Sun Fire™ T1000 Server

Just the Facts

SunWIN token #456966

March 31, 2009

Version 2.1

Sun microsystems

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Revision History

Template Version	Comments	Date	Author
1.0	Original Release	March 2006	Wendy Williams
1.7	Added support for 146GB SAS disk drives. Minor changes to physical dimensions, weight and depth. Added AC power cord Taiwan. Added XRA-ST1CG-160G7K to the Options section. Added X1027A-Z and X4447A-Z Options. Added StorageTek 6540 to the Options section.	March 2007	Sara Muckstadt
1.8	Added support for PCI-X 8 port SAS card. Part number SG-XPCI8SAS-E-Z Added support for DAT-72 tape device Deleted 512MB configs and memory option Added new 1GB configs	November 2007	Sara Muckstadt Byron Magrane
1.9	Reviewed JTF and discovered that minor corrections needed to be made. Added new power cords.	January 2008	Byron Magrane
2.0	Updated PTO configurations in the Ordering Information section Removed Sun System Pack offerings Updated SATA disk to 250GB	January 2009	Sara Muckstadt
2.1	Removed references to JES	March 2009	Sara Muckstadt

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Positioning

Figure 1. Sun Fire™ T1000 server

Introduction

As organizations move from the information age into the "participation" age of network computing, they must deliver new services to larger user bases to remain competitive, and to grow revenue and profitability while reducing operational costs. Delivering new services and supporting larger numbers of users requires purchasing and deploying IT infrastructure capable of addressing increased throughput and performance requirements. This need for IT growth presents major challenges to corporations. Research indicates that over 80 percent of datacenters are constrained by power, cooling, and space. Competitive Intel and RISC based servers magnify the problem with increasing power and cooling requirements.

Servers based on Sun's radical Chip Multithreaded (CMT) processors address these challenges by delivering breakthrough high levels of computing throughput and price performance at very low power, heat, and space levels. CMT processors allow organizations to scale infrastructure to support new users and services, while reigning back demands on power, space, and cooling, thereby helping to reduce operational costs and improve reliability.

The Sun Fire™ T1000 server incorporates the UltraSPARC® T1 processor. This processor delivers up to 32 simultaneous execution threads and 32GB of memory in a rack-optimized 1RU enclosure, and has very low power consumption.

The Sun Fire T1000 server is designed and engineered to address the challenges of today's datacenter by delivering an excellent price-to-performance ratio with a greatly reduced power consumption and a small footprint.

These features make the Sun Fire T1000 server an ideal platform for the delivery of horizontally scaled transaction and web services. The Sun Fire T1000 server also offers one PCI-E slot, four integrated Gigabit Ethernet interfaces, and the choice of one SATA or two SAS disks in a small 1U form factor. This provides an ideal balance of performance, connectivity, density, and price point.

The Solaris™ 10 Operating System installed on this server provides a highly efficient and secure application environment. These capabilities, along with UltraSPARC technology-based binary compatibility, provide customers with great agility, efficiency, and reduced risk.

The Sun Fire T1000 server is optimized for horizontal scaled environments. This server is a great platform for web serving, security applications, network infrastructure nodes such as directory, search and identity, and portal gateways. Its efficient footprint, high performance, and low power needs can result in significant costs savings to an organization:

- Purchase fewer servers to do the same job.

- Take up less floor space for the same performance.

- Reduce power consumption.

- Reduce air conditioning needs.

The Sun Fire T1000 server gives customers the flexibility to scale their processing needs without wasting precious space, making it an ideal server for service providers, including ISPs and ASPs, the financial services sector, telco and government datacenters, or anyone that requires a maximized CPU processing (memory density per square foot of floor space). In addition, many of these customers choose to scale horizontally, which requires the flexibility of attaching external storage via PCI expansion. The Sun Fire T1000 server is intended for cost-sensitive applications where price and price-performance is one of the main buying criteria.

Key Messages

- The Sun Fire T1000 Server is a breakthrough design delivering the highest performance with the lowest energy consumption and the greatest space efficiency.
- The Sun Fire T1000 server is a eco-responsible platform designed and engineered to address the challenges of today's datacenter.
- The Sun Fire T1000 server is the best platform for the delivery of transaction and web services on the planet, when measured by the new SWaP (Space, Watts and Performance) benchmark.

The unique benefits of the Sun Fire T1000 server are delivered through the following capabilities:

- The Chip Multithreaded (CMT) design provides up to 32 threads per each Sun Fire T1000 server, which helps to increase performance with less power in a smaller footprint compared to previous products.
- New high-end RAS features are designed into the processor, including memory Chipkill support, memory address parity protection, memory hardware scrubbing, an L2 cache scrubber, soft error rates, and DRAM sparing.
- The Sun Fire T1000 server is able to handle compute- and data-intensive applications with multithreaded capabilities and large amounts (16 GB) of memory.

UltraSPARC T1 processor—CoolThreads™ technology lowers power costs.

Sun Fire T1000 server's "CoolThreads technology" requires significantly less power than competitive processors making them significantly less expensive to operate and packing more capacity into existing data center facilities.

- UltraSPARC T1 processor is the clear performance-per-watt leader allowing these systems to run cooler and more efficiently while delivering high output.
- UltraSPARC T1 processor uses as little as 70W per processor—the wattage needed to power a light bulb—which is much less than competitive processors which require about the same amount of power *per thread*.

Power cost reductions from UltraSPARC T1 processor-based systems can save enterprises millions of dollars annually.

More performance, less space.

The Sun Fire T1000 server provides higher compute density, yielding greater performance in less space, easing the space limitations that many datacenters are currently experiencing.

- According to Sun's analysis, companies using UltraSPARC T1 processor-based systems can experience up to a 6:1 reduction in the number of servers.
- The Sun Fire T1000 server provides up to 32 compute threads in a single processor as compared to one thread per each x86 processor (or two with hyper-threading), packing high throughput into a small footprint.

- The Sun Fire T1000 server delivers up to 5 times more performance per watt compared to competitive servers.

Greater application efficiency and security.

Sun Fire T1000 servers come with the Solaris 10 Operating System, which provides an efficient and secure application environment while further increasing performance and utilization.

- The Solaris 10 OS multithreaded design takes full advantage of the Sun Fire T1000 server's CMT architecture, boosting throughput and efficiency.

- Solaris Containers run multiple applications providing up to five times the industry-standard utilization.

- The Solaris 10 OS protects against both malicious external attacks and data access violations from the inside. The Process Rights Management component provides control over the rights given to users and processes.

- UltraSPARC T1 processor-based systems provide full binary compatibility, which make it easy for customers to run and move their applications across UltraSPARC/Solaris 10 OS-based servers.

Key Product Features, Functions, and Benefits

Feature	Function	Benefit
• UltraSPARC T1 processor equipped with up to 8 four-way multithreaded cores	• Support for 32 simultaneous threads, with eight threads executed per clock cycle	• Radically higher throughput for multiple, single-threaded applications or multithreaded applications
• Cores connected through a 134 GB/sec. crossbar switch	• Very fast communication between cores	• Higher performance through low latency
• High-bandwidth four-way shared 3-MB Level-2 cache	• Optimum sized cache for multithreaded processors	• Reduces processor cost and complexity, ensuring a balance is achieved between high throughput and low cost/complexity
• Two on-chip DDR2 channels delivering 12.8 GB/sec. processor to memory bandwidth	• Direct access from processor to memory, with minimum contention for memory	• High throughput with low memory latency and low power
• Typical processor power consumption of 72 watts, delivering 32 simultaneous threads	• Keeps the performance to power ratio very low while reducing heat dissipation	• Helps reduce cost, improve reliability, and ensure customers can grow within current data center power and thermal limitations
• SPARC® v9 implementation	• Standard SPARC processor implementation, delivering binary compatibility with previous generation of Sun systems and Solaris software	• Customers investments in existing software assets and skills are preserved
• ECC and parity protection on caches, TLBs, and register files	• Maintenance of data integrity across on-chip memories	• Mainframe class processor RAS with features unique to volume processors, enhancing system

Feature	Function	Benefit
		uptime
• Chipkill and DRAM sparing	• Chipkill is used to detect failing DRAM; DRAM channel is then mapped away from failing DRAM through sparing	• Extreme levels of main memory reliability and availability, enhancing system uptime by allowing the system to keep running in the event of a memory DRAM failure
• Space efficient, rack-optimized 1 RU design	• Offers high compute density, providing maximum value per rack unit	• Up to 32 threads in a dense, rack-optimized enclosure enables customers to maximize datacenter throughput
• Four onboard 10/100/1000-Mbps Ethernet ports	• Exceptional I/O performance and increased network reliability by providing redundancy	• Increases network efficiency, flexibility, and availability
• One PCI-E slot and one serial port	• Connectivity	• Cost-effective means to provide network and storage connectivity. Allows for fast deployment into an IT environment
• Solaris 10 11/06 Operating System pre-installed	• With features such as Solaris Containers, predictive self-healing, Solaris Dynamic Tracing and support for the latest UltraSPARC platforms, Solaris 10 OS sets entirely new standards for performance, efficiency, availability and security	• Innovations in the Solaris 10 OS save customers significant and measurable time and money when deploying, operating, and managing their IT infrastructure
• Legacy application support and Solaris Binary Compatibility Guarantee	• Software applications written to the Solaris ABI can run on new UltraSPARC T1 CPU-based systems with no modification required.	• No need to migrate OS or to port applications to take advantage of new hardware features, providing unrivaled investment protection
• Rack-optimized system with support for most industry standard four-post racks	• Installation and serviceability	• Ease integration and deployment into production environments while enabling customers to preserve their investments in existing datacenter environments
• Sun Customer Ready Systems (CRS) program	• For factory-configured, pre-racked, custom Sun Fire T1000 servers, refer to the CRS program website: http://www.sun.com/crs	• Simplification and speed of system deployment
• SunSpectrumSM Instant Upgrades available for the Sun Fire T1000 servers	• Provides essential services, support, system administration resources and Solaris OS updates in one package.	• Lower cost, higher productivity and improved system uptime; peace of mind that all service needs will be handled painlessly. One stop shop

Feature	Function	Benefit
		for all customer needs

Product Family Placement

This product is a new entry in the SPARC® processor-based product family.

- The Sun Fire T1000 server joins the Sun Fire T2000 server as the first platforms to incorporate the breakthrough UltraSPARC T1 processor.

- The UltraSPARC T1 processor represents Sun's first generation of radical CMT products, designed to be complimentary to Sun's existing line of UltraSPARC IIIi, UltraSPARC IV, and Opteron processor-based servers.

Overall platform positioning can be summarized as follows:

- **Sun Fire CoolThreads servers** for mission-critical, web and application tier workloads, including Java and other thread-rich environments

- **Sun Fire x64 servers** for FP performance and compute-intensive workloads and for environments that are already standardized on x64 or Linux/Windows-based applications

- **Sun Fire V210 to V440 server** for massive infrastructure build out with the world's best selling UNIX® platforms

- **Sun Fire V490 to E25K servers** for workload consolidation and highly scalable, mission-critical workloads

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Sun Fire X Series Servers

Sun Fire X2100 – X4200

X 1-4 cores & 16GB memory, scaling to 16 cores over FY06
s Solaris 10/Linux/Windows multi-OS support
m Best in Class for x86/x64 standards
s Excel in HPTC & mixed workload capabilities
w Fastest growing x86 servers in the market

Sun Fire CoolThreads Servers

Sun Fire T1000 - T2000

s 1-8 cores & 32GB memory Solaris 10 Support
S Web/App Tiers demanding highest throughput in lowest space and power footprint. Best performance per watt, price / performance and SWaP in class
i Breakthrough innovation as world's first eco-responsible servers

Sun Fire Entry-Level & Mid-Range

Sun Fire V210 – V890

V 1-16 cores & 4GB-64GB memory
m Rack and Tower form factors
R Solaris 8/9/10 support
S Web and App Tiers
W Mixed workloads w/ floating point/ single-threading or multi-threaded apps
m Highest selling UNIX servers in the market

Sun Fire Enterprise Servers

Sun Fire E2900 – E25K

E 8-144 Cores & 576GB memory
8 Enterprise Consolidation w/ Domains
D Max. flexibility/utilization w/ Uniboards
U Best TCO w/ USIII/IV/IV+ & Sol 8/9/10 support
8 Apps w/ highest levels of RAS, and use vertical scaling or unpredictable performance req's

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Feature Comparison of UltraSPARC T1-based Servers

Feature	Sun Fire T2000 Server	Sun Fire T1000 Server
CPUs	4 to 8 cores, 1.0 or 1.2-GHz UltraSPARC T1 processors	6 or 8 cores, 1.0-GHz UltraSPARC T1 processors
Threads	32 max.	32 max.
Max. memory	64 GB	32 GB
Max. internal disk drives	Four 73-GB SFF SAS disks with support for HW RAID (0+1)	One 250-GB SATA disk or two 73-GB or 146GB SAS disks
I/O	Slimline DVD/CD-RW Four USB 1.1 ports	N/A
PCI	Three PCI-E slots, low profile *Two PCI-X slots, low profile *(On older models, one PCI-X slot is occupied with a disk controller.)	One PCI-E slot, low profile
Ethernet	Four on-board Gigabit ports	Four on-board Gigabit ports
Power supplies	Two 450W hot-swap (N+1) (redundant)	One 300W
Nominal Power	275W *(Earlier models containing 550W power supplies have a typical operating power of 325W)	180W
Fans	Redundant cooling fans	Single fan tray assembly
Target use	OLTP, CRM, ERP, database, collaboration, and J2EE custom applications	Web server, portal server, network server, security server, and J2EE custom applications
Form factor	2 RU	1 RU
Solaris OS version	Solaris 10 1/06 or later	Solaris 10 1/06 or later
Pricing	~ $8k to $27K	~$3.5K to $12K

Select the Sun Fire T2000 server when:	Select the Sun Fire T1000 server when:

• Customer demands best levels of throughput and expandability
  – More memory, I/O, and internal disk
  – Higher frequency processor
• Customer demands high levels of system RAS to deliver high uptime
  – Redundant power, cooling, and disks
• Typical workloads
  – Demanding mid-tier app server deployments or web tier consolidation projects requiring maximum uptime with future growth and integration into diverse environments
	• Customer needs very high throughput but has significant power, cooling, and space constraints
	  – 32 thread UltraSPARC T1 processor in 1RU, low power package
	• Customer demands very high levels of price/performance with lowest acquisition price
	  – Lower redundancy and expandability
	• Typical workloads
	  – Compute node within massively horizontally scaled environment, typically access/presentation tier of low-end app layer of web services environment

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Feature Comparison with Other UltraSPARC Processor-based Servers

Feature	Sun Fire T1000 Server	Sun Fire V210 Server	Sun Fire V240 Server
CPUs	6 or 8 cores, 1.0-GHz UltraSPARC T1 CPUs	Up to two 1.34-GHz UltraSPARC IIIi CPUs	Up to two 1.34/1.5-GHz UltraSPARC IIIi CPUs
Threads	32 max.	1 per CPU (2 max.)	1 per CPU (2 max.)
Max. memory	32 GB	8 GB	8 GB
Max. internal disk drives	One 250-GB SATA or two 73-GB or 146GB SAS disks	Two 73/146-GB Ultra160SCSI	Four 73/146-GB Ultra160SCSI
Removable media	—	Slimline ATAPI DVD-ROM (opt.)	Slimline ATAPI DVD-ROM (opt.)
Weight max.	29 lb./13.2 kg	34.3 lb./15.6 kg	49.3 lb./22.4 kg
Power consumption--typical	180W	400W	450W
Heat/cooling load	615 BTUs/hr.	1,366 BTUs/hr.	1,539BTUs/hr.
PCI	One PCI-E slot for low-profile cards (supports 1x, 4x, and 8x width)	One 33/66-MHz full-length PCI 2.2	Three PCI 2.2 slots
Ethernet	Four on-board Gigabit ports	Four Gigabit ports	Four Gigabit ports
Reliability features	Low component count, environmental monitoring, ASR, Chipkill, DRAM sparing	Hot-pluggable disk drives, environmental monitoring, ASR	Hot-pluggable disk drives, redundant, hot-swappable power supplies, environmental monitoring, ASR
Target workloads	Web server, portal server, network server, security server, and J2EE custom applications	Best price/performance for mixed workloads on SPARC/Solaris OS, support for legacy environments	Best balance of price to mixed-workload performance on SPARC/Solaris OS, coupled with expandability and RAS, support for legacy environments
Form factor	1 RU	1 RU	2 RU
Solaris OS version	Solaris 10 11/06 or later	Solaris 8 or later	Solaris 8 or later

Feature Comparison with Sun's x64 Opteron-based Servers

Feature	Sun Fire T1000	Sun Fire V20z	Sun Fire X2100	Sun Fire X4100	Sun Fire X4200
CPUs	6 or 8 cores, 1.0-GHz UltraSPARC T1 CPUs	Up to two single-core or dual-core 2.0 - 2.6-GHz AMD Opteron 200-series CPUs	Single-core or dual-core AMD Opteron 100-series processor	Up to two single-core or dual-core 2.0 - 2.8-GHz AMD Opteron 200-series processors	
Threads	32 max.	4 max.	2 max.	4 max.	
Max. memory	132GB	16 GB	4 GB	16 GB	
Max. internal	One 250-GB	Up to two	Up to two 3.5 inch SATA drives		Up to four 3.5

Feature	Sun Fire T1000	Sun Fire V20z	Sun Fire X2100	Sun Fire X4100	Sun Fire X4200
disk drives	SATA or two 73-GB or 146GB SAS disks	Ultra320 SCSI drives			inch SATA drives
Removable media	—	One CD-ROM/ floppy (std), Slimline DVD (opt)	One EIDE DVD-ROM drive		
Weight maximum	29 lb./13.2 kg	35 lb./16 kg	28.7 lb./13 kg	39.3 lb./17.9 kg	35 lb./16 kg
Power consumption typical	180W	320W	230W	450W	450W
Heat/cooling load	615 BTUs/hr.	1,100 BTUs/hr	785 BTUs/hr	1,536 BTUs/hr	1,536 BTUs/hr
PCI	One PCI-E slot for low-profile cards (supports 1x, 4x, and 8x width)	Two 64-bit PCI-X slots	One PCI-E slot (supports 8x width)	Two PCI-X slots	Five internal MD2w 64-bit PCI-X slots
Ethernet	Four on-board Gigabit ports	Two integrated Gigabit ports		Four integrated Gigabit ports	
Reliability features	Low component count, environmental monitoring, ASR, Chipkill, DRAM sparing	Dual redundant fans	Hot-swappable drives	Hot-swappable drives, on-board RAID 0, 1	ALOM, redundant, hot-swappable drives and power supplies
Form factor	1 RU	1 RU	1 RU	1 RU	2 RU
Solaris OS version	Solaris 10 11/06	Solaris 10, Red Hat Linux, SUSE Linux, Microsoft Windows Server 2003			

Positioning Comparison with Other UltraSPARC and Opteron Servers

- Sun Fire T1000 server:
  - Best solution for Web and Application tiers, Java, and horizontally scaled database applications, providing dramatically increased system throughput
  - Designed to solve today's datacenter power, space, and cooling constraints, potentially extending the useful life of data center resources
  - Customer demands the lowest cost, highest transaction throughput for commercial applications
  - Existing Sun/Solaris OS customers looking to move to a new computing paradigm while maintaining the consistency offered through the Solaris OS/SPARC architecture
  - IBM, Dell, and HP x86 customers dealing with the management and power issues of horizontal sprawl

- Sun Fire X2100 to X4200 Opteron servers:
  - Highest per core performance delivering the best single-thread performance for Web/App tiers and the floating-point performance
  - Designed for application environments currently addressed by Wintel/Lintel (x86/x64) solutions (run floating point and compute intensive, single-threaded applications up to 1.6x faster than Xeon-based servers)
  - For customers who have standardized on x86 computing and who have no requirements or access to

UNIX®/RISC applications or support
- Full Solaris OS X86 binary compatibility, with support of Linux or Windows-based applications to provide maximum flexibility
- Fastest, most reliable x64 servers in the market
- Uses one-third the power of Xeon servers making it the most energy efficient x64-based server
- HTPC/compute environments demanding cost-effective, high performance floating-point results
- Existing Sun/Solaris OS/SPARC customers looking to leverage x64 technology
- IBM and Dell Xeon/Itanium customers looking for a lower cost, lower power alternative

- Sun Fire V210 to V890 servers:
  - Addresses Web and Application tiers for customers who continue to utilize Solaris 8 and 9 OS
  - Existing SPARC/Solaris OS customers with high levels of floating point/single-threaded applications
  - Excellent platform for small database instances especially where legacy Solaris support is needed
  - Existing Sun/SPARC customers looking to maintain application and expansion stability as they plan for future technology enhancements

- Sun Fire E2900 to E25K servers
  - Designed for applications that require maximum performance, highest levels of RAS, and use vertical scaling
  - Mid-tier and backend database applications which demand high performance and expandability
  - Up to five times the performance of UltraSPARC III CPU-based systems within the same footprint
  - Have very long deployment lifecycles that will benefit from the ability to add new UltraSPARC IV+ CPU to existing UltraSPARC III or IV systems and all run at rated speed. Especially true of mission critical applications requiring long-term stability and protection of asset investments
  - Customer demands highest uptime for critical applications, delivered through full hardware redundancy
  - Virtually all interruptions can be prevented or recovered from automatically with predictive self healing and dynamic reconfiguration
  - Superior virtualization capabilities allow customers dealing with server sprawl to consolidate using domains and Solaris Containers
  - UltraSPARC III/IV processor customers with open slots can augment existing applications or add new projects to an
    established platform

Availability

The Sun Fire T1000 server achieved General Availability on March 29, 2006.

Target Users

Large datacenters where throughput, power, cooling, and space are key issues preventing them from scaling to deploy new services to new users. Typically these customers run large farms of X86-based web and app servers, and use UNIX or Linux environments.

- The Sun Fire T1000 server delivers breakthrough performance with the greatest power and space efficiency for web and application workloads.

- The Sun Fire T1000 server is able to handle integer-based compute- and data-intensive applications with multithreaded capabilities and large amounts (16 GB) of memory.

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- Typical applications include:

  - Web Serving
  - Streaming Media
  - Security Applications
  - Java Application Servers
  - Java Virtual Machines
  - Network Infrastructure
  - SOA and Business Integration platforms
  - Compute and Network node

- Target users include:

  - Those running large datacenters where throughput, power, cooling and space are key issues

  - Multiple single-threaded integer-based applications consolidated using processor sets or Solaris Containers

Target Markets

The Sun Fire T1000 server is a high-performance, low-power, and space-affordable server targeted at a distributed computing model. As servers become overloaded, IT organizations have traditionally added servers or distributed multiple functions residing on one server across several others. This approach, known as scaling out, or horizontal scaling, can increase performance (e.g., server farms), improve availability (e.g., high-availability clusters) or provide an immediate fix to a pressing IT need. Horizontally scaled systems are characterized by multiple servers connected by communication links, applications are load balanced across these systems, and each server runs the same copy of the operating system and application. The Sun Fire T1000 server is well aligned due to its rack-optimized 1U chassis, four Gigabit Ethernet ports, low power consumption, and PCI-E slot.

The Sun Fire T1000 is ideally suited for large data centers in markets such as financial services, ASPs, ISPs, telecommunications companies, and government agencies. Just about any organization in these categories is also a target:

- Proxy caching
- Email service
- Streaming media
- Web serving

- Networking
- Security
- Systems management
- Java application servers and Java Virtual Machines

Selling Highlights

Market Value Proposition

Sun Fire™ CoolThreads servers deliver breakthrough throughput at dramatic cost savings to meet the increasing demands of the networked enterprise infrastructure using Sun's radical Chip Multithreaded (CMT) processor architecture. The Sun Fire T1000 and T2000 servers' high compute density eases datacenter space, power, and cooling constraints. With the Solaris™ 10 Operating System, these servers provide a highly efficient and secure application environment. These capabilities, along with UltraSPARC® technology-based server binary compatibility, provide customers with outstanding agility, efficiency, and reduced risk.

- The Sun Fire T1000 and T2000 servers are designed and engineered to address the challenges of today's horizontally scaled datacenter.

- The Sun Fire T1000 server delivers leading performance with very low power consumption in a small 1RU footprint at an aggressive price.

- The Sun Fire T1000 and T2000 servers are ideal platforms for the delivery of transaction and web services, when measured by the new Space, Watts, and Performance (SWaP) benchmark.

The SWaP Benchmark

Traditional system to system performance benchmarks are valuable to many customers as a way of comparing one system to another, but are limited when it comes to understanding the power and density attributes of a system.

For this reason, Sun has developed the Space, Watts and Performance (SWaP) benchmark, which is designed to provide a simple and transparent measure of overall datacenter efficiency. SWaP is calculated using the following formula:

$$\text{SWaP} = \text{Performance/(Space*Power)}$$

- **Performance** is measured by industry standard, audited benchmarks (such as SPECjappServer2004).

- **Space** refers to the height of the server, measured in rack units (RUs).

- **Power** is measured by watts used by the system. This is either measured during actual benchmark runs or is taken from vendors site planning guides.

An example of SWaP, based on an comparing the Sun Fire T1000 server to a four-processor Xeon-based server running an application tier benchmark is shown in the table below.

In this example, the Sun Fire T1000 server outperforms the dual-processor Xeon-based server by 2.18 times on an application tier benchmark, yet requires 2.38 times less power. This equates to a performance-per-watt advantage of 5.2 times the Xeon-based server.

When comparing fully populated racks, the Sun Fire T1000 server delivers nearly 2.2 times more throughput at 2.38 times less power.

	Feature	Sun Fire T1000 Server	Dual-Processor Xeon Server	Sun Fire T1000 Server Advantage
	Space (RU)	1	1	**same**
	Watts	180	428	**2.38 times**
System to system comparison	Performance (application tier benchmark)	53,026	24,208	**2.18 times**
	Performance per watt	294.589	56.561	**5.21 times**
Rack to rack comparison	Performance per full rack	2,121,040	968,320	**2.2 times**
	Power per full rack	7,200	17,120	**2.38 times**
	Performance per typical rack	1,325,650	254,523	**5.21 times**
System efficiency	SWaP	294.6	56.6	**5.2 times**
	Annual power cost per server	$204	$486	**57.9%**

Selling Strategies

The Sun Fire T1000 server delivers breakthrough throughput with dramatic space and power efficiency and, with the Solaris 10 OS, provides a highly efficient and secure application environment.

This powerful value proposition allows the Sun Fire T1000 server to drive an effective Retain-Develop-Acquire selling strategy.

Retain

The first stage of selling strategies is to propose the Sun Fire T1000 server into installed base accounts to counter competitive threats and capture design win opportunities. The installed base of Sun UltraSPARC II and UltraSPARC III platforms provides a huge opportunity to migrate the customer base to the latest SPARC®/Solaris 10 platform.

Use the sales collateral and success stories developed to support the Sun Fire T1000 server, coupled with local iForce™ Centers and loaner programs to seed the account and prove the benefits of CMT.

Develop

As install base accounts qualify the Sun Fire T1000 server and measure the benefits delivered by CMT technology, propose the platform as a consolidation solution to address the web and application tier sprawl created by Xeon-based servers running Windows and Linux environments.

Use the consolidation tools and migration guides created as part of the Consolidation Growth Target program.

Acquire

As the benefits of CMT are proved through the sales collateral discussed above and actual account wins, propose the Sun Fire T1000 server into current non-Sun accounts running competitive UNIX® or Linux solutions.

Applications

Web and application tier workloads make **excellent candidates** for the Sun Fire T1000 server. These are characterized by:

- High-throughput applications

- Multithreaded applications with a few highly threaded processes

- Multiprocess applications that are often single threaded and communicate through shared memory

- Single-threaded applications that can be consolidated using Solaris OS processor sets or Solaris Containers

Poor candidates for the Sun Fire T1000 server include:

- Single-threaded, long-running batch applications, for which the primary performance metric is elapsed time.

- HPC floating-point intensive applications

- Applications with a high-number of VIS™ instructions

Compatibility

Because the Sun Fire T1000 server runs the Solaris 10 Operating System, it runs the same applications as all other Solaris OS-based UltraSPARC servers that have been qualified for the Solaris 10 OS.

Enabling Technology

The New and Innovative UltraSPARC® T1 CMT Processor

The UltraSPARC® T1 multicore processor is the first chip that fully implements Sun's Throughput Initiative. Each of the eight on-board processor cores can fully support four threads, resulting in 32 threads total. Each core has an instruction cache and a data cache as well as fully associated instruction and data TLBs. The eight cores are connected through a crossbar to an on-chip unified Level 2 cache.

Some of the other important features of this chip are:

- SPARC® V9 implementation

- All cores connected through a 134.4 GB/sec. crossbar switch

- 79-watt worst case nominal power dissipation, 73 watts typical

- JBus interface with 3.1 GB/sec. peak effective bandwidth

- Two DDR2 channels (12.8 GB/sec. total) for faster access to memory

- Extensive built-in RAS features including ECC protection of register files, Chipkill, memory sparing soft error rates and rate detection, and extensive parity/retry protection of caches

The UltraSPARC T1 chip makes the Sun Fire™ T1000 server an exceptional server. This chip provides large amount of compute performance and protection in a small footprint with a greatly reduced need for power.

The UltraSPARC T1 Multicore Processor
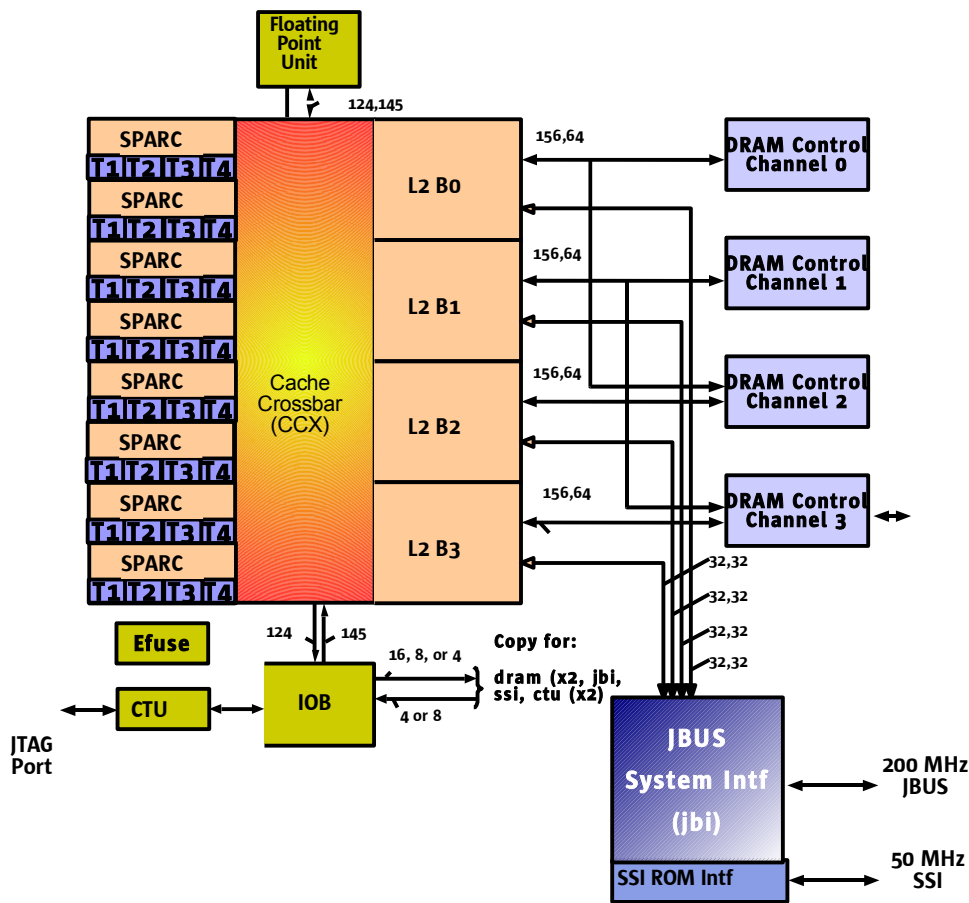
Figure 2. The UltraSPARC T1 multicore processor block diagram
(Note: Sun Fire T1000 server utilizes two memory controllers)

The UltraSPARC T1 multicore processor is the basis of the Sun Fire T1000 server. The UltraSPARC T1 processor is based on Chip Multithreaded (CMT) technology that is optimized for highly threaded transactional processing. The UltraSPARC T1 processor improves throughput while using less power and dissipating less heat than conventional processor designs.

Depending on the Sun Fire T1000 server model purchased, the processor has six or eight UltraSPARC cores (the Sun Fire T2000 server has four, six and eight core models). Each core equates to a 64-bit execution pipeline capable of running four threads. The result is that the eight-core processor handles up to 32 threads concurrently.

Additional processor components, such as L1 cache, L2 cache, memory access crossbar, DDR2 memory controllers, and a JBus I/O interface have been carefully tuned for optimal performance.

Chip Multithreaded (CMT) Processor Design

The CMT processor is designed to deliver many benefits, including the ability to effectively translate the expanded transistor budgets made available by each new generation of semiconductor process technology

into higher levels of throughput performance. This design provides a dramatic overall improvement in system reliability, availability, and serviceability (RAS). The CMT processor design represents a fundamental shift in the way in which SMP systems are built, internalizing much of the communication that formerly occurred between processors to within a chip. The resulting reduction in part count, combined with enhanced processor RAS features, delivers a highly favorable overall impact on system reliability, availability, and serviceability.

Throughput Computing is the underlying strategy of Sun's new family of UltraSPARC processors designed to significantly increase real-world application processing throughput while helping to cut the cost and complexity of network computing. These processors help maximize throughput (the aggregate amount of work done) for network computing workloads by incorporating Chip Multithreaded (CMT) technology. While traditional processors stall waiting for data from the memory, CMT helps ensure that there is useful work being done during otherwise idle cycles, allowing a single processor to execute tens of software threads simultaneously. Essentially, any application that is vertically or horizontally scalable can benefit from CMT. These include real-world applications such as database, Web-based services, transaction processing, application server, data-mining, ERP, CRM, and so on.

Throughput Computing is designed to offer customers significantly improved processing efficiency by allowing applications to be processed much faster. CMT-based systems deliver a variety of savings to customers including lower cost of acquisition as well as dramatically reduced space, power, and maintenance requirements. In addition to lower cost of acquisition, Throughput Computing environments are by definition more reliable because fewer systems are needed and the systems themselves have fewer components. This translates to a lower cost of ownership for our customers, so they are able to focus their IT budgets on building competitive advantage through the deployment of new business services and the enhancement of existing services.

Moore's Law states that the number of transistors in a given area of silicon doubles every two years. In the past, this has also allowed processor performance to double approximately every two years. Unfortunately, memory speeds have only been doubling every six years, creating an ever-increasing gap. As a result, today's processors are stalled as much as 75 percent of the time while they wait for memory to fetch data. With CMT, when a thread must wait for the memory, the processor simply starts processing another thread. By keeping itself busy most of the time, the same area of silicon is getting useful work done more often, leading to a significantly increased application throughput.

Sun is uniquely positioned to deliver the most sophisticated implementations of Throughput Computing:

- Sun's multithreaded SMP-based systems are already providing high throughput solutions for the thread-rich network computing environments today. By bringing this concept down to the chip level, our customers would be able to seamlessly transition to CMT-processor based systems without disrupting their software model.

- A threaded environment requires an operating system capable of handling and scheduling multiple threads. The Solaris Operating System is regarded as one of the leading operating systems in enterprise computing today and has supported multithreaded applications since 1992.

- CMT processors also benefit from lots of memory to support such computational capacity. 64-bit addressability like the UltraSPARC processor offers is a significant benefit over the addressing limitations of a 32 bit processor.

CPU Highlights

- SPARC® V9 architecture

- On-chip Level 2 cache

- Public key encryption support (RSA)

- 48-bit virtual, 40-bit physical address space
- 1.0 GHz frequency on Sun Fire T1000 server

Cache Highlights

- 16-KB primary instruction cache per core
- 8-KB primary data cache per core
- 3-MB unified level 2 cache with ECC

Integration Highlights

- Eight cores, four threads per core
- Two 144-bit DDR2-533 SDRAM interfaces
    - Quad error correct, octal error detect
    - Chipkill ECC
- JBus interface
    - 3.1 GB/sec. peak effective bandwidth
    - 128-bit address/data bus
    - 150 to 200-MHz operation

The UltraSPARC® T1 Processor RAS Features

The UltraSPARC® T1 chip comes with a host of new RAS features built into it, including:

- Extensive ECC on the chip
- Memory Chipkill support
- Memory DRAM sparing/reconfiguration
- Memory address parity protection
- A memory hardware scrubber and an L2 cache scrubber
- Soft error rates and soft error rate detection
- DRAM channel deconfiguration
- Redundancy (cache RAM row/column sparing, core sparing, and eFUSE)

The UltraSPARC T1 multicore processor provides parity protection on its internal cache memories, including tag parity and data parity on the D-cache and I-cache. The internal 3-MB L2 cache has parity protection on the tags and ECC protection on the data.

DIMMs employ error-correcting code (ECC) to help ensure high levels of data integrity. The system reports and logs correctable ECC errors. Such errors are corrected as soon as they are detected.

The Chip Multithreaded (CMT) processor design effectively translates the expanded transistor budgets made available by each new generation of semiconductor process technology into higher levels of throughput performance. This design provides a dramatic overall improvement in system RAS, because the CMT processor design represents a fundamental shift in the way in which SMP systems are built, internalizing much of the communication that formerly occurred between processors to within a chip.

The resulting reduction in part count, combined with enhanced processor RAS features, deliver a highly favorable overall impact on system reliability, availability, and serviceability.

In addition to the RAS benefits of the CMT design approach, the processor implements numerous state-of-the-art RAS features to help ensure a system continues to operate, avoid or shorten downtime, and diagnose and fix a broken system. The UltraSPARC T1 processor's RAS highlights include:

- Protection of on-chip memories
- Main memory reliability and availability
- Power and thermal reliability

CMT System Reliability

When the very high reliability of a UltraSPARC T1 processor is combined with the fact that one CMT processor replaces many processors in an equivalent SMP system, system level reliability can increase dramatically with CMT designs. This effect is already visible in systems based on the first generation of Sun's CMT processors, the UltraSPARC IV processor generation. For the same level of delivered throughput performance, there is less to go wrong in an UltraSPARC IV system than in an UltraSPARC III system, because the former system is built with just half the number of processor boards (and processor chips) as the latter. Assuming the individual components in two different system are similar in terms of their reliability, on average, the system with the fewer parts can be expected to suffer proportionally fewer failures, corresponding to the difference in their respective part counts.

In this generation of processors, where one UltraSPARC T1 processor replaces many processors in an equivalent SMP system, the system level reliability effects will be dramatic. As shown in the figure below, the associated conversion of interchip communication in a traditional SMP system is simplified to intrachip communication in a UltraSPARC T1 system.

The UltraSPARC T1 processor improves throughput while using less power and dissipating less heat than conventional processor designs.
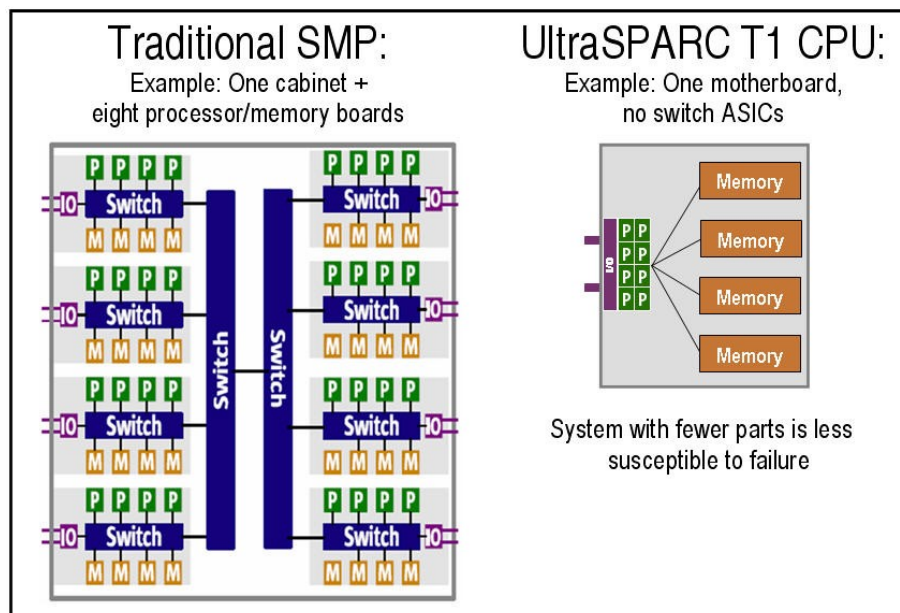
Figure 3. Traditional SMP vs. UltraSPARC T1 CPU design

In Figure 3, the traditional SMP server is housed in a refrigerator-sized cabinet and consists of eight processor/memory boards, each with four processors, memory, and an IO interface. Each board has switch ASICs to connect the on board components, and the cabinet has another set of switch ASICs to connect one group of four boards to the other group of four boards. In contrast, the UltraSPARC T1 system offers a much more integrated and tightly coupled solution than the traditional SMP by shrinking the eight cell boards into a single chip. Without any need for switch ASICs, the whole system now fits on one motherboard, and has many fewer parts and pins to fail. Moreover, maintaining and servicing the boards was reduced from eight boards to one board.

Protection of On-Chip Memories

As semiconductor technology continues to enable increasing chip densities, the processor has become more susceptible to soft error rates. A soft error is a "glitch" in a semiconductor device. These glitches are random, usually not catastrophic, and normally do not destroy the device. Soft errors are caused by charged particles or radiation, and are transient. Many systems can tolerate some level of soft errors. Contemporary CPUs like the UltraSPARC T1 processor, which are manufactured on cutting-edge process technology, are especially prone to these soft errors. With this problem in mind, Sun systematically designed the UltraSPARC T1 processor with the appropriate level of protection of its on-chip memories. In general, the UltraSPARC T1 processor protects memory arrays with either single error correction/double error detection (SEC/DED) or parity protection. Redundant arrays are protected with parity, while non-redundant arrays are protected with Error Correcting Code (ECC).

The table below lists the UltraSPARC T1 processor's on-chip memories and its corresponding protection mechanism.

Memory Array	Protection
Integer Register File	ECC
Floating Point Register File	ECC
L1 Instruction Cache - Data	Parity/retry
L1 Instruction Cache - Tag	Parity/retry
Instruction TLB	Parity/retry
Data TLB	Parity/retry
L1 Data Cache - Data	Parity/retry
L1 Data Cache - Tag	Parity/retry
L2 Cache - Data	ECC
L2 Cache - Tag	ECC
L2 Cache Scrubber	Yes

A notable feature in this schema is the ECC protection of the integer and floating point register files, an extensive level of protection only matched by mainframe-class processors. While processor designs have mainly focused on protecting the datapath, caches, and main memories, the register file has largely been neglected. Since the register file is accessed very frequently, which increases the probability of errors, protecting the register files is critically important. In addition, protecting the register file prevents errors in the register file from quickly spreading to different parts of the system, and prevents an application from crash or silent data corruption.

System Architecture Overview
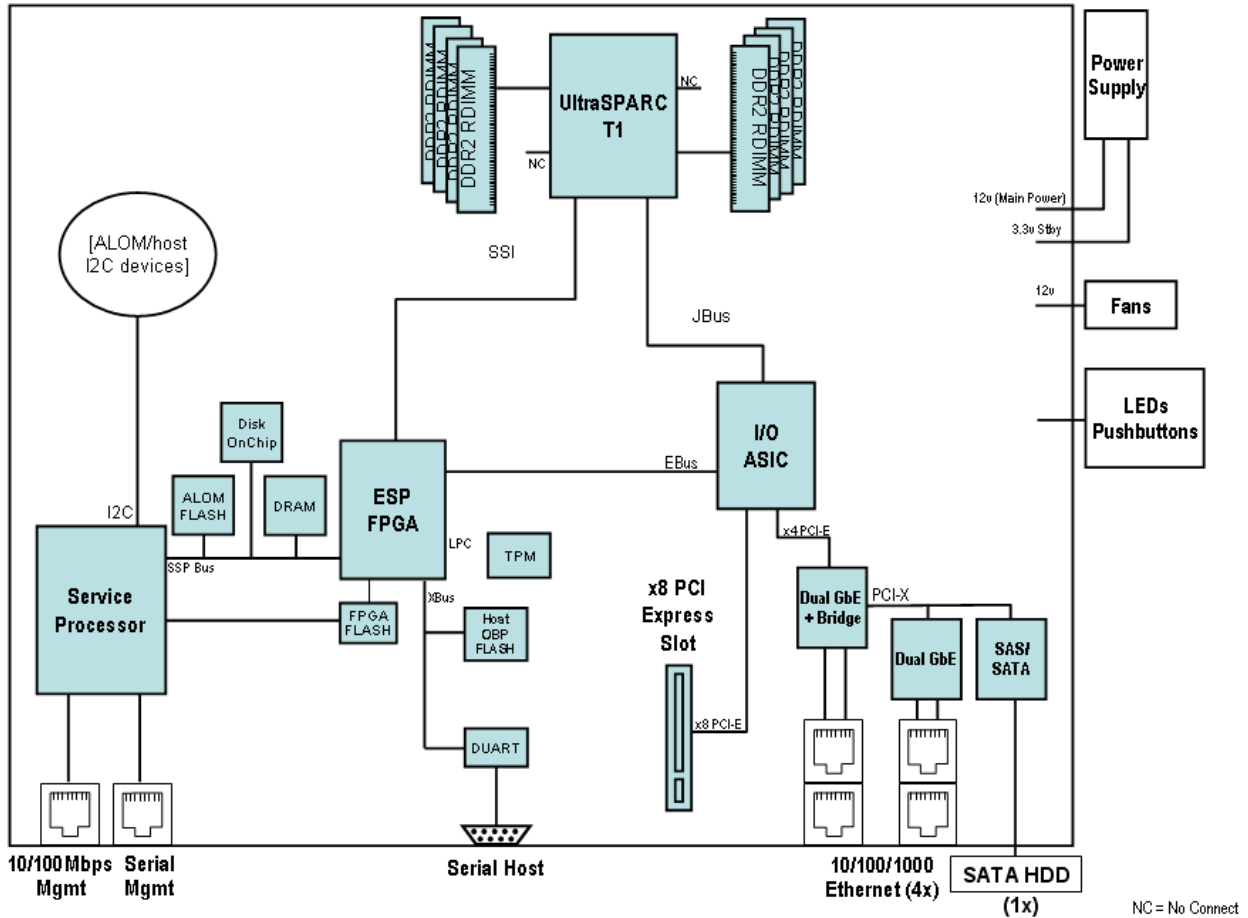
Figure 4. Sun Fire™ T1000 server block diagram

Feature Summary

The Sun Fire T1000 server includes the following features:

Feature	Description
Processor	One UltraSPARC T1 multicore processor (6 or 8 cores)
Memory	Eight slots that may be populated with one of the following types of DDR-2 DIMMS: • 1 GB (8 GB maximum) • 2 GB (16 GB maximum) • 4 GB (32 GB maximum)
Ethernet ports	Four ports, 10/100/1000 Mbs auto-negotiating
Internal hard drive	One SATA, 250-GB, 3.5-inch form factor hard drive or two SAS, 73-GB or 146-GB hard drives
Cooling	Integrated fan tray assembly

Feature	Description
PCI interface	One PCI-Express (PCI-E) slot for low-profile cards (supports 1x, 4x, and 8x width cards)
Power	One 300W power supply unit (PSU)
Remote management	ALOM system controller with a serial and 10/100 Mb Ethernet port
Firmware	OBP for reset and POST support Hypervisor for OS hardware independence ALOMv4 for remote management administration
Cryptography	Hardware-assisted cryptographic acceleration
Operating system	Solaris 10 1/06 Operating System preinstalled

Enclosure

The Sun Fire T1000 enclosure is 1U tall, approximately 19 inches deep by 16.8 inches wide, and fits in a standard 19-inch rack. The chassis consists of a base unit, a removable top cover, and a front bezel.

Contained within the chassis (to the right side, as viewed from the front) is the single hard disk drive and the single power supply. The power supply is justified fully to the rear of the unit, allowing a direct connection to an external power cord. The power supply provides cooling both for itself and the disk drive. In the center of the chassis, justified to the rear of the unit, is the system board. All system I/O connectors are accessible at the rear of the system, as are any I/O connectors on an optional single, horizontally mounted, expansion card. In front of the system board is the system fan assembly, which consists of a sheet metal bracket plus four 40-mm fans. One fan is located to primarily cool the expansion card, while the other three fans cool the system board. All cooling airflow in the system is from front to back. None of the system components are hot-pluggable/hot-swappable; all are serviced from the top of the system, with the top cover removed.

System Board

The Sun Fire T1000 system board contains all of the logic components for the system. This includes the UltraSPARC T1 processor and all DIMMs, the I/O bridge ASIC and the I/O subsystem, and the service processor subsystem. The system board contains the rear-panel I/O connectors for both the host system and the service processor. It also includes a PCI Express expansion card connector. A small vertical riser board is used to interface between the system board connector and an optional horizontally mounted expansion card. Only low-profile PCI Express expansion cards are supported.

Power Supply

The Sun Fire T1000 server includes a single 300W non-redundant AC power supply. To provide for the best (i.e., lowest) possible power rating on the supply and to minimize excess heat generation, high efficiency is a key aspect of the power supply design. The power supply contains its own cooling fan (which is also used to provide cooling for the system's hard disk drive). The power supply operates from a wide-range 100 to 240V AC input.

Memory

Each of the two UltraSPARC T1 DDR2 memory controllers has a 16-byte wide (128 data bits plus 16 ECC check bits) data interface. Two basic memory configurations are supported, with either two or four

DIMMs per controller. All DIMMs must have identical capacity. The Sun Fire T1000 server uses only two of the four UltraSPARC T1 DDR2 memory controllers, with a maximum memory configuration of eight DIMMs. DIMM sizes of 1 GB, 2 GB, and 4 GB are supported. DIMMs must be installed four at a time (with one pair on each controller), yielding only a four-DIMM configuration and an eight-DIMM configuration.

I/O Subsystem

The UltraSPARC T1 processor contains a JBus controller and a I/O ASIC to translate between JBus and an industry standard I/O bus. The I/O ASIC, which performs this function in the Sun Fire T1000 server, contains two PCI Express (PCI-E) root complexes, each providing one PCI-E link, with each link having a maximum port width of eight lanes. The two PCI Express interfaces operate independently of each other and each supports link widths of one, two, four, or eight lanes. The JBus is clocked at 200 MHz. The first PCI-E interface from the I/O ASIC connects directly to the system's PCI-E expansion slot. Full link speed and link width (x8) are supported. The second PCI-E interface connects to an on-board combination PCI-E to PCI-X bridge and Ethernet controller, and is the root of all integrated I/O within the system. The bridge/Ethernet device, and hence this PCI-E link, operates with an x4 link width.

PCI-E Slot

The Sun Fire T1000 server provides one PCI Express slot (PCI-E) for low-profile cards. This slot supports 1x, 4x, and 8x width cards.

Network

The Sun Fire T1000 server includes four 10/100/1000BASE-T auto-negotiating Ethernet ports, implemented with two dual-ported controllers. Each of the four Ethernet RJ45s includes two LEDs:

- A green link indicator, lit when a link is established at any speed

- A yellow activity indicator, which blinks during packet transfers

A fifth 10/100BASE-T port is available on the back panel for a remote management connection (part of the ALOM controller). Use Telnet to connect to ALOM through this Ethernet connection.

Storage

Internal hard drive storage is supported by a serial attached SCSI (SAS)/serial ATA (SATA) controller. The combined SATA/SAS controller allows the Sun Fire T1000 server to provide a low-cost SATA configuration supporting a single SATA hard drive or a reliable dual SAS disk drive configuration.   No internal removable media drive is included or supported. The Sun Fire T1000 server does not include an embedded provision for external storage connectivity. An expansion card is necessary for this purpose.

Front and Rear Panel Features

Figure 5. Front view of server
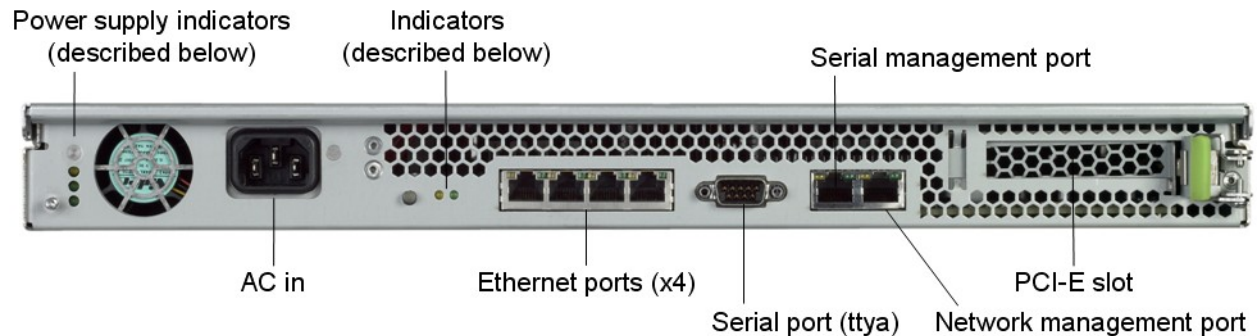
Figure 6. Rear view of server

The following system indicators are located on the front and rear panels:

- Locator (white)

  - OFF = Steady state.

  - FAST BLINK = Indicates to the user "here I am."

- Service Required (yellow)

  - OFF = Steady state, no service action is required.

  - STEADY ON = Service action required, an event(s) has been acknowledged but the problem still needs attention.

- Activity (green) = State of the server

  - OFF = The system is not running in its "normal" operating state. System power may be on or in standby mode. Service processor may be running.

  - STEADY ON = The system is powered on and is running in its normal operating state. No service action is required.

  - STANDBY BLINK = The system is running at a minimum level and is ready to be quickly returned to full function. Service processor will be running.

  - SLOW BLINK = Normal transitory activity is taking place. This could indicate that the system diagnostics are running, or that the system is booting the operating system.

Power supply indicators:

- PSU Fault (amber) = When on, a power supply failure event occurred.

- PSU OK LED (green) = When on, the power supply is running normally.

- AC (green) = When on, AC power is present.

- The minimum cable connections for the Sun Fire T1000 system are as follows:

  - At least one system on-board Ethernet network connection (GBE ports)

  - The system controller serial management port (SERIAL MGT port)

  - The system controller network management port (NET MGT port)

  - AC power cable for the system power supply

- **Advanced Lights Out Manager management ports:** There are two SC management ports for use with the ALOM system controller.

  - The serial management port (labeled SERIAL MGT) uses an RJ-45 cable and is always available. This is the default connection to the ALOM system controller.

  - The network management port (labeled NET MGT) is the optional connection to the ALOM system controller. This port is not available until you have configured network settings for the system controller (through the serial management port). The network management port uses an RJ-45 cable for a 10/100BASE-T connection. This port does not support connections to Gigabit networks.

- **Ethernet ports:** The Sun Fire T1000 server Ethernet interfaces operate at 10 Mbps, 100 Mbps, and 1000 Mbps. The transfer rates for the Ethernet ports are shown in the table below.

Connection Type	IEEE Terminology	Transfer Rate
Ethernet	10BASE-T	10 Mbit/sec.
Fast Ethernet	100BASE-TX	100 Mbits/sec.
Gigabit Ethernet	1000BASE-T	1000 Mbit/sec.

- **TTYA serial port:** Use the Sun Fire T1000 server's DB-9 connector with a null modem cable for serial devices. This port is not connected to the SC serial management port.

- **AC power cables:** Do not attach the power cable to the Sun Fire T1000 power supply until you have finished connecting the data cables, and have connected the server to a serial terminal or a terminal emulator (PC or workstation). The server goes into standby mode and the ALOM system controller initializes as soon as the AC power cables are connected to the power source.

Reliability, Availability, and Serviceability (RAS)

Main Memory Reliability and Availability

The UltraSPARC® T1 processor protects main memory using several mechanisms. Chipkill technology is used to withstand multi-bit memory errors within a DRAM device, including a failure that causes incorrect data on all data bits of the device.

Standard ECC memory is a proven industry-standard technology that has had a considerably positive impact on server reliability. ECC memory is able to detect and correct single bit memory errors, which make up the vast majority of memory errors. However, the increase of memory capacity, the density of memory on a single DIMM, and the increase in speed of the memory subsystem have significantly increased the risks of multi-bit memory errors that cannot be corrected by standard ECC memory and result in the system hanging. To address this issue, designers implemented Chipkill technology to correct multi-bit memory errors, and in doing so, increased system availability considerably.

The UltraSPARC T1 processor's Chipkill mechanism uses Galois Field instead of Hamming in its Chipkill implementation. The Galois Field algorithm provides higher bandwidth than Hamming Chipkill (21.33 vs. 10.66 GB/sec.), which can correct any error contained within a single memory nibble (4 bits), and detects any uncorrectable errors contained within any two nibbles. When writing data to the DIMM, information is appended to the data in the form of a checksum. If a single nibble memory error occurs, then the data is immediately recovered by recalculating the data from the checksum information. This procedure allows the system to correct not only the single bit errors that standard ECC memory can correct but also 2, 3, and 4-bit errors and even a whole DRAM chip failure. To illustrate the effectiveness of Chipkill technology, the table below shows the results of an analysis[1] comparing server outages due to memory failures of parity, ECC, and Chipkill-equipped servers over three years.

Memory Size	Protection	Number of Outages Over 3 years
32 MB	Parity	700 outages per 10,000 servers
1 GB	ECC	900 outages per 10,000 servers
4 GB	Chipkill	6 outages per 10,000 servers

Despite using larger size memories, which increases the likelihood of systems to crash due to a memory error, the Chipkill-equipped server fails at a rate of about two orders of magnitude less than the ECC-protected subsystem.

In conjunction with Chipkill, DRAM sparing is implemented in the UltraSPARC T1 processor to improve main memory availability. Where Chipkill detects a failed DRAM chip, DRAM sparing reconfigures a DRAM channel to map out the failed chip, effectively replacing it with a corrected DRAM chip. This technique restores the capability of correcting any random single-nibble error and allows the system to run with minor impaired memory error protection until the DIMM can be replaced.

Another mechanism implemented in the UltraSPARC T1 processor to help ensure main memory reliability is memory scrubbing. Each of the UltraSPARC T1 processor's four memory controllers has a background error scanner/scrubber to reduce the incidence of multinibble errors. The background checker performs reads of main memory and checks for errors on a single memory line (64 bytes). If a correctable error is found, the error is logged, corrected, and written back to memory. In this manner, any single bit

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[1] From "A Whitepaper on the Benefits of Chipkill-Correct ECC for PC Server Main Memory," Timothy J. Dell, IBM, November 1997, http://www.ibm.com/servers/eserver/ pseries/campaigns/chipkill.pdf

or a group of adjacent bits can be corrected before a soft error impacts the same memory row. This background checker is even programmable on how often it performs an error scan operation.

Environmental Monitoring

The Sun Fire™ T1000 server has an environmental monitoring subsystem designed to protect the server and its component against extreme temperatures, lack of adequate airflow, power supply failures, and hardware faults.

Temperature sensors are located throughout the system to monitor the ambient temperature of the system and internal components. The server's software and hardware help ensure that the temperatures within the enclosure do not exceed safe operational ranges.

All error and warning messages are sent to the system controller system console and are logged in the ALOM console log file. Required LEDs remain lit after an automatic system shutdown occurs, to aid in problem diagnosis.

The power subsystem is monitored in a similar fashion by monitoring the power supply and reporting any fault in the front and rear panel LEDs.

Error Correction and Parity Checking

The UltraSPARC T1 multicore processor provides parity protection on its internal cache memories, including tag parity and data parity on the D-cache and I-cache. The internal 3-MB L2 cache has parity protection on the tags, and ECC protection on the data.

DIMMs employ error-correcting code (ECC) to help ensure high levels of data integrity. The system reports and logs correctable ECC errors. (A correctable ECC error is any single-bit error in a 128-bit field.) Such errors are corrected as soon as they are detected. The ECC implementation also detects double-bit errors in the same 128-bit field and multiple-bit errors in the same nibble (4 bits), and is capable of detecting and correcting errors caused by a failed memory chip.

Fault Management and Predictive Self Healing

The Sun Fire T1000 server features the latest fault management technologies. With the Solaris™ 10 Operating System, Sun introduced a new architecture for building and deploying systems and services capable of predictive self-healing. Self-healing technology allows Sun systems to accurately predict component failures and to mitigate many serious problems before they actually occur. This technology is incorporated into both the hardware and software of the Sun Fire T1000 server.

Predictive Self Healing

Predictive self-healing is an innovative capability in the Solaris 10 OS that automatically diagnoses, isolates, and recovers from many hardware and application faults. As a result, business-critical applications and essential system services can continue uninterrupted in the event of software failures, major hardware component failures, and even software configuration problems.

Solaris Fault Manager: The Solaris Fault Manager facility collects data relating to hardware and software errors. It automatically and silently detects and diagnoses the underlying problem, with an extensible set of agents automatically responding by taking the faulty component offline. Easy-to-understand diagnostic messages link to articles in Sun's Knowledge Base (`http://www.sun.com/msg/`) that clearly guide administrators through corrective tasks that require human intervention. The open design of the Solaris Fault Manager facility also permits administrators

and field personnel to observe the activities of the diagnostic system. With Solaris Fault Manager, the overall time from a fault condition to automated diagnosis to any necessary human intervention is greatly reduced, increasing your application uptime.

Solaris Service Manager: The Solaris Service Manager facility creates a standardized control mechanism for application services by turning them into first-class objects that administrators can observe and manage in a uniform way. These services can then be automatically restarted if they are accidentally terminated by an administrator, if they are aborted as the result of a software programming error, or if they are interrupted by an underlying hardware problem. In addition, the Solaris Service Manager software reduces system boot time by as much as 75 percent by starting services in parallel according to their dependencies. An "undo" feature helps safeguard against human errors by permitting easy change rollback. Solaris Service Manager is also simple to deploy; developers can convert most existing applications to take full advantage of Solaris Service Manager features just by adding a simple XML file to each application.

Specific Sun Fire T1000 Server Capabilities

- **CPU Offline** takes a core offline that has been deemed faulty. "Offlined" CPUs are stored in the resource cache and stay offline on reboot unless the processor has been replaced, in which case the core is cleared from the resource cache. (`/var/fm/fmd/rsrc`)

- **Memory Page Retirement** retires pages of memory that have been marked faulty. Pages are stored in resource cache and stay retired on reboot unless the DIMM has been replaced, in which case affected pages are cleared from the resource cache. (`/var/fm/fmd/rsrc`)

- **IO Retirement** currently logs errors and faults.

- **fmlog** logs faults to `/var/adm/messages*`.

Automatic System Recovery

The system provides for automatic system recovery (ASR) from failures in CPU core/threads, memory modules or PCI card. The ASR functionality allows the system to resume operation after experiencing certain nonfatal hardware faults or failures. When ASR is enabled, the system's firmware diagnostics automatically detect failed hardware components. An auto-configuring capability designed into the system firmware enables the system to unconfigure failed components and to restore system operation. As long as the system is capable of operating without the failed component, the ASR features enable the system to reboot automatically, without operator intervention.

Performance Enhancements

The Sun Fire T1000 server introduces several new technologies with its sun4v architecture and multi-core multithreaded UltraSPARC T1 multicore processor. Some of these enhancements are:

- Large page optimization

- Reduction on TLB misses

- Optimized block copy

Software

Operating System Requirements

The Sun Fire™ T1000 server requires Solaris™ 10 11/06 Operating System or later. The minimum OS that can be used is Solaris 10 1/06, but it is recommended to always use the latest Solaris 10 release.

Software Provided

The following software comes with the Sun Fire T1000 server:

- Solaris 10 Operating System
- SunVTS™ software
- Sun Studio 11
- CoolTuner
- GCC
- SPOT, BIT, ATS

Solaris 10 Operating System

 With the introduction of the Solaris 10 Operating System, Sun provides new functionality to deliver optimal utilization, relentless availability, unparalleled security, and extreme performance for both vertically scaled and horizontally scaled environments. Key features of the Solaris 10 OS include:

- Solaris 10 OS runs on a broad range of SPARC® and x86-based systems and compatibility with existing applications is guaranteed.
- Solaris Containers (formerly N1 Grid Containers) enable as much as a four times increase in system utilization by making it possible to efficiently and securely support thousands of applications per system with no performance hit.
- Predictive self-healing technologies provide new levels of application availability.
- Process rights management enables precise control of system privileges, significantly reducing exposure to system intrusion and limiting unauthorized access to administrative functions, sensitive data, and other critical system elements.
- DTrace provides "always on" rapid evaluation and resolution of system problems and bottlenecks, reducing downtime and yielding dramatic performance improvements.

The Solaris 10 OS has specific features for Throughput Computing. One of the most attractive features of systems based on the UltraSPARC® T1 processor is that they appear as a familiar SMP system to the Solaris OS and the applications it supports. The Solaris 10 OS has incorporated many features to improve application performance on CMT architectures:

- **CMT awareness:** The Solaris 10 OS is aware of the UltraSPARC T1 processor hierarchy so that the scheduler can effectively balance the load across all the available pipelines. Even though it exposes each of the up to 32 individual strands as a logical processor, the Solaris OS understands the correlation between strands and cores.

- **Fine-granularity manageability:** The Solaris 10 OS has the ability to enable or disable individual processors. In the case of the UltraSPARC T1 processor, this ability extends to enabling or disabling individual hardware strands. In addition, standard Solaris OS features such as processor sets provide the ability to define a group of processors (or strands), and schedule processes or LWPs on them.

- **Binding interfaces:** The Solaris OS allows considerable flexibility in that processes and individual LWPs can be bound to either a processor or a processor set, if required or desired.

- **Solaris Containers:** Solaris Containers provide fine-grained partitioning, virtualization, and allocation of resources within a given Solaris instance. For example, the resources of a single UltraSPARC T1 processor can be easily partitioned into multiple containers, with each securely supporting a separate web or application server.

- **The Hypervisor and the sun4v kernel sub-architecture:** The UltraSPARC T1 processor features a new Hypervisor and identifies itself through the Solaris OS as the sun4v kernel subarchitecture. Because the sun4v kernel subarchitecture is new, applications that query for the system details should recognize sun4v as a valid architecture, fully compatible with sun4u.

Compatibility

- **Same OS—Low-End to High-End Systems:** The Solaris OS is built from a single source base and optimized to run on multiple platforms, providing customers with the same best of breed OS on SPARC, Opteron AMD64 64-bit, and x86 32-bit processor-platforms.

- **Solaris Application Guarantee Program:** This program guarantees binary compatibility between versions of Solaris OS on each platform and has been extended to include source code compatibility as well.

- **Linux Compatibility:** With unwavering support for interoperability and open standards, and a commitment to delivering customer choice, Sun has made Linux interoperability a high priority.

  – Hundreds of Linux applications and libraries are included in Solaris OS, including the key Linux libraries Glib, Gtk+, JPEG, PNG, TIFF, and XML2, as well as the GNOME desktop.

  – Linux Compatibility Assurance Toolkit (LinCat) helps to simplify the process of porting Linux applications to run natively on the Solaris OS.Pricing/Support

The Solaris 10 OS is free to end-users upon registration and is available via free download. Media kits are available for purchase. Support is available at an additional charge.

System Management

System Administration

The Sun Fire™ T1000 server comes with a large selection of software to support system management.

ALOM

Sun's advanced lights out manager (ALOM) is a system controller that enables an administrator to remotely manage and administer a Sun™ server.

The ALOM software comes preinstalled on the Sun Fire™ T1000 server. Therefore ALOM works as soon as you install and power on the server. The administrator can then customize ALOM to work with a particular installation.

ALOM enables the administrator to monitor and control a server, either over a network or by using a dedicated serial port for connection to a terminal or terminal server. ALOM provides a command-line interface that an administrator can use to remotely administer geographically distributed or physically inaccessible machines.

In addition, ALOM enables the administrator to run diagnostics remotely (such as power-on self-test), that would otherwise require physical proximity to the server's serial port. The administrator can also configure ALOM to send email alerts of hardware failures, hardware warnings, and other events related to the server or to ALOM.

The ALOM circuitry runs independently of the server, using the server's standby power. Therefore, ALOM firmware and software continue to function when the server operating system goes offline or when the server is powered off.

ALOM monitors many components. The list below shows some of the components that ALOM can monitor on the server.

Component Monitored	What ALOM Reveals
Disk drives	Whether each slot has a drive present, whether it can be removed, and whether it reports OK status
Fans	Whether a fan is present, fan speed, and whether the fans report OK status
CPUs	The temperature measured at the CPU, and any thermal warning or failure conditions
Power supplies	Whether each bay has a power supply present, and whether it reports OK status
System enclosure temperature	System ambient temperature, as well as any enclosure thermal warning or failure conditions
Current	Status of current sensors
Voltages	Status of voltage rails
Server front/rear panel	Status of LEDs

Sun Management Center Software

Sun Management Center software is an element management system for monitoring and managing the Sun environment. It integrates with the leading enterprise management systems to provide customers with a unified management infrastructure. The base package is free and provides hardware monitoring. Advanced applications (add-ons) extend the monitoring capability of the base package, Sun Management Center software provides:

• Agents for managing Solaris™ OS/SPARC®, Solaris x86, and Linux operating systems

• In-depth hardware and software diagnostics

• Aggregate CPU utilization reporting

• Event and alarm management for thousands of attributes

• Corrective action automation through scripts triggered by alarm thresholds

• Secure management controls for remote dynamic reconfiguration

The ability to customize modules with a powerful, easy-to-use GUI

Specifications

Physical Specifications

Description	U.S.	International
Height	1.75 in. (1RU)	4.3 cm (43 mm)
Width	16.7 in.	42.5 cm (425 mm)
Depth	18.4 in.	46.7 cm (467 mm)
Weight - Max. (with slide rails)	24 lb.	10.9 kg

Clearance for Service Access

Description	Specification
Clearance, front of system	36 inches (91 cm)
Clearance, rear of system	36 inches (91 cm)

Environment

Specification	Operating	Non-Operating
Temperature **Sea Level to 3000 ft (900m)**	5°C to 35°C (41°F to 95°F)	-40°C to 70°C (-40°F to 158°F)
Above 3000 ft (900m)	Decrease maximum temperature as altitude increases, 1.6°F/1000 ft (1°C/300m) up to a maximum altitude of 10,000 ft (3,048 m)	
Relative Humidity	10-90%, RH 27°C (81°F) max. wet bulb (non-condensing) IEC 60068-2-56	93%, RH 38°C (100°F), non-condensing, IEC 60068-2-56
Altitude	0- 3,048 meters (0-10,000 feet) IEC 60068-2-13	0 - 12,000 meters (0-40,000 feet) IEC 60068-2-13
Vibration	0.20 Gs, swept sine 5-500 Hz, 1 octave/min, all axes, IEC 60068-2-6	1.0 Gs, swept sine 5-500 Hz, 1 octave/min, all axes, IEC 60068-2-6
Shock	5.0 Gs peak 11 milliseconds, half-sine pulse, IEC 60068-2-27	15 Gs peak 11 milliseconds, half-sine pulse, IEC 60068-2-27

Sun microsystems

Power Source Requirements

Description	Specification
Operating input voltage range	100 to 240 VAC
Operating frequency range	50 to 60 Hz
Maximum operating input current	2.2 A @ 100 to 120 VAC 1.1 A @ 200 to 240 VAC
Typical heat dissipation	614 BTUs/hr.
Maximum heat dissipation	750 BTUs/hr.
Typical operating input power	180W
Maximum operating input power	220W

Acoustic Noise Emissions

Description	Mode	Specification
LwAd (1B = 10 dB)	Operating acoustic noise Idling acoustic noise	7.7 B 7.7 B
LpAm (bystander positions)	Operating acoustic noise Idling acoustic noise	66 dB 66 dB

Compliance

This product meets or exceeds the following requirements.

Category	Relevant Standards
Safety	UL/CSA-60950-1, EN60950-1, IEC60950-1 CB Scheme with all country deviations, IEC825-1, 2, CFR21 part 1040, CNS14336, GB4943
Ergonomics	EK1-ITB-2000
RFI/EMC	EN55022 Class A KSC 5858 Class A 47 CFR 15B Class A GB 9254 Class A ICES-003 Class A EN61000-3-2 VCCI Class A GB 17625.1 AS/NZ 3548 Class A EN61000-3-3 CNS 13438 Class A
Immunity	EN55024 IEC 61000-4-5 IEC 61000-4-2 IEC 61000-4-6 IEC 61000-4-3 IEC 61000-4-8 IEC 61000-4-4 IEC 61000-4-11
Telecommunications	EN 300 386
Regulatory Markings (pending)	CE, FCC, ICES-003, C-tick, VCCI, GOST-R, BSMI, MIC, UL/cUL, UL/S-mark, CCC, UL/DEMKO/GS

![Sun microsystems logo]

Ordering Information

When ordering Sun Fire T1000 servers, hardware configuration choice (number of cores, amount of memory needed) and desired customer support SIU (Spectrum Instant Upgrade) requirements each play a role in selecting suitable standard configuration part numbers.

This document will first walk you through the options available to configure a Sun Fire T1000 server, then service options will be explained in greater detail.

Standard Configurations – Preconfigured Systems

All servers ship with one UltraSPARC® T1 processor with six or eight cores. The processors in the Sun Fire T1000 run at 1.0 GHz with a 3-MB L2 cache. The model type of the server determines the number of processor cores. Each processor core has four threads.

All Sun Fire T1000 server configurations come with these features:

- One power supply
- Four 10/100/1000 Mb/sec. Ethernet ports
- One serial port
- Category F

- One PCI-E slot
- RoHS compliant
- Advanced lights out management (ALOM)
- Four-post rackmount kit with cable management arm

Part Number	Description
T10Z106A-08GE1J	Sun Fire T1000 Server, 6 core, 1.0GHz UltraSPARC T1 processor, 8GB DDR2 memory (8 * 1GB DIMMs), 250GB 3.5" 7.2K rpm SATA hard disk drive, 1 power supply, 4 10/100/1000 Mb/s Etherent ports, 1 serial port, 1 PCI-E slot, Solaris 10 pre-installed, RoHS-5 compliant. (Standard Configuration)
T10Z108A-08GA2G	Sun Fire T1000 Server, 8 core, 1.0GHz UltraSPARC T1 processor, 8GB DDR2 memory (8 * 1GB DIMMs), 2 * 73GB 2.5" 10K rpm SAS hard disk drive, 1 power supply, 4 - 10/100/1000 Mb/s Etherent ports, 1 serial port, 1 PCI-E slot, Solaris 10 pre-installed, RoHS-5 compliant. (Standard Configuration)
T10Z108A-16GA2G	Sun Fire T1000 Server, 8 core, 1.0GHz UltraSPARC T1 processor, 16GB DDR2 memory (8 * 2GB DIMMs), 2 * 73GB 2.5" 10K rpm SAS hard disk drive, 1 power supply, 4 - 10/100/1000 Mb/s Etherent ports, 1 serial port, 1 PCI-E slot, Solaris 10 pre-installed, RoHS-5 compliant. (Standard Configuration)

Power Cord Kits

The Sun Fire T1000 server comes standard with one power supply. A no-charge power cord kit option must be ordered for each power supply. Available power cord kits include the following:

Part Number	Description
X311L	AC Power Cord U.S./Asia AC Power Cord U.S./Asia
X312E	AC Power Cord China
X312F	AC Power Cord Argentina
X312G	AC Power Cord Korea
X312L	AC Power Cord Continental Europe
X314L	AC Power Cord Switzerland
X317L	AC Power Cord U.K
X332T	AC Power Cord INTL
X333A-25-10-IL	AC Power Cord Israel
X333A-25-15-JP	AC Power Cord, Japan, 2.5m, PSE 5-15
X333F-25-15-JP	AC Power Cord, Japan, 2.5m, PSE 6-15
X340L	AC Power Cord N.A./Asia
X384L	AC Power Cord Italy
X383L	AC Power Cord Denmark
X386L	AC Power Cord Australia
X9237-1-A	AC Power Cord Jumper, 1.0m
X9238-1-A	AC Power Cord Jumper, 2.5m

Assemble-to-Order Configurations (ATO)

Assemble-to-Order (ATO) configurations are not available. The listed configurations and upgrades greatly reduce the need for custom configurations.

Options

The following additional options are supported by the Sun Fire™ T1000 server.

Options that include an (X) in the part number indicate that the part can be ordered as a field-installable part.

Part Number	Option Description	Max#	Comments
Internal Storage Devices			
XRA-ST1CG-80G7K	80-GB, 7200-rpm, 3.5-inch serial ATA disk drive with bracket and cable	1	The T1000 can accommodate a single 80GB (or 160GB) SATA disk. EOL 4/3/07
XRA-ST1CG-160G7K	160GB 7200 RPM 3.5" Serial ATA Disk Drive with bracket.	1	The T1000 can accommodate a single 80GB (or 160GB) SATA disk. EOL Ocotber 2008
XRA-SS2CG-73G10KZ	Two 73-GB, 10K-rpm, 2.5-inch SAS disk drives with bracket and cable	1	The T1000 can accomodate either a single SATA disk or two SAS disks. Use this part to upgrade systems from SATA to SAS.
XRA-SS2CG-146G10KZ	Two 146GB 10K RPM 2.5" SAS HDD with bracket and cable	1	The T1000 can accomodate either a single SATA disk or two SAS disks. Use this part to upgrade systems from SATA to SAS.
Memory			
(X)7801A	2-GB memory expansion kit(2 x 1 GB)	4	Select additional memory if desired and able to accommodate. The T1000 supports a maximum memory config of 32 GBs (comprised of eight DIMMs). DIMMs must be same size and installed 4 at a time (one pair per controller). Adding memory to any base configuration – except the entry configuration - will require removing DIMMs.
(X)7802A	4-GB memory expansion kit(2 x 2 GB)	4	
(X)7803A	8-GB memory expansion kit(2 x 4GB)		
PCI-E Cards: Networking Interfaces			
(X)7280A-2	Dual port GigE UTP low-profile. RoHS-6 compliant	1	
(X)7281A-2	Dual port GigE MMF low-profile. RoHS-6 compliant	1	
(X)1027A-Z	Sun PCI-E Dual 10 GigE Fiber XFP Low profile Adapter. Requires fiber transceiver. RoHS-6 compliant Card	1	Requires X5558A or X5560A-Z
(X)4447A-Z	Sun x8 PCI express Quad Gigabit Ethernet UTP low profile adapter, LP bracket on board, Std bracket included, RoHS-6 compliant. The card is developed by Sun	1	
PCI-E Cards: Storage Host Bus Adapters (HBAs)			
SG-(X)PCIE1FC-QF4	Single Port PCI-E 4Gb FC HBA. RoHs-6 compliant	1	

Part Number	Option Description	Max#	Comments
SG-(X)PCIE2FC-QF4	Dual Port PCI-E 4Gb FC HBA. RoHs-6 compliant	1	
SG-(X)PCIE1FC-EM4	Single Port PCI-E 4Gb FC HBA. RoHs-6 compliant	1	
SG-(X)PCIE2FC-EM4	Dual Port PCI-E 4Gb FC HBA. RoHs-6 compliant	1	
SG-(X)PCIE2SCSIU320Z	RoHS 6 Compliant Sun StorageTek PCI Express x4 Dual Channel Ultra320 SCSI HBA	1	
Crypto Accelerator Adapter (X)6000A	SSL/IPsec Accelerator with keystroke and FIPs Support. PCI-E card. Low Profile. RoHS-6 compliant	1	Due to export controls, this product comes with IPsec Acceleration disabled. In order for a customer to deploy IPsec acceleration, they need to also purchase part (X)6099A for approx. $35.00 USD. This CD with the necessary drivers is sold through Sun Export. Since the T1000 does not have CD Rom drive, these drivers would need to be loaded across a network.
Racks SR900-36N SR900-38 SR1000-38 SR1000-42 SG-XARY030A	Sun Rack 900 - 36N (alloy) Sun Rack 900 - 38 (alloy) Sun Rack 1000 - 38 (alloy) Sun Rack 1000 - 42 (alloy) Sun StorEdge 72-inch expansion cabinet Sun Fire cabinet		EOL 1/10/06
External Storage Devices	Sun StorageTek 3511 Array Sun StorageTek 3510 Array Sun StorageTek 6120 Array Sun StorageTek 6130 Array Sun StorageTek 6140 Array Sun StorageTek 6540 Array Sun StorageTek 6920 System Sun StorageTek 9990 Array Sun StorageTek 9980 Array Sun StorageTek 9985 Array Sun StorageTek 9910 Array Sun StorageTek 9960 Array Sun StorageTek 9970 Array		These storage devices have been tested and certified to work with the Sun Fire T1000. When deciding on storage, attention should be paid to the fact that not every device listed below can be directly attached to the T1000 given IO card options for the system (no SCSI or quad port cards available currently).
External Tape Devices	Sun StorageTek C4 Tape Library Sun StorageTek DAT 72 tape drive *tested with Rhea Card		External tape libraries were tested using the Summit SG-(X)PCIE2FC-QF4 card via Brocade 3850 SAN

Part Number	Option Description	Max#	Comments
	Sun StorageTek L25 Tape Library Sun StorageTek L180 Tape Library Sun StorageTek L500 Tape Library		switch (WWW switch zoning). The specific test configuration used is depicted in the picture below this table.

Part Number	Option Description	Max#	Comments
Switches			
	Brocade 48000 Director Brocade Mi10K Director Brocade 200E Switch Brocade M4700 Switch Brocade M4400 Switch QLogic SANbox 5600 QLogic SANbox 5602		

Upgrades

Upgrade Paths

Under the Sun™ Upgrade Advantage Program (UAP) customers receive trade-in value for qualified Sun and non-Sun systems towards the purchase of new Sun Fire™ T1000 servers. Whether consolidating many servers to one, or trading in one system, Sun UAP offers the flexibility of options to receive trade-in credit towards the new system purchase.

For more information regarding Sun UAP, refer to the following sites, or contact your Sun Sales Representative.

Go to `http://sun.com/ibb/upgrades` for more information.

Sun Upgrade Allowance Program (Sun UAP)

Through the Sun Upgrade Allowance Program, Sun offers customers a simple, flexible, and easy-to-understand way of ordering desktop workstation upgrades. The Sun UAP program uses a percentage-based upgrades model. This model simplifies the upgrades process by providing a trade-in value as a percentage allowance. This percentage allowance can then be applied to the list price of a regular Sun system configuration.

Under the Sun UAP program, allowance codes or part numbers are used and the percentage allowance is built into this part number (see below).

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

Allowance Code Numbering Scheme

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

Allowance code = ALW-05-S-J-T10

- **ALW** = Upgrade identifier (All allowance codes start with ALW.)

- **05** = Allowance percentage – Percentage is applied to the list price of a standard marketing part number. "05" means 5 percent off of list price, "08" means 8 percent off of list price, and so on.

   (Note: Any other discounts such as volume discounts should also be taken off the list price and not the net of the above.)

- **S** = Desktop upgrades, S for server upgrades, and D for storage upgrades.

- **J** = Indicates the residue group—a way of grouping system in the Sun installed base. The letters A through X are reserved for Sun systems. The letter Z is used for competitive systems.

- **T10** = Identifies the product family that the customer is purchasing.

How to Determine the Right Allowance Code

Scenario: My customer has a Sun Fire V120 server and would like to upgrade to a Sun Fire T1000 server. What allowance part number should I select?

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

2. The correct allowance part number appears in the right column. The correct number for the Sun Fire V210 server is **ALW-05-S-J-T10**. This part number is applied to the list price of the standard marketing part number. In this case it is a 5% allowance for the old Sun Fire V120 server.

Entry Level Server Upgrade and Allowance Matrix

FROM:	UPGRADE TO: Sun Fire T1000 Server
Sun Fire V100, V120, Netra 120 **Sun Enterprise™ 250, 220R** **Netra™ 1120, 1125**	**ALW-05-S-J-T10**
Sun Fire V210, V240, V250 **Sun Enterprise 450, 420R, V440, XX00**	**ALW-10-S-J-T10**
3 to 5-year old competitive systems	**ALW-05-S-Z-T10**
Less than 3 year old non-Sun systems	**ALW-10-S-Z-T10**

Service and Support

Warranty - Basic Configurations

The Sun Fire™ T1000 server features a 1 year warranty providing a next business day response time with replacement parts delivered on-site or via parts exchange as applicable for all components designated as Customer Replaceable Units (CRUs).

- Duration: 1 year
- HW coverage hours: Business hours
- HW response times: Next business day
- Delivery Method: Parts exchange for customer replaceable units or onsite
- HW phone coverage: Business hours
- HW phone response time: 8 hours
- Operating system support: Media kit replacement only

Sun Global Customer Services offers a full range of services to assist customers who deploy the Sun Fire T1000 and Sun Fire T2000 servers. Whether it is architecture services, implementation services, or services to help customers manage the servers once released to production, Sun has the right services during every phase of the project's life cycle.

Sun provides a service plan to meet every customers needs: the SunSpectrum℠ Service Plan for full system support ranging from basic to mission critical service levels and the Sun Software Service Plan.

- **SunSpectrum Service Plans:** Get integrated hardware and software support.

- **Sun Software Service Plans:** For fundamental software services such as technical phone or web-based support and software maintenance (updates and upgrades), Sun offers two levels of service for production system software.

Why the Warranty Is Not Enough

While computer system warranties provide business customers with some assurance of product quality, they do not provide many essential system services or operating system support. In addition, warranties provide default repair times and coverage hours which may not suit customer needs. A warranty and a Service Plan are two very different things with two very different objectives. Break/fix is no way to live —make sure your customers have Service Plan coverage on all their active Sun systems. For more information, go to `http://www.sun.com/comparewarranty`.

SunSpectrum Service Plans

SunSpectrum Service Plans provide integrated hardware and Solaris operating system support for Sun systems as well as comprehensive storage system support. For each Sun system, customers can choose the service plan that best fits their needs. Customers benefit from lower SunSpectrum Instant Upgrade (SIU) pricing when purchasing support at time of system sale.

More information is available at `http://www.sun.com/service/support/sunspectrum.`.

SunSpectrum Service plan highlights include:

- Integrated whole-system support
- All the essentials for one great price
- Priority service
- No "per incident" limits
- Includes Solaris OS releases and updates
- Resources for proactive system management
- A choice of four simple plans
- Proven return on investment [2]

Warranty Upgrade to SunSpectrum Service

The following table includes the part numbers and descriptions for the warranty upgrades to SunSpectrum Service for the Sun Fire T1000 servers.

Part Number	Description
Eight Core Server Upgrades	
W9D-T1000-8-1P	1-year upgrade to SunSpectrum Platinum℠ plan for Sun Fire T1000 8-core server
W9D-T1000-8-24-1G	1-year upgrade to SunSpectrum Gold℠ plan 24x7 for Sun Fire T1000 8-core server
W9D-T1000-8-1G	1-year upgrade to SunSpectrum Gold for Sun Fire T1000 8-core server
W9D-T1000-8-1S	1-year upgrade to SunSpectrum Silver℠ plan for Sun Fire T1000 8-core server
W9D-T1000-8-2P	2-year upgrade to SunSpectrum Platinum for Sun Fire T1000 8-core server
W9D-T1000-8-24-2G	2-year upgrade to SunSpectrum Gold-24x7 for Sun Fire T1000 8-core server
W9D-T1000-8-2G	2-year upgrade to SunSpectrum Gold for Sun Fire T1000 8-core server
W9D-T1000-8-2S	2-year upgrade to SunSpectrum Silver for Sun Fire T1000 8-core server
W9D-T1000-8-3P	3-year upgrade to SunSpectrum Platinum for Sun Fire T1000 8-core server
W9D-T1000-8-24-3G	3-year upgrade to SunSpectrum Gold-24x7 for Sun Fire T1000 8-core server
W9D-T1000-8-3G	3-year upgrade to SunSpectrum Gold for Sun Fire T1000 8-core server
W9D-T1000-8-3S	3-year upgrade to SunSpectrum Silver for Sun Fire T1000 8-core server
Six Core Server Upgrades	
W9D-T1000-6-1P	1-year upgrade to SunSpectrum Platinum for Sun Fire T1000 6-core server
W9D-T1000-6-24-1G	1-year upgrade to SunSpectrum Gold-24x7 for Sun Fire T1000 6-core server
W9D-T1000-6-1G	1-year upgrade to SunSpectrum Gold for Sun Fire T1000 6-core server
W9D-T1000-6-1S	1-year upgrade to SunSpectrum Silver for Sun Fire T1000 6-core server
W9D-T1000-6-2P	2-year upgrade to SunSpectrum Platinum for Sun Fire T1000 6-core server
W9D-T1000-6-24-2G	2-year upgrade to SunSpectrum Gold-24x7 for Sun Fire T1000 6-core server
W9D-T1000-6-2G	2-year upgrade to SunSpectrum Gold for Sun Fire T1000 6-core server
W9D-T1000-6-2S	2-year upgrade to SunSpectrum Silver for Sun Fire T1000 6-core server

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[2] Based on Total Economic Impact Study by Forrester Research. This study is available at:
`sun.com/service/support/sunspectrum`

Part Number	Description
W9D-T1000-6-3P	3-year upgrade to SunSpectrum Platinum for Sun Fire T1000 6-core server
W9D-T1000-6-24-3G	3-year upgrade to SunSpectrum Gold-24x7 for Sun Fire T1000 6-core server
W9D-T1000-6-3G	3-year upgrade to SunSpectrum Gold for Sun Fire T1000 6-core server
W9D-T1000-6-3S	3-year upgrade to SunSpectrum Silver for Sun Fire T1000 6-core server

Sun Software Support Services

Sun Software Standard Support

The Sun Software Standard Support offering provides customers with a comprehensive support plan. Features include:

- Extended local business hours (12 hour) for telephone and online support (5x12)

- Four business hour response on Priority 1 (Urgent) requests

- Two authorized contacts

- Online incident submission and tracking

- Software updates and patches

- Access to online self-solve resources

Sun Software Premium Support

The Sun Software Premium Support offering is designed for critical environments where high availability is a priority and round-the-clock support is a customer requirement. In addition to all of the features of the Standard support level, this level of service offers:

- 24x7 coverage with live call transfer for Priority 1 (Urgent) requests

- Sun Vendor Integration Program (Sun VIP℠ Program)

- Three authorized contacts per 8-hour shift

Optional Services

Both the Standard and Premium offerings give customers the option to purchase the following to enhance their service plans:

- Dedicated or Assigned Service Account Manager (SAM)

- Dedicated Technical Support Engineer (TSE)

- Additional authorized contacts

Post Warranty Support for Sun Fire T1000 Servers

The following services are available for post warranty support:

- SunSpectrum Platinum program

- SunSpectrum Gold program 24x7 Onsite
- SunSpectrum Gold program
- SunSpectrum Silver program
- SunSpectrum Bronze℠ program

Installation Service for Sun Fire T1000 Servers

Sun's exceptional support for server installation is also available for the Sun Fire T1000 server. This service can be purchased at the time of the server sale. Use the following part numbers to order the installation service.

Part Number	Description
EIS-WGS-E	Install Workgroup Server
ESI-WGS-E-AH	Install Workgroup Server-AH
EIS-WGS-5-E	Install 5 Workgroup Servers
ESI-WGS-5-E-AH	Install 5 Workgroup Servers-AH
EIS-WGS-10-E	Install 10 Workgroup Servers
ESI-WGS-10-E-AH	Install 10 Workgroup Servers-AH

For additional information about the server installation service see:

`http://www.sun.com/service/support/install/entrylevel-server.html`

The Online Support Center

The Online Support Center (OSC) provides Web-based solutions anytime, anywhere. Providing high-quality availability services has always been a top priority at Sun. As a pioneer in Web-based customer solutions, Sun continues to utilize the power and versatility of the Internet to offer customers a broad variety of online service offerings.

The online answer/transaction process can save customers valuable time by eliminating the time spent waiting on the phone for a customer service representative. The Online Support Center empowers the user by offering anywhere, anytime access to Web-based support, training, and consulting solutions for Sun hardware and software products. The site serves as a portal for proactive service offerings, systems support features, and resource links.

For more information on the above support offerings, visit:
`http://www.sun.com/service/support`

Education and Learning Services

A number of courses are available for learning more about the Sun Fire T1000 server, as listed below:

For customer audiences there are two options:

1. An additional component for the PK-VC-ES-5088. The Sun Fire T1000 Server training includes:
   - WET-5354 - Sun Fire T1000 Server Administration
   - WGS-PREX-5354 - Sun Fire T1000 Server Administration Assessment

2. A separate offering - WEB-5354 Sun Fire T1000 Server Administration Web Course Bundle includes:
   - WET-5354 - Sun Fire T1000 Server Administration
   - WGS-PREX-5354 - Sun Fire T1000 Server Administration Assessment

For internal Sun Services and Service Partners, WZB-SSG-5354 Sun Fire T1000 Server Administration which includes:
   - WZT-SSG-5354 - Sun Fire T1000 Server Administration
   - WXI-SSG-5354 - Sun Fire T1000 Server Administration Assessment

Solaris Operating System Courseware and Certification

Sun offers flexible training options for the Solaris Operating System ranging from individual courses to certifications. Sun provides students with the knowledge to successfully install, manage, and troubleshoot the Solaris Operating System.

Sun Server Skills Package

SunSkills™ program packages are prepackaged training solutions which contain the recommended courseware that will deliver the skills needed to effectively manage and optimize the customer's Sun Fire T1000 servers in their computing environment. When a skills package order is received, an education manager contacts the customer to develop a tailored training program. Contact a local Sun Education representative for details on availability and pricing of these learning solutions.

Security Courseware

To help ensure the data stored on a Sun server is implemented and maintained in a secure environment, Sun training helps enterprises understand how to develop and implement solid security strategies to protect their critical data. Sun's security courses listed below teach corporations how to deploy and manage Sun security products for maximum protection of the massive amounts of corporate data which will reside on their Sun server system.

Education Consulting Services

Education Consulting Services allows customers to make the most out of training and provide optimal return on total IT investment by assessing requirements, delivering solutions, and measuring results. And, customers can bridge the gap between training and organizational goals by aligning IT structure, people, and skills with business objectives. Sun's Education Consulting Services help companies change the way learning takes place by creating custom training solutions that allow people to develop the right skills at the right time.

For more information on training and the above courseware, visit `http://www.suned.sun.com`.

Professional Services

Available services direct from Sun will help customers monitor and manage their Sun Fire T1000 system hardware and OS up through their key business applications. Sun Managed Operations Service is an alternative to outsourcing which keeps customers in control and adds efficiency, not bodies, to their IT operations. Learn more at `http://sun.com/service/mgdopservices/index.html`.

Through Sun Environmental Services, Sun can also assist customers in taking full advantage of the dramatic space and environmental advantages that this new system can bring to their data center.

If the customer has a unique design problem, there is an opportunity to sell a Sun PS architectural workshop service to the customer. Additionally, Sun PS can provide the following services:

- Network Identity

- Security Services

- Identity Management Services

- Java Enterprise System Implementation Services

Glossary

Chipkill
A technology developed by IBM for situations that high availability. It allows a system (usually CPU or motherboard) to detect problems with the computer's memory and selectively disable the problematic DIMMs.

CMT
Chip Multithreaded. A ground-breaking technology that speeds processing by dedicating silicon and threads to network tasks. Compute, packet processing, and switching tasks run concurrently, not sequentially as in single threaded systems, resulting in dramatic increases in performance and system utilization.

FC-AL
Fibre Channel Arbitrated Loop. A loop topology used with Fibre Channel.

PCI-E
Peripheral Component Interconnect Express. Formerly known as third-generation IO, this implementation of the PCI computer bus that uses existing PCI programming concepts and communication standards, but bases it on a much faster serial communications system.

SAS
Serial Attached SCSI. The successor to the original SCSI technology with the ability to address up to 16,256 devices per port. It also has a more reliable point-to-point serial connection at speeds of up to 3 Gbps.

SATA
Serial ATA. Extends the ATA technology by delivering disk interconnect speeds starting at 1.5 Gbps. It also has a lower cost per GB.

Materials Abstract

All materials will be available on SunWIN except where noted otherwise.

Collateral	Description	Purpose	Distribution	Token # or COMAC Order #
Product Literature				
– *Sun Fire™ T1000 Server, Just the Facts*	Reference Guide (this document)	Training Sales Tool	SunWIN, Reseller Web	456966
– *Sun Fire Servers with CoolThreads Technology Customer Presentation (including technical content)*	Customer Presentation with Notes	Sales Tool	SunWIN, Reseller Web	456808
– *SWaP Datasheet*	Data Sheet	Sales Tool	SunWIN	457127
– *Sun Fire Servers with CoolThreads Technology Pocket Facts*	Pocket Facts	Sales Tool	SunWIN	456807
References				
– *Sun Intro*	E-mail Introduction	Sales Tool	SunWIN, Reseller Web, E-mail	456867
– *Data Sheet*	Data Sheet	Sales Tool	SunWIN, Reseller Web, COMAC	456806
– *Developing Scalable Applications for the UltraSPARC T1 Processor: Reaping the Benefits of Chip Multithreading (CMT) Technology*	White Paper	Sales Tool	SunWIN	456815
– *Throughput Computing Changing the Economics of the Datacenter with Revolutionary SPARC® Technology*	White Paper	Sales Tool	SunWIN	457125
– *CMT Platform*	White Paper	Sales Tool	SunWIN	456814
External Web Sites				
– *General information on the Sun Fire T1000 server*	http://www.sun.com/Servers/CoolThreads/SunFireT1000			
– *IBB*	http://www.sun.com/ibb/			
– *Customer Ready Services*	http://www.sun.com/crs			