-board connection to the internal disk drives in the Sun Enterprise 3500 server or to Sun StorEdge™ A5000 disk arrays.

Can I use the 100-MHz-compatible system boards in Sun Enterprise 3000–6000 servers?

Yes. These new system boards are compatible with existing Sun Enterprise 3000–6000 servers. There is no problem mixing these system boards in a Sun Enterprise 3000–6000 server that already uses the previous system boards.

What CPU modules are supported in the Sun Enterprise 3500–6500 servers?

The Sun Enterprise 3500–6500 servers can be ordered with factory-configured, 250-MHz/4-MB, 336-MHz/4-MB or 400-MHz/4-MB UltraSPARC modules. The 250-MHz/1-MB, 167-MHz/1-MB, and 167-MHz/0.5-MB UltraSPARC modules are also supported, but they not available as factory-configured options.

Note: *Customers with 167-MHz UltraSPARC processors who wish to migrate their modules to Sun Enterprise 3500–6500 servers might require a PROM upgrade as the minimum PROM level supported is 3.2.10.*

How does a customer determine the PROM level on their system? And if the PROM level is below 3.2.10 how can the customer obtain a PROM upgrade?

The system POST (Power On Self Test) displays the OpenBoot™ PROM software version of the system during the POST. Customers with versions below 3.2.10 can download a patch for the PROM level upgrade at URL: `http://sunsolve.sun.com/` (access is limited to customers on Sun Enterprise Services contract).

Do the Sun Enterprise 4500–6500 servers support the previous 4.2-GB disk board?

Yes.

Do current Sun Enterprise 3000–5000 server customers need to upgrade their existing CPU/memory and I/O boards?

Only if 400-MHz/4-MB CPU modules are being installed will the customer be required to have 26X2A 100-MHz-compatible CPU/memory and I/O boards installed. Otherwise, their current CPU/memory boards are capable of supporting 167-MHz, 250-MHz, or 336-MHz UltraSPARC modules. However, in

order to take advantage of the 4-MB cache of either the 250-MHz/4-MB or 336-MHz/4-MB CPU modules, either the 2601A or 2602A CPU/memory board is needed. The older 2600A CPU/memory boards support modules with 4-MB cache but only 2 MB of cache per processor is used.

Can Sun Enterprise Server systems support a combination of new and older CPU/memory boards and/or I/O boards?

No, if 400-MHz/4-MB CPU modules are installed. Yes, if slower speed modules are installed in which case the old and new boards may be mixed in the Sun Enterprise 3500–6500 servers and in the Sun Enterprise 3000–6000 servers. In a mixed configuration the server runs at the speed of the lowest-speed component in the system (system board(s) speed(s) and the Gigaplane speed).

Which components can a customer carry forward during an Intra-Family Upgrade from the Sun Enterprise 3000–5000 server to Sun Enterprise 4500–6500 server?

Existing memory, power/cooling modules, and internal tape devices. can be carried forward. In addition, the following components will migrate if the customer is upgrading in order to use more system slots and plans to expand their configuration with the same speed UltraSPARC processors as they have in their existing Sun Enterprise 3000–5000 server: existing CPU/memory boards, I/O boards, and UltraSPARC CPU modules.

What options are available to customers who are upgrading from the Sun Enterprise 3000 server to Sun Enterprise 3500, 4500 or Sun Enterprise 5500 server, where the internal disk does not migrate?

Sun offers the following disk upgrade (trade in) options to customers:

• Trade in 4 GB of disk and upgrade to 9.1-GB FC-AL disk drive

• Trade in 30 GB of disk and upgrade to Sun StorEdge A3000 disk array

Can customers install their own upgraded system? What services are available to aid them?

The Sun Enterprise 3500–6500 server upgrades can be accomplished by the customer. However, it is strongly recommended that the customer purchase installation services from Sun Enterprise Services. Because of the variability in customer configurations, installation services purchased from Sun Enterprise Services need to be quoted on a time and material basis.

When does a customer need a clock board upgrade?

A customer needs to purchase a clock board upgrade if the Sun Enterprise 3000–6000 server was purchased prior to November 19, 1996 and the customer wants to upgrade from 167-MHz processors to the 250-MHz or 336-MHz processor module. Or, if the customer is upgrading the Sun Enterprise 3000–5000 to run the 400-MHz/4-MB CPU module

Can existing Sun Enterprise 4000–5000 systems be upgraded to support faster than 84-MHz Gigaplane system bus?

Yes. See announcement dated January 26, 1999 or refer to pages earlier in this section for details

Where do I find more information on which servers are eligible in each of the competitive server trade-in categories?

Contact the Installed Base Business representative in your area.

Are there any software-compatibility issues with applications migrating to the servers based on the UltraSPARC processor architecture?

The UltraSPARC processor-based servers require a new version of the Solaris Operating Environment™ (Solaris 2.5.1). This new version of the Solaris Operating Environment is fully binary-compatible with the current version of the Solaris Operating Environment (Solaris 2.5). Sun does not anticipate any major problems with ISVs supporting their application software on the next version of the Solaris Operating Environment.

Which SPARCserver 1000E and SPARCcenter 2000E system components can be used in the systems based on the UltraSPARC processor architecture?

Upgrading from a SPARCserver 1000E or SPARCcenter2000E system requires a chassis swap. The chassis, system boards, SuperSPARC processors, and memory must be replaced. The components from a SPARCcenter 2000E or SPARCserver 1000E systems that can be migrated to an UltraSPARC processor-based server include SPARCstorage™ Array subsystems, and disk trays.

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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 Microsystems, Inc., customers today take advantage of the SunSpectrum program, underscoring the value it represents. Customers should check with their local Sun Enterprise™ Services representative for program/feature variance and availability in their area.

FEATURE	SUNSPECTRUM PLATINUM℠ Mission-Critical Support	SUNSPECTRUM GOLD℠ Business-Critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Systems Features				
Systems approach coverage	Yes	Yes	Yes	Yes
System availability guarantee	Customized	No	No	No
Account Support Features				
Service account management team	Yes	No	No	No
Personal technical account support	Yes	Yes	No	No
Account support plan	Yes	Yes	No	No
Software release planning	Yes	No	No	No
On-site account reviews	Monthly	Semi-annual	No	No
Site activity log	Yes	Yes	No	No
Coverage / Response Time				
Standard telephone coverage hours	7 day/24 hour	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday
Standard on-site coverage hours	7 day/24 hour	8 a.m.–8 p.m., Monday–Friday	8 a.m.–5 p.m., Monday–Friday	N/A
7 day/24 hour telephone coverage	Yes	Yes	Option	Option
7 day/24 hour on-site coverage	Yes	Option	Option	N/A
Customer-defined priority setting	Yes	Yes	Yes	No
– Urgent (phone/on-site)	Live transfer/ 2 hour	Live transfer/ 4 hour	Live transfer/ 4 hour	4 hour / N/A
– Serious (phone/on-site)	Live transfer/ 4 hour	2 hour/next day	2 hour/next day	4 hour / N/A
– Not critical (phone/on-site)	Live transfer/ customer convenience	4 hour/ customer convenience	4 hour/ customer convenience	4 hour / N/A
Additional contacts	Option	Option	Option	Option

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FEATURE	SUNSPECTRUM PLATINUM℠ Mission-Critical Support	SUNSPECTRUM GOLD℠ Business-Critical Support	SUNSPECTRUM SILVER℠ Systems Support	SUNSPECTRUM BRONZE℠ Self Support
Enhanced Support Features				
Mission-critical support team	Yes	Yes	No	No
Sun Vendor Integration Program (SunVIP™)	Yes	Yes	No	No
Software patch management assistance	Yes	No	No	No
Field change order (FCO) management assistance	Yes	No	No	No
Remote Systems Diagnostics				
Remote dial-in analysis	Yes	Yes	Yes	Yes
Remote systems monitoring	Yes	Yes	No	No
Remote predictive failure reporting	Yes	Yes	No	No
Software Enhancements and Maintenance Releases				
Solaris enhancement releases	Yes	Yes	Yes	Yes
Patches and maintenance releases	Yes	Yes	Yes	Yes
Sun unbundled software enhancements	Option	Option	Option	Option
Internet and CD-ROM Support Tools				
SunSolve™ license	Yes	Yes	Yes	Yes
SunSolve EarlyNotifier℠ Service	Yes	Yes	Yes	Yes

Service and Support

Warranty

The Sun Enterprise family of servers offers extensive warranties that can be enhanced through the Sun Enterprise Services SunSpectrum product offering. The table below describes the Sun Enterprise XX00 server warranties (warranties may vary in different countries).

	Sun Enterprise 3500	Sun Enterprise 4500	Sun Enterprise 5500	Sun Enterprise 6500
Hardware	1 year	1 year	1 year	1 year
Software	90 days	90 days	90 days	90 days
Telephone Assistance	8 a.m.–8 p.m., Monday–Friday 8-hour response	8 a.m.–8 p.m., Monday–Friday 8-hour response	8 a.m.–8 p.m., Monday–Friday 4-hour response	8 a.m.–8 p.m., Monday–Friday 4-hour response
On-site Assistance	8 a.m.–5 p.m., Monday–Friday next day	8 a.m.–5 p.m., Monday–Friday next day	8 a.m.–5 p.m., Monday–Friday 4-hour	8 a.m.–5 p.m., Monday–Friday 4-hour
Installation	Basic	Basic	ServerStart℠ installation	ServerStart installation

Sun microsystems

Glossary

Circuit-switched bus	A bus in which a transaction is normally implemented in an automatic fashion. Simple and easy to construct, a circuit-switched bus is often less efficient than a comparable packet-switched bus. SBus is a circuit-switched bus.
ECC	Error checking and correcting. ECC code is used to verify the integrity of data and can be used to correct some data errors. The ECC code used in the Sun Enterprise™ 3500–6500 servers is able to detect and correct single-bit errors, and detect double-bit errors.
Fault-resistant	Systems that are fault-resistant are able to withstand and recover from many types of system problems.
Fault-tolerant	Systems that are fault-tolerant are able to withstand and recover from any system problem and offer 100 percent uptime. These systems are typically more expensive that comparable fault-resistant systems.
FC-AL	Fibre Channel Arbitrated Loop
Gigaplane™	Gigaplane is the system bus that is used in the Sun Enterprise 3500, Sun Enterprise 4500, Sun Enterprise 5500, and Sun Enterprise 6500 servers. The Gigaplane bus is a packet-switched bus, capable of offering a sustained data transfer rate of 3.2 GB per second at 100 MHz.
High availability	Availability is the time a particular resource, such as a system, application, or data is accessible and usable. High availability means the resource is accessible and usable a maximum amount of time.
Hot-plug	A hot-plug component means that it is electrically safe to remove or add that component while the machine is still running. Typically, the system must be rebooted before the hot-plug component is configured into the system.
Hot-swap	A hot-swap component can be installed or removed by simply pulling the component out and putting the new one in. The system will either automatically recognize the component change and configure itself as necessary or will require user interaction to configure the system; however, in neither case is a reboot required. All hot-swappable components are hot pluggable, but not all hot-pluggable components are hot-swappable.
Interleaved memory	Interleaved memory helps reduce memory access time by permitting multiple memory components to operate in parallel. In interleaved memory schemes, memory is divided into n banks arranged so that every nth byte is supplied by a different memory bank. In a two-way interleaved system, the first doubleword is supplied by bank 0 while the second is supplied by bank 1. Normally, the size and extent of interleave is arranged so that a single typical request is satisfied by as many banks as possible. This arrangement permits a single memory request to be fulfilled without waiting for memory recycle time.
OBP	OpenBoot™ PROM.

Packet-switched bus	A bus in which information is transmitted in fixed-sized units. This type of bus is often associated with the use of split transactions. Gigaplane and UPA are packet-switched buses.
Parity	Parity is a simple technique used to verify the integrity of data. Parity detects single-bit errors.
POST	Power-on self-test. POST is a suite of hardware integrity tests implemented in firmware that verifies the integrity of system components.
RAS	Reliability, availability, and serviceability. Reliability is a measure of the likelihood that problems will occur. A highly reliable system will have few problems. Once a problem occurs, availability is the measure of how the system will protect the user from being adversely affected by the problem. Serviceability is a measure of how easy it is to repair the problem.
SunVTS™	Sun Validation Test Suite. This is the replacement for SunDiag™.
UPA Bus	Ultra™ Port Architecture bus. Used as an intermediate bus on the CPU/memory and I/O boards.
XBus™	Intermediate bus used on system boards for the SPARCserver™ 1000E and SPARCcenter™ 2000E servers. The Sun Enterprise 3500, Sun Enterprise 4500, Sun Enterprise 5500, and Sun Enterprise 6500 servers use the UPA bus in place of the XBus.

Glossary

Sun microsystems

Materials Abstract

All materials are available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or Comac order #
Powerpack				
– *Sun Enterprise™ 3500–6500 Servers: Just the Facts, 2/99*	Reference guide for the Sun Enterprise 3500–6500 servers	Sales tool Training	SunWIN, Reseller web	83501
– *Sun Enterprise 3500–6500 Servers: Customer Presentation 2/99*	Overview, strategy, and details of the Sun Enterprise 3500–6500 Servers	Sales tool	SunWIN, Reseller web	83552
References				
– *Sun Intro: New 400 MHz, 4-MB CPU Modules and Upgrades, 1/99*	Introduction e-mail	Sales tool	SunWIN, Reseller web, E-mail	98881
– *Sun Intro: Sun Enterprise and Sun HPC 3500–6500 Server Family and Related Upgrades; Repricing of 250-MHz, 4-MB and 336-MHz, 4-MB UltraSPARC Modules, 4/98*	Introduction e-mail	Sales tool	SunWIN, Reseller web, E-mail	83553
– *Sun Intro: Transition of Sun Enterprise 3000–6000 Upgrades, Sun HPC Servers and System Boards; Transition of 250-MHz, 1-MB UltraSPARC Module, 4/98*	Introduction e-mail	Sales tool	SunWIN, Reseller web, E-mail	84906
– *Sun Intro: New 336 MHz, 4-MB UltraSPARC™ Module, Server Base Packages and Upgrades; Repricing of Sun Enterprise and Sun HPC 6000 and Upgrades, 2/98*	Introduction e-mail	Sales tool	SunWIN, E-mail	80958,
– *Sun Intro: PROMOTION: Sun Enterprise 3000–6000 167-MHz, 1-MB UltraSPARC Module, 1/98*	Introduction e-mail	Sales tool	SunWIN, E-mail	77886,
– *Sun Intro: New CPU/ Memory Board and Options for Sun Enterprise 3000 through 6000 Servers, 4/97*	Introduction e-mail	Sales tool	SunWIN, E-mail	65197,

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Collateral	Description	Purpose	Distribution	Token # or Comac order #
References (continued)				
– *Sun Intro: New 250-MHz UltraSPARC Module, Server Base Packages, and Options for Sun Enterprise 3000 through 6000 Servers, 4/97*	Introduction e-mail	Sales tool	SunWIN, Reseller web, E-mail	66305, 70255
– *Sun Intro: 250-MHz UltraSPARC Module and Other Options for Sun Enterprise X000 Servers, 1/97*	Introduction e-mail	Sales tool	SunWIN, E-mail	61369,
– *Sun Intro: Enhanced Ultra™ Sun Enterprise X000 Servers; Sun Enterprise Clock Board Upgrade, 11/96*	Introduction e-mail	Sales tool	SunWIN, E-mail	59334,
– *Sun Intro: Ultra Sun Enterprise X000 Memory and CPU Module, 10/96*	Introduction e-mail	Sales tool	SunWIN, E-mail	57901,
– *Sun Intro: New Sun Enterprise X000 Configurations and Options, 7/96*	Introduction e-mail	Sales tool	SunWIN, E-mail	55828,
– *Sun Intro: Ultra Sun Enterprise X000 Server Family, 4/96*	Introduction e-mail	Sales tool	SunWIN, E-mail	52836,
– *Sun Server Product Line Overview, 4/98*	Quick reference card	Sales tool	SunWIN, Reseller web, E-mail	24517
– *Competitive Summary— Servers, 4/98*	Quick reference card	Sales tool	SunWIN, Reseller web, E-mail	24515
– *Sun Enterprise X000 Server Family All-in-One, 8/97*	Specification summary	Sales tool	SunWIN, Reseller web	53152
Training				
– *IQ Kit: Sales Information Quickstart, 4/98*	Detailed sales and marketing information for Sun Enterprise 3500–6500 servers and related software	Sales tool	SunWIN, Reseller web	83556
– *IQ Kit: Technical Information Quickstart, 4/98*	Detailed technical document for Sun Enterprise 3500–6500 servers and related software	Sales tool	SunWIN	83557
– *IQ Kit: Reference Information Quickstart, 4/98*	Detailed resource catalog for Sun Enterprise 3500–6500 servers and related software	Sales tool	SunWIN, Reseller web	83558
– *IQ Kit: Facilitator's Information Quickstart, 4/98*	Facilitator's guide for training on Sun Enterprise 3500–6500 servers and related software	Sales tool	SunWIN	83559

Collateral	Description	Purpose	Distribution	Token # or Comac order #
Product Literature				
– *Sun Enterprise 3000–6000 Servers: Just the Facts, 3/98*	Reference guide for the Sun Enterprise 3000–6000 servers (in two parts)	Sales tool Training	SunWIN, Reseller web	52489 52966
– *Sun Enterprise SyMON™: Just the Facts, 11/98*	Reference guide for the Solstice SyMON monitoring software	Sales tool Training	SunWIN, Reseller web	52499
– *Sun Enterprise XX00 Servers System Options, 4/98*	Comprehensive reference guide for Sun Enterprise 3000–6000 and 3500–6500 server options	Sales tool	SunWIN	63142
– *Sun Enterprise 3000–6000 Servers: Customer Presentation 3/98*	Overview, Strategy, and Details of the Sun Enterprise 3000–6000 Servers	Sales tool	SunWIN, Reseller web	81540
– *Server Family Brochure, 4/98*	High-level overview brochure on Sun server and storage products	Sales tool	SunWIN, Reseller web, Comac	69480 BE607-1
– *Sun Enterprise 3500 Datasheet, 4/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	81065 DE827-0
– *Sun Enterprise 4500 Datasheet, 4/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	81067 DE828-1
– *Sun Enterprise 5500 Datasheet, 4/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	81070 DE829-0
– *Sun Enterprise 6500 Datasheet, 4/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	81072 DE830-0
– *Sun Enterprise 3000 Datasheet, 1/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	53188 DE647-1
– *Sun Enterprise 4000 Datasheet, 1/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	53190 DE644-2
– *Sun Enterprise 5000 Datasheet, 1/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	53194 DE658-1
– *Sun Enterprise 6000 Datasheet, 1/98*	Datasheet	Sales tool	SunWIN, Reseller web, Comac	53221 DE643-1

Materials Abstract

Collateral	Description	Purpose	Distribution	Token # or Comac order #
Product Literature (continued)				
– *Sun Enterprise 3500–6500 Server Family: Architecture and Implementation White Paper, 4/98*	In-depth discussion of Sun Enterprise 3500–6500 server architecture	Sales tool	SunWIN, Reseller web	84915
– *Ultra Sun Enterprise 3000–6000 Server Family: Architecture and Implementation White Paper, 4/98*	In-depth discussion of Sun Enterprise 3000–6000 server architecture	Sales tool	SunWIN, Reseller web	53094
– *Availability Features in the Sun Enterprise 3500–6500 Server Family White Paper, 4/98*	In-depth technical discussion of Sun Enterprise 3500–6500 server availability features	Sales tool	SunWIN, Reseller web	88368
– *Sun Enterprise 3500 Ordering Flow Chart, 2/99*	Ordering information	Sales tool	SunWIN, Reseller web	84910
– *Sun Enterprise 4500 Ordering Flow Chart, 2/99*	Ordering information	Sales tool	SunWIN, Reseller web	84911
– *Sun Enterprise 5500 Ordering Flow Chart, 2/99*	Ordering information	Sales tool	SunWIN, Reseller web	84912
– *Sun Enterprise 6500 Ordering Flow Chart, 2/99*	Ordering information	Sales tool	SunWIN, Reseller web	84913
– *Sun Enterprise 3000 Ordering Flow Chart, 4/98*	Ordering information	Sales tool	SunWIN, Reseller web	53154
– *Sun Enterprise 4000 Ordering Flow Chart, 4/98*	Ordering information	Sales tool	SunWIN, Reseller web	53156
– *Sun Enterprise 5000 Ordering Flow Chart, 4/98*	Ordering information	Sales tool	SunWIN, Reseller web	53158
– *Sun Enterprise 6000 Ordering Flow Chart, 4/98*	Ordering information	Sales tool	SunWIN, Reseller web	53160
– *56-Inch Sun Enterprise Expansion Cabinet Ordering Flow Chart, 4/98*	Ordering information	Sales tool	SunWIN, Reseller web	53162
Product Brief				
– *Sun Enterprise 3000 Product Brief, 7/97*	On-line version of datasheet	Sales tool	SunWIN, Reseller web	53247
– *Sun Enterprise 4000 Product Brief, 7/97*	On-line version of datasheet	Sales tool	SunWIN, Reseller web	53250
– *Sun Enterprise 5000 Product Brief, 7/97*	On-line version of datasheet	Sales tool	SunWIN, Reseller web	53256
– *Sun Enterprise 6000 Product Brief, 7/97*	On-line version of datasheet	Sales tool	SunWIN, Reseller web	53264
– *Solstice SyMON Product Brief, 7/97*	Overview of Solstice SyMON monitoring software	Sales tool	SunWIN, Reseller web	53243

Materials Abstract

Collateral	Description	Purpose	Distribution	Token # or Comac order #
Competitive				
– *Competitive Edge—IBM, 4/98*	Updated competitive information e-mail	Sales tool	SunWIN, E-mail	84928
– *Competitive Edge—HP, 4/98*	Updated competitive information e-mail	Sales tool	SunWIN, E-mail	84929
– *Competitive Edge—DEC, 4/98*	Updated competitive information e-mail	Sales tool	SunWIN, E-mail	84930
– *Competitive Edge—NT, 4/98*	Updated competitive information e-mail	Sales tool	SunWIN, E-mail	85056
External Web Sites				
– *List of Sun-tested PCI cards*	`http://www.sun.com/pci`			
– *SPEC home page*	`http://www.specbench.org/results.html`			
Internal Web Site				
– *Memory configuration tool for calculating actual memory bandwidth based on given memory configuration.*	`ftp://newstop.eng/sun/tech-mktg/perf-tools/`			
– *Sun Enterprise Server Ordering Flowchart*	`http://edss.corp/servers/flowcharts/`			