

Sun Fire™ V440 Server Architecture

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Introduction

Growing demand for horizontally scalable and available services coupled with modern economic realities are re-shaping the design of the multi-tiered data center. Customers desire products and solutions that reduce their overall cost and complexity by combining low price, better price/performance, improved environmental requirements, system manageability, and increased availability. Today's challenging economic climate means that successful organizations must look at initial system acquisition costs as well as total cost of ownership (TCO) and investment protection to make sure their decisions make long-term business sense.

Many organizations have realized that filling racks with inexpensive horizontally scalable servers is only part of the solution. The administrative costs of dealing with hundreds or thousands of systems, managing software, and enforcing security can quickly drive TCO upward. In addition, systems can become unavailable for a variety of reasons ranging from hardware failure to security issues or a lack of individual system performance and scalability. Systems that aren't available are the most expensive of all, causing lost productivity, broken service-level agreements, and customer dissatisfaction.

Sun understands that low- and high-end entry servers must meet customer requirements in terms of price/performance, reliability, security, availability, and manageability. As a result, the Sun Fire™ V440 server is designed to be affordable while reducing data center cost and complexity. Running the proven Solaris™ Operating System and compatible with the rest of Sun's high-performance family of UltraSPARC® servers, these systems provide the price/performance, manageability, availability, and expandability features to help organizations anticipate rapidly changing situations. With up to four processors, aggressive price points, low power and cooling requirements, and new availability and management features, Sun Fire V440 servers can address the increasing requirements for low-cost network computing solutions in a compact, rack-mount enclosure.

This document describes the system architecture of the Sun Fire V440 server along with key software components for remote management, resource management, and services that promote available application delivery in the data center.

The Sun Fire V440 Server — Exceptional Price/Performance in a Compact Footprint

The Sun Fire V440 server is the latest member of Sun's powerful line of servers for enterprise network computing based on the UltraSPARC IIIi processor technology. This next-generation volume server brings multiprocessing power, Ultra320 SCSI disk drives, and the industry-standard Peripheral Component Interconnect (PCI) I/O bus to a rack optimized 4RU (rack unit) design. In addition, the Sun Fire V440 server delivers outstanding value, while at the same time preserving 100-percent SPARC®/Solaris binary compatibility with application software.

Pictured in Figure 1-1, the Sun Fire V440 server can be configured with two to four processors running Solaris 8 HW 07/03 or later. Processors run at 1.062 GHz or 1.28 GHz, using industry-standard DDR1 memory DIMMs added in pairs. Each of the four CPU modules in a V440 system support up to 4 DIMMs. The V440 will support 512-MB and 1-GB DIMMs, for a total system memory capacity of 16 GB. The Sun Fire V440 server also supports four internal, 36-GB or 73-GB Ultra320 SCSI hard drives, and six PCI slots connected to three high-performance PCI I/O buses. The Sun Fire V440 server is designed to satisfy any application or enterprise where compute density at an affordable price is a high priority.

Figure 1-1: Sun Fire V440 server



Product Family Placement

The Sun Fire V440 server is a four-way member of the Volume Server Product family, bridging the scalability path between the low-cost, high-performance two-way Sun Fire V210/V240 and the eight-way Sun Fire V880. The Sun Fire V210 and V240 servers are entry data center-class servers with high availability and expandability features. Featuring up to two UltraSPARC IIIi processors, four built-in Gigabit Ethernet ports, pre-installed software, a system configuration card, advanced remote management, and an optional integrated SSL card; the Sun Fire V210 and V240 servers provide exceptional compute density, network performance, and Sun™ ONE software at affordable prices. The Sun Fire V880 is a rack-mountable tower that is the high-end workgroup server. This versatile, high-performance and reliable server provides a growth path for today's E450 and E3500 customers who require more application scalability, higher performance, and built-in availability and reliability components.

All of these systems have several things in common, including:

- The UltraSPARC processor family with 100-percent binary compatibility from the low end to the high end
- Scalable from the low-end uniprocessor systems to the 106-way Sun Fire 15K server
- Modular, easily replaceable components

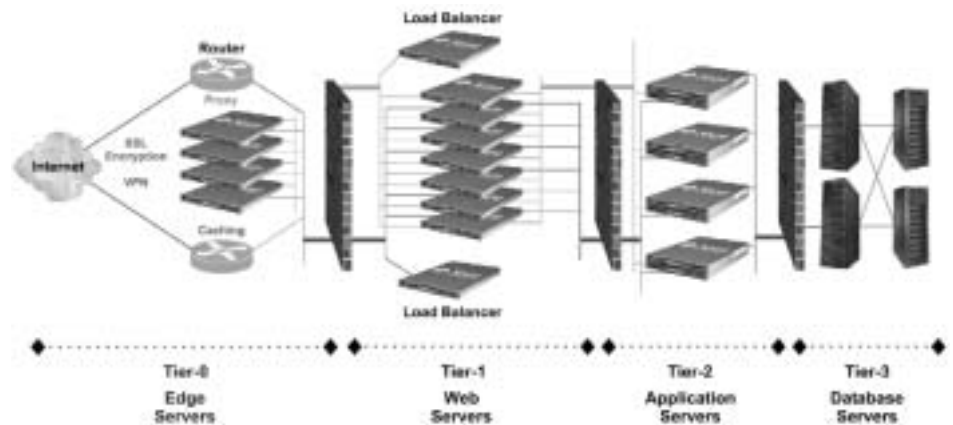
Features	Sun Fire V240	Sun Fire V440	Sun Fire V880
Rack or tower	Rack	Rack	Tower (rack optional)
Number of processors	1-2	2-4	2, 4, 6, or 8
CPU type	UltraSPARC IIIi	UltraSPARC IIIi	UltraSPARC III
CPU speed	1.06/1.28 GHz	1.06/1.28 GHz	900 MHz/1.05 GHz
Level 2 cache	1 MB internal cache	1 MB internal cache	8 MB external cache
Minimum/maximum memory	512 MB/8 GB	4 GB/16 GB	1024 MB/64 GB
O/S	Solaris 8/9	Solaris 8	Solaris 8/9
PCI slots	3 (1 x 66 MHz/64 bits, 2 x 33 MHz/64 bits)	6 (3 x 66 MHz/64 bits, 3 x 33/66 MHz/64 bits)	8 (1 x 66 MHz/64 bits, 7 x 33 MHz/64 bits)
Network connections	4 x built-in 10/100/1000 BaseT Ethernet ports	2 x built-in 10/100/1000 BaseT Ethernet ports	1 x built-in 10/100/1000 Fiber Ethernet port
I/O connections	1 x serial, 2 x USB, 1 x LVD 160 SCSI	2 x serial, 4 x USB, 1 x Ultra320 SCSI	2 x serial, 2 x USB, 1 x 10/100MB/s, 1 x GbE, 1 x FC-AL
Number of disks and type	4 x Ultra160 SCSI 36 GB/73 GB	4 x Ultra320 SCSI 36 GB/73 GB	12 x FC-AL 36 GB/73 GB
Remote management	ALOM (standard), 1 x 10 Mb/s Ethernet, 1 x RJ45 Serial	ALOM (standard), 1 x 10 Mb/s Ethernet, 1 x RJ45 Serial	RSC, 1 x 10 Mb/s Ethernet, 1 x RJ45 Serial, 1 x RJ45 Modem
System Configuration Card	Yes	Yes	N/A
Power supplies	2 (redundant 1+1)	2 (redundant 1+1)	3 (redundant N+1)
Height/depth	2U/24 in.	4U/25 in.	17U/32.9 in.
Maximum power	470 W	650 W	2880 W
Heat dissipation	1603 BTU/hr.	2218 BTU/hr.	9829 BTU/hr.
Additional features	Optional Integrated SSL card option, DVD-ROM	DVD-ROM	Optional DDS-3/DDS-4 DAT and DVD-ROM
Weight	26 kg (57.3 lb.)	37 kg (82 lb.)	130.9 kg (288 lb.)

Table 1-1: Sun Fire V440—feature comparison with Sun Fire V240 and Sun Fire V880

Multi-tiered Data Center Architectures

Like all Sun servers, the Sun Fire V440 server is designed to deliver on the Sun™ Open Network Environment (Sun ONE) vision that gives customers “dial tone” reliability while delivering new services that reside on the network. As an integral part of the data center, these servers must provide both scalability and availability to the application services they support. In most industries, the multi-tiered service-delivery architecture (Figure 1-2) has evolved to provide reliable service delivery by associating services with appropriate hardware platforms. The Sun Fire V440 is ideally suited to deployment at Tier-2.

Figure 1-2: Multi-tiered data center architecture



By layering functions into multiple tiers, organizations can optimize scalability, availability, manageability, and security by using techniques appropriate for each tier, for example:

- **Edge Servers** in Tier-0 provide services such as caching, encryption, and VPN to improve bandwidth, security, and performance for servers in tiers 1–3. Due to the nature of the services they host, these systems are often scaled horizontally to provide availability through multiple redundant servers.
- **Web Servers** in Tier-1 are generally stateless and can be horizontally scaled as a way to rapidly respond to increasing workloads, dramatically increasing availability over a single server.
- **Application Servers** in Tier-2 must execute complex business rules, broker requests for content from databases, and store user-session state. Because of the compute power required in this tier, vertical scaling is used for performance, with horizontal scaling used for availability.
- **Database Servers** in Tier-3 store an organization’s most important information in the form of business-critical data and are protected from end users by two security layers. Because database applications are highly stateful, they are often deployed in asymmetric clustered configurations, with one active and one hot standby server. Capacity in terms of transactions per second is key for this tier.

Sun Fire V440 servers are appropriate for horizontally scaled Tier-2 deployment where their aggressive price points, competitive price/performance, multiprocessor performance, and large memory capacities are ideally suited for horizontally scaled applications and services. Ideal infrastructure and application services for the Sun Fire V440 servers are shown in Table 1-2.

Table 1-2: Target applications for the Sun Fire V440

Application server	Ideal
Application development	Yes
Media streaming (audio/video) and messaging	Yes
Compute farm	Ideal
Data mining	Ideal
E-mail server (SMTP/IMAP/POP)	Yes
ERP/CRM/e-commerce	Ideal
File/print server (NFS, ftp front end)	Yes
Network infrastructure (NIS/DNS/ LDAP/ DHCP, proxy/cache, load balancing, wireless)	Yes
EDA	Ideal
Small database	Ideal
HTTP/Web server	Yes

High-density, Serviceable, Rack-centric Design

Sun Fire V440 servers are designed for high-performance, high-density, rack-centric data center environments. Occupying only four rack units (4RU) of vertical space, the Sun Fire V440 server is intended to operate in a four-post rack within a data center. The system is only 25-in. deep and will fit in Sun StorEdge cabinets and most third-party 32-in. or 36-in. depth, four-post cabinets. Data centers typically arrange equipment within racks for the most efficient use of floor space. Each Sun Fire V440 ships with a four-post rack kit and cable management arm.

An optional two-post rack mount kit, X7417A, is also available. Within a 36RU Sun StorEdge rack, up to eight fully populated Sun Fire V440 servers may be installed. Each unit weighs 82 lb./32 kg fully configured.

For servicing in a four-post cabinet, the system slides forward from the rack. The top panel opens for access to the processor/memory modules or the I/O subsystem, including the PCI adapters. The majority of components are capable of being serviced without dismounting from the slides. Power supplies and internal disk drives are front accessible.

The Sun DeLorean Rack, SG-XARY030A, and the Sun Serengeti Expansion Rack, SF-XCAB, may also be used. Table 1-2 outlines the physical characteristics of the Sun Fire V440 server.

	U.S.	Metric
Height 4RU—Rack Based System	6.77 in.	172 mm
Width	17.3 in.	440 mm
Depth (Including 1-in. Bezel)	25 in.	635 mm
Weight (maximum)	82 lb.	37 kg

Table 1-3: Physical dimensions of the Sun Fire V440

Data Center Features

In addition to providing the strengths of traditional Sun servers, the Sun Fire V440 provides additional datacenter features that reduce customer cost and complexity for service delivery:

- **Advanced Lights Out Manager (ALOM)**—A standard System Management Controller module provides remote monitoring and management, as well as power control and integration, with management software such as Sun™ Management Center—allowing a small staff to manage a very large number of servers, either in-house or remotely.
- **Automatic Server Restart**—The Sun Fire V440 server can be configured to automatically reboot in the event that the memory or a PCI card becomes unresponsive, simplifying serviceability and reducing downtime.
- **System Configuration Card**—A removable system configuration card contains system-specific information, accelerating system upgrade or replacement.
- **Front-access, hot-pluggable Ultra320 SCSI Disks with hardware RAID mirroring capability**—Front-access disk drives provide easy access for service and via a secure hinged bezel door, easing maintenance and reducing downtime.
- **Dual-redundant Power Supplies**—Two hot-pluggable power supplies on the Sun Fire V440 server enhance availability and reliability.
- **Rack-centric Design**—Compact (4RU) packaging and front-to-back cooling allow very dense configurations with low power and cooling requirements that fit with data center needs.

Expandability and Management Interfaces

Sun Fire V440 servers are also expandable, allowing a wide range of peripherals and expansion opportunities. Standard expansion ports include:

- **Gigabit Ethernet**—Two auto-negotiating 10/100/1000 BaseT (Gigabit Ethernet) ports provide high-speed, high-bandwidth networking and enhanced availability.
- **Remote Management**—A dedicated 10 BaseT Ethernet port provides a network interface for out-of-band management (see figure 2-4). An RJ-45 serial port provides a console port as well as an out-of-band serial management interface.
- **Serial**—A DB9 serial port allows connection to terminal servers or other devices.
- **USB**—Four USB 1.0 ports support keyboard, mouse, and storage peripherals such as ZIP drives, etc.
- **SCSI**—An external Ultra320 SCSI port enables connection of disk arrays and other high-speed storage devices.
- **PCI**—Six full-length PCI slots are available for individual PCI cards.

Sun Fire V440 Server Architecture

The Sun Fire V440 server is designed to provide multiprocessor performance, scalability, and flexibility in a convenient four-rack unit enclosure. To this end, high-volume components and application-specific integrated circuits (ASICs) have enabled a greatly reduced part count, high reliability, and low cost without compromising access to expansion options through high-performance, standardized interfaces.

The following pages describe the Sun Fire V440 server architecture in detail, including the UltraSPARC IIIi processor and memory modules, network, I/O, and system configuration card.

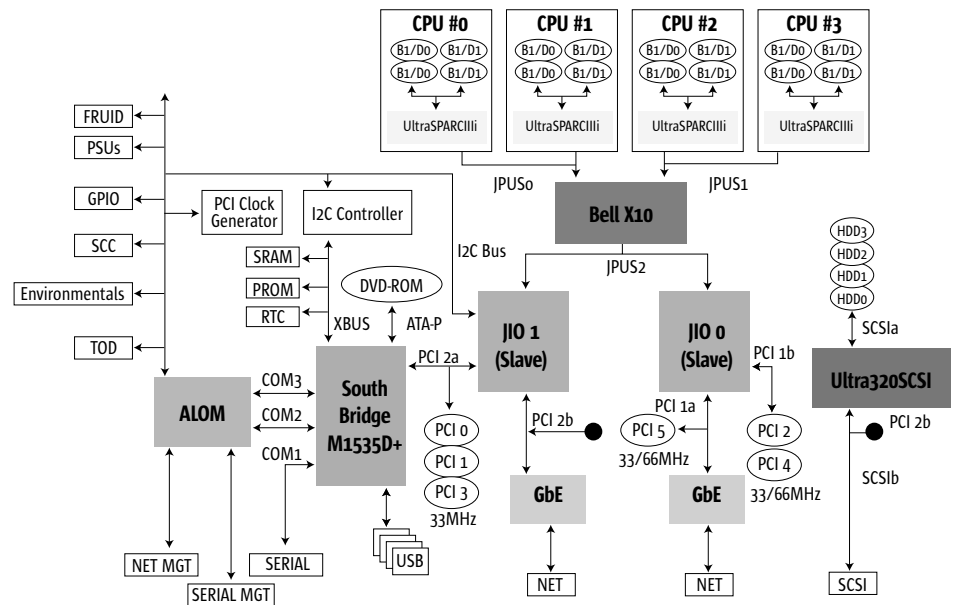
Motherboard and CPU Modules

Sun Fire V440 servers utilize a state-of-the-art compact motherboard. The motherboard implements all of the features shown in the Sun Fire V440 block diagram of Figure 2-1, including:

- Connectors for up to four UltraSPARC IIIi processors
- UltraSPARC IIIi CPU(s), each with integrated 1-MB L2 cache
- 10 Bell JBUS repeater ASICs
- Six PCI slots
- On-board I/O including two Gigabit Ethernet interfaces
- Ultra320 SCSI controller
- SouthBridge I/O device
- Two power supply connectors
- I2C Controller for GPIO devices and System Controller Card (SCC)

The Sun Fire V440 CPU modules comprise the central processing subsystem for the server. The CPU modules are based on the UltraSPARC IIIi CPU processor. The Sun Fire V440 CPU is an “I-series” implementation of the SPARC V9 architecture, where the designation as an “I-series” processor connotes the inclusion of a memory controller in the CPU. The I-series processors represent a mid-range processor implementation and are contrasted with the “S-series” processors at the high end, which include more performance-related features, and the “E-series” processors at the low end, which are targeted at embedded applications—and which typically include both the memory controller and the standard I/O bus bridge. Each of the possible 4-CPU modules contain a single UltraSPARC IIIi CPU, the four memory DIMMs supported by the UltraSPARC IIIi internal memory controller, and DC-DC converters as required to deliver power to the UltraSPARC IIIi CPU and memory DIMMs.

Figure 2-1: Block-level diagram of the Sun Fire V440



UltraSPARC III Processor

Because Sun designs its own UltraSPARC processors, it has unique opportunities to integrate on-chip functionality that is ideally suited for the systems it builds. The UltraSPARC III processor(s) utilized in the Sun Fire V440 server combine high performance with a full feature set and low power consumption, making it ideal for small compact servers.

Running at 1.062 GHz and 1.28 GHz, the UltraSPARC III processor incorporates on-chip memory management and bus interfaces to facilitate the easy and economical integration of cost-effective systems. Based on Sun's Flagship UltraSPARC III processor, the UltraSPARC III processor provides a wealth of benefits for smaller multiprocessor systems:

- A 64-bit, four-way superscalar SPARC-V9 pipeline provides high performance in a low-power package.
- The Memory Controller/System Interface unit manages virtual-to-physical memory address mappings with reduced memory latency and large memory support of up to 4 GB of memory supported per CPU/memory module.
- A 32-KB, four-way associative instruction cache (I-cache) and a 64-KB, four-way associative data cache (D-cache) help ensure low-latency access to instructions and data.
- A 1-MB, four-way associative on-chip L2 cache running at half the CPU core frequency provides increased reliability and high throughput that scales with processor technology improvements.
- The 183-MHz J-Bus system interface provides a simple, lightweight system interconnect optimized for small multiprocessor systems.
- Dual DTLBs with programmable page size support offer performance improvements for floating point-intensive applications.
- A 144-bit DDR1 SDRAM memory interface provides exceptional price/performance and high main memory throughput.
- ECC (memory) or parity (J-Bus) protection on all interconnects helps ensure highly reliable and available systems.

Memory Subsystem

The Sun Fire V440 server uses industry-standard DDR1 memory DIMMs. Each of the four CPU modules in a Sun Fire V440 system can contain up to four DIMMs. By using stacked DIMM technology, the Sun Fire V440 will support up to 1-GB DIMMs, for a total system memory capacity of 16 GB.

Memory Controller

Each CPU contains a DDR1 memory controller and data interface. Unlike standard DDR1 memory interfaces in the PC industry, UltraSPARC IIIi uses a 128-bit data path to main memory. The DIMMs in the memory subsystem are always accessed two at a time. Since each DIMM provides 64 bits of data (plus ECC), the resulting data width is 128 bits (plus ECC). The clock speed of the memory subsystem is up to 133 MHz, which yields a data bit rate of up to 266 Mb/s using the dual data rate signaling inherent to DDR SDRAM technology. A total memory bandwidth of 4.2 GB/s is available between each CPU and the memory directly attached to it, for a total aggregate memory bandwidth of 16.8 GB/s.

J-Bus Interconnect and JIO Hostbridge ASICs

The J-Bus interconnect used in the Sun Fire V440 system offers superior bandwidth and low-latency memory access coupled with reduced chip-count and cost. The J-Bus interconnect provides high throughput paths to memory. In the Sun Fire V440 servers, the J-Bus links the UltraSPARC IIIi processor/memory modules with specialized JIO Hostbridge ASICs that function as J-Bus-to-I/O bridges. The JIO Hostbridge ASIC provides a high-performance PCI implementation and a J-Bus interface operating at up to 183 MHz. An integral I/O cache unit operating at up to 128 MHz serves as a pre-fetch buffer that is fully coherent with main memory, improving sequential PCI DMA performance. This approach minimizes J-Bus transactions for I/O and enhances performance for I/O access to main memory. In addition, the JIO Hostbridge ASICs support PCI DMA write and read bursts of 1 KB (32-bit PCI) and 2 KB (64-bit PCI) with no disconnect. 64-byte PCI DMA writes are executed at peak PCI bus throughput.

Each of the two JIO Hostbridge ASICs provides two 64-bit interfaces that are both compliant with industry-standard PCI 2.2. Two PCI buses are provided by each J-Bus/PCI controller for a total of four system PCI buses for internal and external controllers and devices. Depending on the system, these PCI buses in turn support:

- Ultra320 SCSI controller (for internal disk drives) and external Ultra320 SCSI port (for arrays)
- Two auto-negotiating Gigabit Ethernet controllers
- SouthBridge general I/O ASIC
- Three PCI 64-bit, 66-MHz card slots
- Three PCI 64-bit, 33-MHz card slots

SouthBridge ASIC

The SouthBridge ASIC connects to one of the J10 Hostbridge ASICs via one of its PCI interfaces, and provides serial and general I/O functionality. These capabilities include:

- An internal connector to support the internal DVD-ROM
- A standard EIA/TIA-574 (DB9) asynchronous serial interface using RS-232 levels
- Four USB 1.0A interfaces

The SouthBridge ASIC also connects the System Management Controller ASIC that serves as a service processor for the system's ALOM remote management capabilities. ALOM remote system management can be accessed via either the RJ-45 serial or 10 BaseT Ethernet interfaces provided by the System Management Controller ASIC. More information on ALOM is provided in chapter 3.

Bell ASIC

The Bell ASIC is a J-Bus repeater and forms the core of the Sun Fire V440 J-Bus fabric. As a repeater, Bell determines on a cycle-by-cycle basis which of its four J-Bus ports are being driven actively by another J-Bus device, and then forwards any address, data, and control information from that one J-Bus port to the other three J-Bus ports, with a one clock cycle delay.

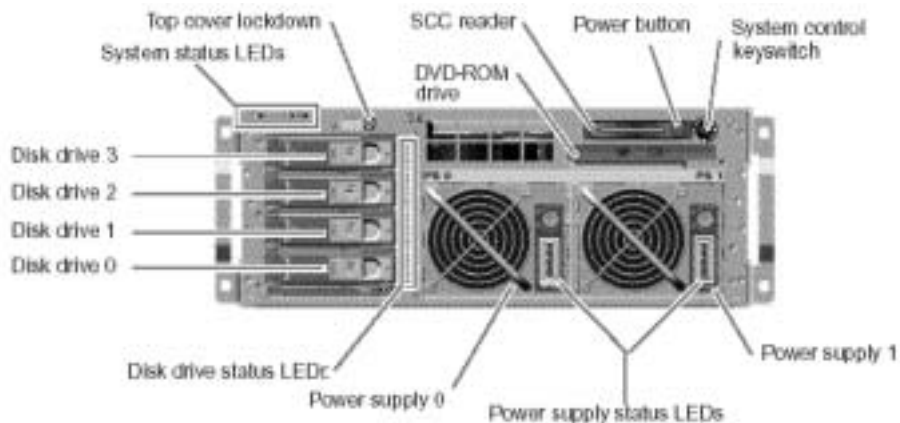
SouthBridge

The SouthBridge chip comprises a key element of the Sun Fire V440 System Architecture and represents approximately 20 years of evolution of PC architecture and system integration. The SouthBridge device adheres to a host of Industry standards and provides the interface to USB, IDE, Serial communications, and X-Bus components within the Sun Fire V440.

X-Bus

The X-bus is defined with a 1-MB memory address space, and a 64-KB I/O address space, both of which are architectural holdovers from the original 8088 microprocessor used in the original IBM PC. The only devices used on the X-bus are the boot PROM, a 32-KB SRAM, the RTC, and the Philips PCF8584 I2C controller.

Figure 2-2: Front view of the Sun Fire V440 (bezel removed)



SCSI Disk Subsystem

The disk subsystem consists of a SCSI controller chip, termination, and connectors for internal and external SCSI connections.

The Sun Fire V440 server provides internal support for Ultra320 SCSI devices. The internal disk drives are hot-pluggable and accessed through the hinged front doors of the system. The Sun Fire V440 server supports up to four 36.4-GB or 72.8-GB disks running at 10,000 rpm, for a total internal capacity of 291.2 GB.

SCSI Controller

The SCSI controller provides the host with SCSI control functions. This controller generates two channels of differential SCSI that conforms to the Ultra320 SCSI Parallel Interconnect specification. The two SCSI buses provide the internal and external SCSI connectivity, one bus is provided via an internal connection to the SCSI backplane, and the other bus via the rear I/O panel for external SCSI expansion over a standard 68-pin SCSI cable connector. The controller uses a 3.3 V, 64-bit, 66-MHz PCI interface, is connected into the system architecture at the PCI2B bus provided by the J10 Hostbridge, and is allocated two interrupts—one per SCSI channel.

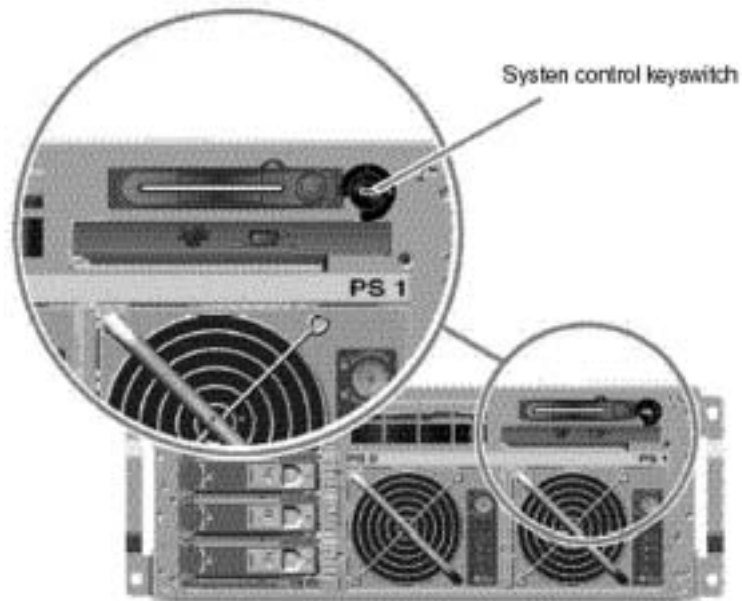
SCSI Termination and Backplane

The SCSI controller is located at one end of both SCSI buses. As such, each of these buses are terminated at the controller. The SCSI backplane provides Sun-standard SCA2 connectors for up to four SCSI drives, with all drives being connected to the internal SCSI bus provided from the motherboard via the SCSI controller. The backplane provides hot-plug required pre-charge circuitry, as well as software power control circuitry to allow the drives to be powered on or off. This supports drive hot-plug capability and also allows all drives to be powered off for reduced power consumption during Energy-star low-power modes.

System Configuration Card

System administrators often need the ability to replace or upgrade a server with minimal downtime. The system configuration card (SCC) reader contains the system configuration card. The SCC resembles a credit card or smart card and is used to store the system's host ID, Ethernet MAC addresses for all on-board Ethernet devices, OpenBoot™ configuration variables, and ALOM system controller user and system configuration data. The card performs the same functions that were performed by the NVRAM module in previous Sun systems, along with enhanced system controller support. With SCC, the identity of a system can be easily transferred from one system to another, enabling administrators to replace a Sun Fire V440 server with minimal reconfiguration. To transfer the system configuration, simply remove the SCC from one server and insert it into another, along with the boot disk from the original system.

Figure 2-3: Location of the Sun Fire V440 SCC reader

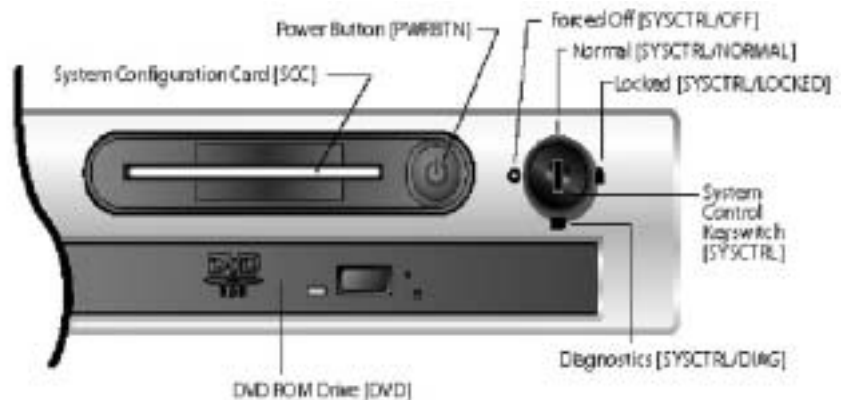


CAUTION: The system configuration card must be installed and in place at all times while the system is running. If the SCC is removed while the system's running, the system will power off within 30 seconds. In addition, if the system is in standby mode and the SCC is missing, the ALOM system controller prevents the system from being powered on.

System Control Key Switch

The four-position system control key switch on the front panel controls the power-on modes of the system. The system control key switch also prevents unauthorized users from powering off the system or reprogramming system firmware. Table 2-1 describes the function of each system control key switch setting.

Figure 2-4: Location of the Sun Fire V440 system control key switch







Position	Icon	Description
Standby		This setting forces the system to power off immediately and to enter standby mode. It also disables the system Power button. This setting is useful when AC/DC power is interrupted and you do not want the system to restart automatically when power is restored. With the system control key switch in any other position, if the system were running prior to losing power and the power state memory is enabled in the ALOM system controller, the system restarts automatically once power is restored. The Standby setting also prevents anyone from restarting the system during an ALOM system controller session. However, the ALOM system controller card continues to operate using the system's standby power.
Normal		This setting enables the system Power button, allowing you to power the system on or off. If the operating system is running, pressing and releasing the Power button initiates a graceful software system shut-down. Pressing and holding the Power button in for four seconds causes an immediate hardware power off.
Locked		This setting disables the system Power button to prevent unauthorized users from powering the system on or off. It also disables the keyboard L1-A (Stop-A) command, terminal Break key command, and ~# tip window command, preventing users from suspending system operation to access the system ok prompt. The Locked setting is recommended for normal day-to-day operations, and prevents unauthorized programming by write-protecting system firmware. The ALOM system controller can still affect the system power state via a password-secured ALOM session, even when the system control key switch is in the Locked position. This capability provides remote management of the system.
Diagnostics		This setting forces the power-on self-test (POST) and OpenBoot Diagnostics software to run firmware diagnostic tests at power on or during reset events. The Power button functions the same as when the system control key switch is in the Normal position.

Table 2-1: Sun Fire V440 system control key switch setting descriptions

Networking and I/O Expansion

The Sun Fire V440 server provides a full complement of networking and I/O expansion options through connectors on the back panel. The rear panel is illustrated in Figure 2-5.

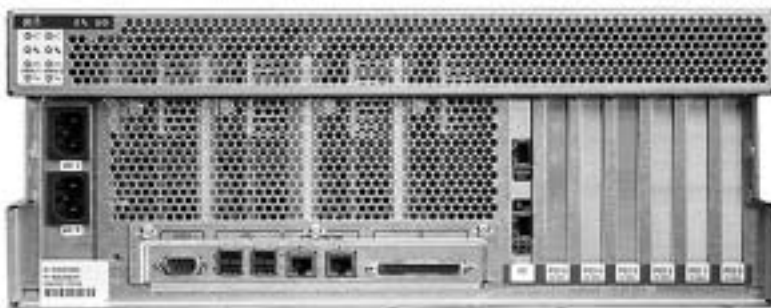


Figure 2-5: Rear view of the Sun Fire V440

Ethernet ports

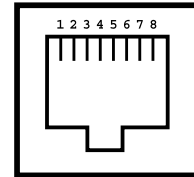
Looking at the rear view of the Sun Fire V440 chassis in figure 2-5, we can see that it provides two Gigabit Ethernet connections, labeled NET0 and NET1, provided over a standard “copper” RJ45 interface, compliant with the IEEE-802.3ab and IEEE-802.3z physical-layer standards. The pin numbering for the RJ45 connectors is shown below in Figure 7, and the signal list is given in

Table 2-2. Note that the signal definitions given in Table 2-2 have different names and functions depending on whether the port in question has auto-negotiated for 1000 BaseT or 100 BaseT operation. Each of the two network ports are driven by separate Ethernet chips, connected into the system through separate PCI buses for optimal performance balancing.

Table 2-2: Sun Fire V440 RJ45 Ethernet signal assignments

Figure 2-6: RJ45 pin assignments

Pin	Signal 1000 (100) BaseT
1	MX0+ (TX+)
2	MX0- (TX-)
3	MX1+ (RX+)
4	MX2+
5	MX2-
6	MX1- (RX-)
7	MX3+
8	MX3-



Gigabit Ethernet technology from Sun is backwards compatible with 10 Mbps Ethernet, with the speed being auto-negotiated by the interface. An additional 10 Mbps Ethernet connection provides access to the ALOM capabilities via a separate RJ-45 connector.

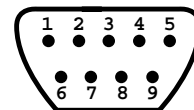
Serial ports — ALOM (RJ-45) and Asynchronous (DB-9)

Serial ports provide a convenient way to connect the Sun Fire V440 server to terminal servers and other serial devices. The serial port (RJ-45 connector) located on the ALOM card is used as a console and serial interface to the System Management Controller ASIC and ALOM remote management capabilities. It is provided by the COM1 interface on the SouthBridge. The serial port (DB-9 connector, labeled 10101) can be used for general serial connectivity and supports asynchronous transfers.

Table 2-3: Sun Fire V440 DB9 RS232 signal assignments

Figure 2-7: DB9 pin assignments

Pin	Signal Name
1	DCD — Data Carrier Detect
2	RXD — Receive Data
3	TXD — Transmit Data
4	DTR — Data Terminal Ready
5	GND
6	DSR — Data Set Ready
7	RTS — Request To Send
8	CTS — Clear To Send
9	RI — Ring Indicate



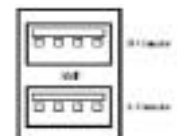
USB ports

The chassis rear provides four USB ports via two “double-stacked” USB connectors. Each of the two connectors has a pin configuration as shown below in Figure 2-8, and a signal assignment as shown in Table 2-4.

Table 2-4: Sun Fire V440 USB signal assignments

Figure 2-8: USB pin assignments

A-Connector Pin	Signal	Signal	B-Connector Pin
1	+5V (fused)	+5V (fused)	1
2	USB0/1-	USB2/3-	2
3	USB0/1+	USB2/3+	3
4	GND	GND	4



Note that the numbering of the USB ports is not sequential within a double-stacked connector, but rather goes back and forth between connectors. Thus, as viewed from the chassis rear, the rightmost double-stacked connector has USB-0 at the bottom, and USB-2 at the top. Similarly, the leftmost double-stacked connector has USB-1 at the bottom and USB-3 at the top. This port numbering is illustrated in Figure 2-9. Note also that the four USB ports associated with each of the two USB controllers in the SouthBridge are physically routed to the USB connectors in a manner consistent with the device nomenclature outlined above. Thus, the SouthBridge chip's first USB controller initialized by OBP drives ports USB-0 and USB-1, and the second USB controller drives ports USB-2 and USB-3.

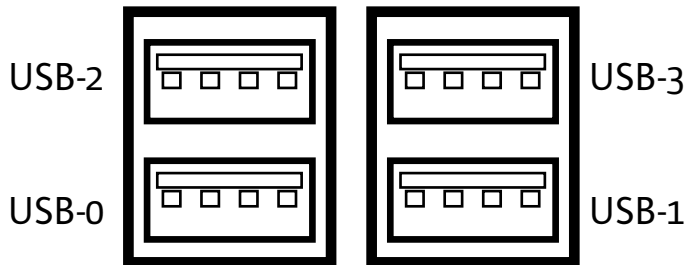


Figure 2-9: USB port numbering

Four USB ports provide a convenient way to connect a keyboard and mouse as well as hand-held devices for configuration management. In addition, USB-based peripheral devices supported by third parties, such as ZIP drives and printers, as well as external CD/DVD-ROM drives, may be attached.

UltraSCSI port

The chassis rear provides a dedicated Ultra320 SCSI port with a data transfer capability of 320 MB/s for connection to external storage devices. This standard 68-pin connector has the pin configuration shown below in Figure 2-10, and uses the connector pinout given in Table 2-5.

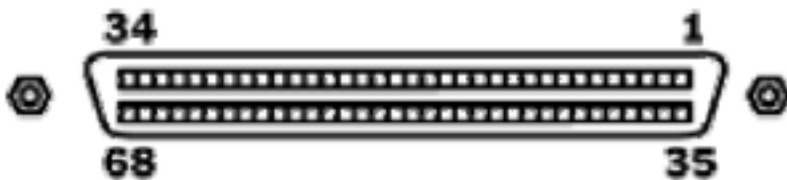


Figure 2-10: External SCSI pin numbering

Table 2-5: Sun Fire V440 external SCSI signal assignments

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	DATA12+	18	TERM_PWR	35	DATA12-	52	TERM_PWR
2	DATA13+	19	(N/C)	36	DATA13-	53	(N/C)
3	DATA14+	20	GROUND	37	DATA14-	54	GROUND
4	DATA15+	21	ATN+	38	DATA15-	55	ATN-
5	PARITY1+	22	GROUND	39	PARITY1-	56	GROUND
6	DATA0+	23	BSY+	40	DATA0-	57	BSY-
7	DATA1+	24	ACK+	41	DATA1-	58	ACK-
8	DATA2+	25	RST+	42	DATA2-	59	RST-
9	DATA3+	26	MSG+	43	DATA3-	60	MSG-
10	DATA4+	27	SEL+	44	DATA4-	61	SEL-
11	DATA5+	28	CD+	45	DATA5-	62	CD-
12	DATA6+	29	REQ+	46	DATA6-	63	REQ-
13	DATA7+	30	I/O+	47	DATA7-	64	I/O-
14	PARITY0+	31	DATA8+	48	PARITY0-	65	DATA8-
15	GROUND	32	DATA9+	49	GROUND	66	DATA9-
16	DIFF_SENSE	33	DATA10+	50	GROUND	67	DATA10-
17	TERM_PWR	34	(N/C)	51	TERM_PWR	68	(N/C)

PCI card slots

There are six full-length PCI slots on the rear of the chassis, numbered PCI-0 through PCI-5, right to left as viewed from the rear of the chassis. Three of the slots are 33-/66-MHz capable, with the remaining three slots being 33 MHz only. All PCI connectors are 64-bit, but can accept 32-bit PCI cards.

Power supplies

Power connection to the Sun Fire V440 server is also located on the back panel. For enhanced reliability and availability, two hot-plug power supplies in an N+1 configuration are provided, each with a separate power cord. Either power supply unit is capable of running the Sun Fire V440 server in the absence of the other in the case of a failure. The power supplies are inserted or removed from the front of the chassis and make all electrical connections to the system via the motherboard power-supply connectors, one per power supply. As hot-pluggable FRUs, the power supplies provide four indicators in compliance with the Service Indicator Standard, as listed in Table 2-6.

Indicator	Color (wavelength)	Function
AC/Standby Status	Green (555nm)	Controlled by power supply internal circuitry, this indicator illuminates when power supply is fully inserted into the chassis, AC input power is present, and 5V_STBY output is active. Controlled by power supply internal circuitry.
DC Power Good Status	Green (555nm)	Controlled by power supply internal circuitry, this indicator illuminates when power supply is ON and all supply rails are in regulation and POWER_GOOD signal is being delivered to the motherboard. Controlled by power supply internal circuitry.
OK To Remove	Blue (430nm)	Controlled by motherboard circuitry, this indicator illuminates on a given power supply when the other power supply is ON and fully operational, i.e., not in any of the possible fault states (see below).
Fault	Yellow (585nm)	Controlled power supply internal circuitry, this indicator illuminates when one of the following fault conditions occurs: <ul style="list-style-type: none"> • Fan Failure • Over-temperature • Over-current on 3.3V, 5V, 12V, or -12V • Over-voltage on 3.3V, 5V, 12V, or -12V

Table 2-6: Sun Fire V440 power supply indicators

Note that the Sun Fire V440 server requires that both power supplies be present at all times, except when swapping a failed power supply with a new one. This requirement stems from the needed contribution that the power supply fans make to the air stream flowing over the CPU modules. The power supply indicators are replicated at the rear of the chassis in their entirety by motherboard circuitry; no software intervention is required.

DVD-ROM Drive

The Sun Fire V440 includes a standard DE DVD-ROM drive. This device is driven from the IDE interface provided by the SouthBridge chip. The DVD-ROM drive and Smart Card reader connect to the motherboard via a single 50-pin ribbon cable.

Diagnostics

The Sun Fire V440 server has been designed for easy diagnosis and problem repair. Supporting this design are several PROM-resident and UNIX® platform-based diagnostic programs that can be applied by end-users and service personnel.

Power-on Self-test

Under user control, a power-on self-test (POST) can be automatically executed to test the system board, NVRAM, on-board I/O devices, and memory system each time power is applied to the system. While not intended to be a comprehensive diagnostic, POST can quickly establish that no severe problems exist with the system. POST tests may be monitored via a serial-port connection to a terminal server, another desktop system, or a dumb terminal.

SunVTS

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

Front Panel Indicators

Located in the upper left corner of the front panel are the Sun standard set of service indicators. The control of the service indicators standards will be through the ALOM service processor. In Service Indicator Standards terminology, the white LED is the Locator indicator, the yellow LED is the Service Required indicator, and the green LED is the System Activity. Note that in the Sun Fire V440, the blue ‘OK to Remove’ indicator is not used at the chassis level, since the chassis is not a hot-plug FRU. All of these indicators are controlled via an I2C GPIO device located on the SCSI backplane. The front panel indicators are controlled by software running on the service processor, and follows the guidelines laid down in the Sun Service Indicator Standard documentation. Of particular interest is the Service Required indicator, as its use is intimately tied into the various diagnostic software subsystems such as POST and OBDiag.

Rack-mount Enclosure and Power

Sun Fire V440 servers are designed to provide reliable and scalable performance while reducing operating expense through lower real estate costs. The small form factor enables multiple systems to be deployed in dense, rack-mounted configurations. All internal components and field-replaceable units (FRUs), including the UltraSPARC IIIi CPU and memory modules, are easily accessed from the top of the enclosure through a hinged lid. Two hinged front doors allow hot-plug disk drives and hot-plug power supplies to be easily inserted or removed from the front of the system. Each Sun Fire V440 server is provided with a Sun rack-mount kit that consists of two slide assemblies, a cable management arm, and bracket and associated screws. Table 2-7 summarizes the power specifications of the Sun Fire V440 server pertaining to fully configured systems and applicable to operation at 50 Hz or 60 Hz. The table data specifies total power input current required for both AC inlets when operating with dual power supplies or current required for a single AC inlet when operating with a single power supply. Smaller configurations will consume less power.

Table 2-7: Sun Fire V440 server full configuration power specifications

Maximum Power Consumption	650 W
Maximum BTU Heat Dissipation	2218 BTU/h

Maximum Configuration: A42—XCB4-16GD, calculated using base system with six PCI cards.
 Power at the following nominal line voltage: 120 V AC, 60 Hz

Environmental and Safety Specifications

The Sun Fire V440 server meets all relevant domestic and international agency safety, ergonomics, EMI, and environmental requirements as summarized in Table 2-8.

Table 2-8: Sun Fire V440 server environmental and safety specifications

Temperature	Fahrenheit	Celsius
Operating	41°–104° F	5°–40° C
Non-operating	40°–140° F	-40°–60° C

Noise	In accordance with ISO 9296:
Operating acoustic noise	6.20 dB (A)
Idling acoustic noise	5.25 dB (A)

Humidity (non condensing)	
Operating	20%–80% non condensing, 27° C max. wet bulb
Non-operating	5%–93%

Regulatory	
Safety	Meets or exceeds the following requirements: UL approval to UL 60950, EN60950, C22.2 No.60950, and CB Report for IEC 950; all including Amendments 1, 2, 3, 4, and 11, and full worldwide deviations. TUV approval to EN60950/IEC 950. GOST Certification for Eastern Block countries. Korean MIC Certification. China CCC mark using UL as agent. CE Declaration of Conformance (SMI self-declaration) to The Electromagnetic Compatibility Directive and Low Voltage Directive with accompanying "Technical Data File." Approval to Argentinean standards using UL as agent.
RFI/EMI	47CFR 15B (Code of Federal Regulations, Part 15, Subpart B) Class A EN55022 Class A per EMC Directive 89/336/EEC (CE Mark) VCCI Class A Industry Canada ICES-003 AS/NZ 3548 (Australia/New Zealand) CNS 13438 (Taiwan) KSC 5858 (MIC Mark/Korea)
Immunity	IEC 1000 EN55024 per EMC Directive 89/336/EEC, including IEC 61000-4-2 Electrostatic discharge immunity test IEC 61000-4-3 Radiated, radio-frequency, electromagnetic field immunity test IEC 61000-4-4 Electrical fast transient/burst immunity test IEC 61000-4-5 Surge immunity test IEC 61000-4-6 Immunity to conducted disturbances, induced by radio-frequency fields IEC 61000-4-8 Power frequency magnetic field immunity test IEC 61000-4-11 Voltage dips, short interruptions, and voltage variations immunity tests Line Distortion EN 61000-3-2 per EMC Directive 89/336/EEC Voltage Fluctuations and Flicker EN 61000-3-3 per EMC Directive 89/336/EEC
X-ray	U.S. DHHS 21CFR Subchapter J, PTB German X-ray Decree

Table 2-8: Sun Fire V440 server environmental and safety specifications (cont.)

Vibration		
Vibration: (IEC-60068-2-6and64)	Operating	Non-operating
	Sine Vibration	
	Z-axis: 0.15 G X/Y-axes: 0.10 G 5-500 Hz sine	Z-axis: 0.50 G X/Y-axes: 0.25 G 5-500 Hz sine
	Random Vibration	
	(Z-axis only) .0001 G2/Hz 5-150 Hz, -12db/octave slope 150-500 Hz	.001 G2/Hz 5-150 Hz, -12db/octave slope 150-500 Hz

Altitude		
Altitude: (IEC 60068-2-13)	Operating	Non-operating
	0-3,000 m (0-10,000 feet)	0-12,000 m (0-40,000 feet)

Software for Highly Available Services

The need for continuous operation in mission- and business-critical environments demands not only well-designed hardware but sophisticated software capabilities as well. The Sun Fire V440 server is well equipped with support for the Sun ONE software suite, the robust Solaris Operating System, integrated support for remote management, and sophisticated resource-management software.

Solaris Operating System

The Solaris Operating System is designed to deliver the power, flexibility, availability, and compatibility to support enterprise-wide computing. It combines key computing elements—operating system, networking, and user environment—into a stable, high-quality foundation that organizations can depend on to develop, deliver, and manage business- and mission-critical computing solutions. The strengths of the Solaris Operating System lie in its enterprise-class reliability, scalability, and performance. Organizations supplying services on demand will appreciate key functionality that aids in the constant and consistent delivery of applications and services to customers:

- High performance through a complete 64-bit computing environment, enabling the delivery of applications and services to large numbers of users
- Extended security features through authentication, data integrity, data privacy, and single sign-on capabilities, so that tampering, snooping, and eavesdropping do not compromise data or associated transactions
- Enhanced scalability with a 64-bit kernel that enables access to more system resources and the ability to consolidate applications onto a single server
- Superior reliability and availability for maximum data and application accessibility, with features such as on-line patch installations without the need for system downtime
- Software investment protection, with complete binary compatibility; additional options, such as Solaris™ Resource Manager and Solaris™ Bandwidth Manager, build upon the reliability and scalability of the Solaris Operating System to help deliver a comprehensive platform infrastructure.

Solaris JumpStart™ Software

With potentially hundreds or thousands of systems to manage, automation is absolutely key. Reducing TCO depends on enabling a small administrative staff to manage a large number of systems. The Solaris Operating System provides many of the key elements that enable efficient, centralized administration and automation. For example, Sun systems are able to boot remotely over the network and can install their operating systems from remote system administration servers. Solaris JumpStart™ software enables fully automatic and remote operating system installation based on custom profiles and scripts. Solaris Jumpstart is a standard component of the Solaris Operating System.

Solaris™ Flash Software

To improve utilization of the systems that make up today's datacenters, administrators are turning to tools such as Solaris™ Flash software. Solaris Flash software provides new provisioning functionality that allows administrators to capture a snapshot image of a complete server—including the Solaris Operating System, the applications stack and the system configuration into

a new Flash Archive format. Using this system image, administrators can then rapidly replicate a reference server configuration onto many target servers. Solaris Flash images can be deployed via standard media or over the network via HTTP and NFS protocols. Solaris Flash images can be installed using custom Solaris JumpStart scripts, the Solaris Web Start graphical interface, or through interactive installation of the Solaris Operating System.

Solaris™ Live Upgrade Software

Solaris™ Live Upgrade software allows the creation, management, upgrade, comparison, and activation of multiple boot environments on systems running the Solaris Operating System. In particular, Solaris Live Upgrade software enables systems to run uninterrupted while a system administrator installs a Solaris Flash archive or upgrades to a new version of the Solaris Operating System. As a result, downtime for upgrades can be reduced to the time needed for a simple reboot.

Remote Management Software

For many years, the remote networking capabilities of the Solaris Operating System have enabled Sun systems to be remotely managed. Administrators can log into remote systems to perform administrative tasks or access system consoles through network terminal servers. These basic capabilities are extended through the use of sophisticated system management and monitoring tools. True lights-out management, with its need for remote event notification and problem diagnosis, requires remote access at a level that makes few assumptions about the correct operation of an operating system or other critical system components. As a result, remote system administration capabilities for geographically distributed or physically inaccessible systems require a fundamental system design that includes an independent or out-of-band control channel. This channel plays an essential role when the operating system on a remote system is not able to respond due to software, hardware, or network connectivity problems, or power outages.

Advanced Lights Out Manager (ALOM)

To address the needs for out-of-band control, the Sun Fire V440 server features an innovative remote management capability known as Advanced Lights Out Manager (ALOM). Provided by an embedded System Management Controller integrated into the Sun Fire V440 server, ALOM gives system administrators the ability to locate and resolve problems quickly, independent of the operating state of the system. Administrators can gain access to the ALOM service through a serial connection from a modem, terminal server, personal computer, or other devices supporting terminal emulation. Ethernet access to ALOM management capabilities is available from any network-attached administrative resource such as a Sun workstation. The serial interface offers a combined console and management CLI. The network port uses an RJ45 connector for connection to CAT 5 cabling and is dedicated to the ALOM supporting a transfer rate of 10 Mb/s. Both interfaces remain accessible even when the system is in the standby state. Monitoring capabilities provide detailed logs for easy troubleshooting. The power on/off functionality allows for full control of service availability, since the server can be remotely powered on with no physical user intervention. Granular user access control provides control over who can access which areas of the server, whether for monitoring or system-level shutdown capabilities. Table 3-1 compares key features of ALOM to the RSC and LOMLite 2 systems found on other Sun systems.

Table 3-1: Sun Fire V440 server ALOM, RSC, LOMLite2 features comparison

Features	RSC (Sun Fire 280R, V480, V880)	LOMLite 2 (Netra 120, Netra 20)	ALOM (Sun Fire V210, V240, V440)
Serial interface	Yes	Yes	Yes
Ethernet interface	Yes	No	Yes
Host-side interface and admin utility	Yes	Yes	Yes
Hardware environmental monitoring and management (fans, power, temperature, PSU, FRU ID, LED, hot-plug)	No	Yes	Yes
Host control (power, reset, LEDs)	Yes	Yes	Yes
Server watchdog (OS monitor and restart)	No	Yes	Yes
Self watchdog and reset	No	Yes	Yes
Event logging	Yes	Yes	Yes
Logging host console	Yes	Yes	Yes
Maximum number of multiple users	4	4	16
E-mail notification	Yes	No	Yes
Out-of-box functionality	No	Yes	Yes
SCC support	No	Yes	Yes
Optimized boot time	Yes	Yes	Yes
CLI	Yes	Yes	Yes
GUI	Yes (Java)	No	No
Telnet via Ethernet	Yes	No	Yes
FRU ID	No	No	Yes
Non-volatile events	No	Yes	Yes
Remote SYS log events	No	No	Yes

Sun™ Management Center Software

Sun™ Management Center (MC) software provides a powerful and easy-to-use platform for administrative and management operations helping Sun systems and the services they provide remain available. Sun MC offers a single point of management for all Sun systems, independent of their geographic location. Through a Web interface, Sun MC enables system administrators to perform remote system configuration and performance monitoring, and isolate hardware and software faults. In addition, the Sun MC software integrates with the ALOM capabilities of the Sun Fire V440 server, further enhancing remote management. The Sun Management Center software provides in-band management support for Sun Fire V440 server alarms and system management features. To enable this support, a Sun MC agent and server module for the Sun Fire V440 must be downloaded and installed on the appropriate system.

Resource Management Software

Automation is also key for effectively managing resources on datacenter servers. Administrators need tools to model and automatically maintain resource levels to keep servers inside healthy operational constraints and maintain service level agreements. Sun provides these important tools for its servers and mass storage arrays and subsystems.

Solaris™ Resource Manager Software

Driven by the increasing popularity of applications and network service providers, customers are demanding service-level agreements to ensure processing, storage, and throughput resources

will be available during periods of peak usage. At the same time, administrators must strive to ensure that meeting the demands of one user or group does not unfairly impact another. Integrated into the Solaris Operating System, Solaris™ Resource Manager (RM) software allows system managers to allocate resources among individual tasks and users in a structured, policy-driven fashion. With Solaris Resource Manager software, administrators can proactively allocate, control, and monitor system resources, such as CPU time, processes, virtual memory, connect time, and logins within a system or domain. This fine-grained control enables the system manager to better predict and guarantee the level of service available to a particular task. When additional resources are required to meet urgent demands, allocations can be easily shifted to provide needed levels of service. Users and applications receive a more consistent level of service, enabling even higher application availability.

Solaris™ Bandwidth Manager Software

Solaris™ Bandwidth Manager software enables administrators to control the network bandwidth assigned to particular applications, users, and departments that share the same intranet or Internet link. By installing Solaris Bandwidth Manager software on a network's major links and application servers, and by setting consistent policies, bandwidth can be evenly distributed throughout the organization. Traffic can also be prioritized, preventing a small number of applications or users from consuming all available bandwidth. The Solaris Bandwidth Manager software enables organizations to:

- Provide differentiated classes of service to users and bill accordingly
- Guarantee bandwidth to priority users, applications, or servers
- Reduce traffic congestion and increase network efficiency
- Control user and application access to network resources
- Gather detailed network use statistics and accounting data for usage-based billing and trend analysis

Storage Management Tools

To manage the growing volumes of mass storage in today's networked environments, Sun provides the advanced Sun StorEdge line of redundant storage arrays along with a variety of powerful management tools. Volume managers are available both as hardware-based options that are an integral part of disk subsystems and host-based managers that run on the host. In addition to individual volume management tools, redundant storage-area networks (SANs) are available to connect storage devices via a switch to deliver high-speed, high-bandwidth access to data. Sun's portfolio of SAN solutions is a customer-ready answer that is easy for customers and partners to install, simple to manage, and very economical. Sun also provides several software suites that help ease storage management tasks:

- **Sun StorEdge™ Utilization Suite** software provides protection and rapid access to large volumes of enterprise data.
- **Sun StorEdge™ Performance Suite** software optimizes storage resources for speed and continuous data availability, even for very large files.

- **Sun StorEdge™ Availability Suite** software provides a comprehensive solution that minimizes disruption, maintains productivity, protects data, recovers from disaster, and ensures continuity in business planning and integration.
- **Sun StorEdge™ Resource Management Suite** software enables administrators to analyze storage usage, understand consumption, identify bottlenecks, forecast growth, and plan efficiently for new storage networks.

Services to Improve Data Center Operations

With significant demands from the industry, qualified system administrative talent is increasingly expensive and hard to find. As organizations continue to grow, they must extend the expertise of valuable system administrative staff asking them to manage larger and larger numbers of systems. In addition, keeping availability high means relying on people and processes even more than products. Sun can provide experts that help integrate the methodologies, expertise, products, and services needed to craft high availability environments that make service grids work smoothly. Based on field-proven methodologies, best practices, and experience implementing thousands of servers into data centers worldwide, Sun's extensive portfolio of services delivers the "how to" architecture, implementation, and operations management services for Sun Fire V440 servers.

Key services include:

- Consulting expertise to help design and implement solutions that can handle rapid growth without sacrificing performance and availability
- Workforce development solutions that provide staff with the skills to assess, architect, build, and manage scalable data centers through a specially designed curriculum
- Comprehensive, flexible support services developed to address the unique needs of the data center and complement the business model and operational support strategy of individual enterprises

Professional Services

Sun Professional Services™ teams help organizations create the right infrastructure based on Sun Fire V440 systems through several services:

- The Sun Fire™ Application Readiness Service provides implementation and project management.
- The Sun Fire™ Data Center Readiness Service addresses configuration, design and testing, change management, and process and documentation issues.
- The SunReady™ Availability Assessment Service identifies the gaps and assesses the risks in an architecture or operational environment, as well as evaluating the organizational structure or personnel skill levels in a particular application environment that may affect availability.
- Mainframe Migration Services help a growing computing environment prepare to take advantage of the latest technologies in hardware, software, and middleware.

Workforce Development Solutions

A properly trained staff can help ensure high levels of availability, fast and accurate deployment of new products and services, quick identification of problems, and rapid response to system failures and interruptions. As a leading supplier of training solutions around the world, Sun Educational Services can help organizations take full advantage of their hardware and software investments by giving their personnel the right training.

Proactive System Management

Managing a large number of servers requires obtaining the right level of support to help improve operational efficiency and increase business and mission-critical system reliability. Sun Support Services offers proactive support, monitoring, and sustaining services to help manage system availability:

- SunSpectrum™ Support Programs enable enterprises to choose a service level based on their specific need. Levels of service range from mission-critical support for maximum solution availability to backup assistance for self-support customers.
- SunSpectrum Platinum™ is Sun's most comprehensive high-availability system support solution, designed to provide services to support around-the-clock, mission-critical computing environments. SunSpectrum Platinum support services include a mission-critical account team, support planning, 24x7 telephone assistance, customer-defined service priorities, 24x7 on-site hardware service, and many other services.
- Sun™ RAS Profile enables enterprises to identify those areas where operational efficiency and business- and mission-critical system reliability can be improved.

Sun™ Remote Services Event Monitoring

The Sun™ Remote Services Event Monitoring program is a set of tools, technologies, and expertise designed to support Sun's remote services strategy. The strategy aims to improve mission-critical support and increase the overall availability of the environments of SunSpectrum Gold™ or SunSpectrum Platinum support customers. Sun Remote Services methodologies allow Sun experts to detect and manage Sun system events faster and more proactively—resolving potential problems before they impact Sun environments and business operations.

SunTone™ Certification and Branding Program

In a market fraught with time-to-market pressures, ensuring the quality and reliability of applications can be a time-consuming task. To help this effort, Sun created the SunTone Certification and Branding program to recognize and promote service provider investments in process, methodology, and infrastructure elements that enable the delivery of secure, reliable, and predictable Internet services. The SunTone Certification and Branding Program provides customers of Web-based services, applications, and integrator services with a means for identifying suppliers who meet highly defined standards for providing quality service over the Internet, and gives the companies that provide those quality services a means to differentiate themselves in an ever more competitive and expanding market. Using the SunTone Certified logo as a guide, customers can quickly and confidently choose service providers who have met high-quality standards aimed at making Web tone as reliable as dial tone. All SunTone Certified services meet established requirements for hardware infrastructure, security, and operational processes. Additionally, in deploying SunTone Certified services, service providers follow a recommended methodology for building services, providing security, and ensuring reliability and scalability. SunTone Certified applications conform to requirements addressing scalability, availability, security, and management practices, and are optimized and tuned to run on the Sun platform.

Conclusions

Today's organizations are facing many challenges. Data centers must be on-line 24 hours a day, and computing infrastructures must be able to scale both horizontally and vertically without downtime or unnecessary system cost and complexity. Organizations must find ways to provide solutions while reducing cost and complexity.

The Sun Fire V440 server is a general-purpose server that sets a new standard for cost-effective, multiprocessor, high-density, server-based computing. Designed with data center environments in mind, these dense, rack-optimized servers offer aggressive price points and competitive price/performance in a compact design. High-performance multiprocessor capabilities make the Sun Fire V440 servers ideal for horizontally scalable application server deployments.

The Sun Fire V440 server reduces customer cost and complexity by offering low acquisition costs in a dense form factor with low power and cooling requirements, and by leveraging the binary compatibility of SPARC processors and the Solaris Operating System. In addition, the Sun Fire V440 server also helps customers reduce cost and complexity with new remote management and identity transfer features.

The Sun Fire V440 servers' value is not just in the product features but its overall value as a low-cost networking solution. The support for Solaris, the Sun Open Net Environment software portfolio, and Sun Cluster software provides customers the low-cost, horizontally scalable solutions they desire. Planned alignment with Project Orion and its predictable and tested release cycle and future alignment with Sun's N1™ software and its ability to virtualize resources will continue to drive down customer cost and complexity.

Sun has been developing high-performance, robust computing technology for over 20 years. In a world where technology advances at breakneck speeds, companies are looking to forge alliances that enable them to capitalize on each other's strengths. The combination of Sun hardware, the Solaris Operating System, Sun ONE, and key technologies such as identity transfer and remote management in the Sun Fire V440 server enable organizations to capitalize on the power of low-cost network computing.

References

Sun Microsystems posts product information in the form of datasheets, specifications, and white papers on its home page at: <http://www.sun.com>. Look for the these and other Sun technology white papers:

Sun Fire V210 and Sun Fire V240 Server Architecture—White Paper

The Next Generation Web Services Platform—Solution Brief

For documentation on the Sun Fire V440 and all other Sun hardware platforms visit <http://docs.sun.com>

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