

Sun Fire™ X4600 M2 Server

with 8-Socket Quad Core

Unique Compact Rack-Mount Server that
scales to 32 x64 Cores for Virtualization and
Database Applications

December 9, 2008

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Sun Fire X4600 Server Positioning



Sun Fire X4600 M2 Server

Introduction

The Sun Fire™ X4600 M2 Server, now with the new Enhanced Quad-Core AMD Opteron processor, is the industry leading 4 to 32-core x64 rack-optimized server in a compact 4U form factor. The server is made of 2 to 8 easy-to-add processor modules with AMD's (Advanced Micro Devices) award-winning Opteron™ processors. The modularity allows the server to be easily scale from 4 to 32 cores and to be upgraded from dual-core processors to quad-core processors.

This compute scalability, combined with high I/O bandwidths, makes the Sun Fire X4600 M2 Server ideal for virtualization, server consolidation, database, and high performance computing applications. The server supports all industry standard operating systems, including Solaris™, Linux, and Microsoft® Windows®, and VMware ESX server operating environments.

With up to 16GB/s of bi-direction I/O with 6 PCI-Express slots and 2 PCI/X slots, this server supports storage, networking, and fabric-based infrastructure to run high performance enterprise applications, as well as enabling high availability clustering architectures to deploy Solaris, Linux, Windows, and VMware ESX.

Designed by Sun Microsystems from the ground up to facilitate system management, the Sun Fire X4600 M2 Server can help customers scale their computing resources without additional complexity by offering a standardized solution featuring state-of-the-art remote management capabilities. Sun Integrated Lights Out Manager (ILOM) Service Processor technology comes fully featured and is integrated as standard, at no additional cost. ILOM provides powerful configuration, monitoring, fault identification, remote firmware update, remote power on/off, remote keyboard/mouse/video/storage, and other management features increasing availability by reducing errors and speeding repair time.

The Sun Fire X4600 M2 Server, when combined with Sun's rich portfolio of software, storage,

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services and network switches, can help reduce cost and complexity in an Enterprise environment while accelerating time-to-revenue for web, applications, database and grid applications.

For more information see: <http://www.sun.com/X4600>.

Features, Functions, and Benefits

Sun Fire X4600 M2 Server Key Features, Functions, and Potential Benefits

Feature	Function	Benefit
Scalability and Performance		
<ul style="list-style-type: none"> Eight modular processors 	<ul style="list-style-type: none"> Support 2, 4, 6, or 8 processors per system Support for dual-core, quad-core, and enhanced quad-core processors Scaling from 4 to 32 cores Processors can be upgraded in the same system (e.g. Dual core to quad core) Scalable performance computing in a compact form factor Processors can be easily changed, added, or upgraded by changing processor boards 	<ul style="list-style-type: none"> Lower total cost of ownership and reduce power consumption --doubles the virtualization and consolidation capacity in a server, compared to competitive servers Simplifying application deployment to fit capacity needs, by offering head-room for applications with minimal work (adding processors)
<ul style="list-style-type: none"> Up to 256GB of memory 	<ul style="list-style-type: none"> Support for 2GB and 4GB DDR2-667 memory With 8 DIMM slots per processor, supports max 32 DIMM slots All 8 DIMM s run at 667MHz (on the quad-core processor modules) 	<ul style="list-style-type: none"> Solve bigger and more complex problems Support more virtual machines in system Support more transactions
<ul style="list-style-type: none"> AMD Opteron™ Dual and Quad-Core Processors 	<ul style="list-style-type: none"> Delivers both 32- and 64-bit Enterprise-class computing for increased scalability of applications while not requiring instruction set changes HyperTransport Technology and integrated 128-bit wide DDR memory controller 	<ul style="list-style-type: none"> Deliver system computation results with lower power Compatible with x86 / x64 operating systems and applications
<ul style="list-style-type: none"> Support for AMD Opteron Quad Core Split Plane feature in the processor module 	<ul style="list-style-type: none"> Dual Dynamic Power Management Separate power planes for cores and memory controller enable cores to operate at reduced power consumption levels while offering full performance for memory intensive workloads that aren't compute constrained. 	<ul style="list-style-type: none"> This feature optimizes performance while minimizing power consumption. Dual Dynamic Power Management also improves performance by 3-10%, depending on the number of processors in a system and the workload.

Feature	Function	Benefit
<ul style="list-style-type: none"> Up to 16GB/s of bi-directional I/O 	<ul style="list-style-type: none"> 4 PCI-Express slots at 8X (20Gbit/s) 2 PCI-Express slots at 4X (10Gbit/s) 2 PCI-X slots at 100MHz 	<ul style="list-style-type: none"> Many I/O choices available Enable support for high-availability cluster technologies Delivers applications results for transactions based applications, as well as data analysis applications
<ul style="list-style-type: none"> Support for AMD quad core Dual Dynamic Power Management™ (DDPM™) (split plane) on each quad core processor module (only) 	<ul style="list-style-type: none"> Support per processor for this feature, which provides optimum memory bandwidth and performance. Separate power planes for the cores and the memory controller allow power to be distributed efficiently and use different voltages to increase memory controller operational frequencies by up to 200MHz for increased throughput and CPU performance. In multi-socket systems, memory controllers can continue to run at high frequency even while the cores throttle back — maintaining NUMA high-bandwidth performance. This can increase throughput while allowing under used cores to reduce frequency and voltage levels to decrease platform power consumption and noise generation 	<ul style="list-style-type: none"> Up to 10% improvement in system performance, depending on applications
Raising the Bar for Industry Standard Servers with Reliability and Expandability		
<ul style="list-style-type: none"> ECC memory with ChipKill, light indicator on each DIMM slot to indicate any error 	<ul style="list-style-type: none"> ECC provides automatic single-bit error correction ChipKill allows a single DRAM chip to fail and the system will continue to run System tracks memory errors in system logs DIMM slot light indicator for memory errors on processor board module – no power is needed 	<ul style="list-style-type: none"> Continued system operations
<ul style="list-style-type: none"> Integrated 4 Gigabit Ethernet with port aggregation and failover 	<ul style="list-style-type: none"> Outstanding network I/O performance Port aggregation to increase bandwidth Network Failover support with network drivers for Windows, Linux, Solaris. 	<ul style="list-style-type: none"> Increased network connectivity without need for PCI cards Increased system availability Higher I/O bandwidth on Ethernet networks
<ul style="list-style-type: none"> 0 to 4 Hot-swappable SAS HDDs 	<ul style="list-style-type: none"> With 0 disks, system can be booted with other options High performance 10Krpm and 15Krpm disks 	<ul style="list-style-type: none"> Fast system operations with local disks
<ul style="list-style-type: none"> Integrated Hardware RAID 0, 1, 0+1 	<ul style="list-style-type: none"> RAID support for local disks to provide redundancy in case a disk fails Striping across disks is supported 	<ul style="list-style-type: none"> High disk performance with striping Protection against disk failures



Feature	Function	Benefit
<ul style="list-style-type: none"> Multiple boot options 	<ul style="list-style-type: none"> Boot from USB Boot from DVD Boot from network Boot from choice of disks Boot from PCI controlled disk arrays 	<ul style="list-style-type: none"> Expedite deployment and testing of server
<ul style="list-style-type: none"> Integrated DVD-R/CDRW 	<ul style="list-style-type: none"> Read DVD, booting off DVD CD read / write function with appropriate software in operating system 	<ul style="list-style-type: none"> Easy software and system installation, updates Easy loading of data Backup of some data in system
<ul style="list-style-type: none"> 2+2 Redundant hot-swap high-efficiency power supplies 	<ul style="list-style-type: none"> Up to 2 power supplies could fail and system continues to run System generates notifications via ILOM if a power supply fails Support for two power sources in data center 	<ul style="list-style-type: none"> Increased IT infrastructure availability Lower power consumption with 87% efficient power supplies
<ul style="list-style-type: none"> Front and back LED indicators with system identification switch 	<ul style="list-style-type: none"> Manual or remote control of front/back light 	<ul style="list-style-type: none"> Easy to identify system in a rack, from the front or the back
<ul style="list-style-type: none"> Fans: Redundant, hot-swap, easily replaceable, variable speed 	<ul style="list-style-type: none"> Front access – w/o need to remove top cover Provides controlled cooling of the processor boards Fan speed varies with ambient and CPU temperature 	<ul style="list-style-type: none"> Non disruptive replacement of fans, as system cables in the back do not move much with front access fans System can continue to operate with a fan failure
<ul style="list-style-type: none"> Standard 19" rack mount, 4U form factor, 24" depth 	<ul style="list-style-type: none"> Compatible with industry standard 19" racks 4U (7") height allows up to 10 X4600 M2 servers in a 40U high rack cabinet 24" depth allows servers to easily fit into most 19" racks, with extra room in the back of server for cables 	<ul style="list-style-type: none"> Fits into most customer installations Easy to plan for space allocation in crowded data centers
<ul style="list-style-type: none"> Simple to install rack-mount kit 	<ul style="list-style-type: none"> Comes standard with each server 	<ul style="list-style-type: none"> Quick to install server onto a rack
<ul style="list-style-type: none"> Cable management arm 	<ul style="list-style-type: none"> Manage cables connected to the system in the back Moves with server if the server is slid in and out of the rack 	<ul style="list-style-type: none"> Increase systems availability by ensuring that cables mounted to the server are organized and also ensures that cables can move with the server if it is slid in and out of the rack
Operating System and Management Environment		

Feature	Function	Benefit
<ul style="list-style-type: none"> Sun Integrated Lights Out Manager (ILOM) – Advanced Remote Lights Out Management 	<p>Sun Integrated Lights Out Manager (ILOM):</p> <ul style="list-style-type: none"> Remote management with full Keyboard, Mouse, Video, Storage (KVMs) Remote media capability (floppy, CD etc.) Full DMTF CLI scripting Browser UI for control of the system through a graphical interface. IPMI 2.0 compliant for management and control SNMP v1, V2c, V3 for system monitoring Monitor and report system and component status on all FRUs Remote power on/off/reset Remote system firmware updates Same management framework for all Sun x64 servers 	<ul style="list-style-type: none"> Reduce customer sustaining costs by allowing the server to be managed remotely All management which does not require physically touching the system can be performed remotely Easily integrates into customer's existing management environment by supporting industry standards
<ul style="list-style-type: none"> Sun Installation Assistant for Windows server, Linux 	<ul style="list-style-type: none"> Helps install Windows Server, Red Hat and SUSE Linux supported on this system. Administrator simply boots from this CD and follows the instructions, providing their Linux OS media when prompted. Automatically installs any required drivers to maintain system performance and reliability 	<ul style="list-style-type: none"> Fast, simple installation of Windows Server, Linux Helps to greatly improve customer experience at setup time
<ul style="list-style-type: none"> OS pre-install options 	<ul style="list-style-type: none"> Choice of Solaris 10 or Windows 2003 Server 	<ul style="list-style-type: none"> Enable for fast system operation right after customer receives server
<p>Support for:</p> <ul style="list-style-type: none"> Solaris 10 OS on x64 (32/64 bits) RHEL 3 64-bit (max 8 processor cores) RHEL 4 64-bit RHEL 5 64-bit SLES 10 64-bit Windows Server 2003 Enterprise & Standard Editions (32-bit) Windows Server Enterprise & Standard Editions 2003 (64-bit) VMware ESX 3.x 	<ul style="list-style-type: none"> Run applications on industry standard platform running OS of choice 	<ul style="list-style-type: none"> Customers can standardize on one hardware platform for most of the data center applications, which reduces management and operational costs Consolidation of applications using Solaris containers or VMware helps increase server utilization and reduce costs Maximize application performance with best OS Ease transition to 64-bit computing Maximize IT investment by standardizing hardware to reduce required training and spares

AMD Enhanced Quad-Core Features

The new enhanced quad-core AMD Opteron CPU introduces improvements on performance

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and power efficiency. AMD-V has been designed for 25% faster "world switch" time with enhanced Rapid Virtualization Indexing. With the enhanced AMD Opteron Quad-Core processors, AMD has been able to reduce their chip size from 65nm to 45nm. This reduction enables the enhanced Quad-Core processors to achieve higher clock frequencies while staying within the same power envelope of predecessor 65nm processors. AMD Smart Fetch technology helps reduce power consumption by allowing idle cores to enter a halt state. These technologies has been shown to reduce system level power consumption by up to 15W.

The enhanced quad-core AMD Opteron processor also has an increased 6MB L3 cache, which improves multi-threaded application performance and avoid thrashing. The large, on-die high-speed L3 cache helps improve performance of transaction-intensive applications and databases such as CRM, ERP and messaging.

AMD Quad-Core Features

Dual Dynamic Power Management ("splitplane")

Separate power planes for cores and memory controller enable cores to operate at reduced power consumption levels while offering full performance for memory intensive workloads that aren't compute constrained. This feature optimizes performance while minimizing power consumption. Dual Dynamic Power Management also improves performance by 3-10%, depending on the number of processors in a system and the workload. The processor module for Sun Fire X4600 M2 supports this feature.

AMD-V with Rapid Virtualization Indexing ("Nested Page Table")

New Rapid Virtualization Indexing of AMD Virtualization technology moves address translation from software to hardware and improves performance of guest Oses in systems running virtualized environments. Increased performance and efficiency are seen for many virtual workloads, which drives increased system utilization, allowing for a higher performing, more flexible IT environment. This is a new, and AMD unique feature.

Notes: If using VMware, VMware ESX 3.5 update 1 or ESX 3.0.3 is required for Quad Core.

AMD Balanced Smart Cache

Dedicated L1 and L2 cache on each core and shared L3 enables a more balanced approach to achieving high performance. Larger caches require more power. Intel Harpertown has large L2 cache, which is shared across 2 cores. In that design, only one core can use L2 cache at a time; other core can then only use only use L1 cache, which can result in lower performance. Large L2 caches drive up system heat and energy costs.

AMD Wide Floating Point Accelerator

128-bit SSE floating point capabilities enable each processor to execute **up to four flops per clock per core** for significantly improved performance on compute intensive applications. This feature is unique to Opteron.

Memory Optimizer Technology

AMD Memory Optimizer Technology optimizes memory bandwidth for quad- core operation, improving performance of multi-threaded software environments. A prefetcher cache area manage the way instructions access memory and are processed by cores – located very close to the cache location, prefetchers watch the instruction stream (order/size) and predetermine what cache (L1/L2/L3) is optimal. This feature allows AMD Opteron Quad Core systems to

scale more efficiently, particularly on virtualized applications and more intensive workloads.

Independent Dynamic Core Technology (formerly known as PowerNow)

The CPU cores performance and power work in concert with the operating system to automatically optimize performance and power to match the compute workloads, thus reducing processor heat & energy consumption during non-peak compute activities. Requires native core chip design, so unique feature to AMD Opteron processors. Released in Dual Core, enhanced for Quad Core. Requires customer is running an OS which supports PowerNow and that customer enables PowerNow feature in BIOS.

AMD CoolCore Technology

Automatically turns off portions of the process logic and memory controller when not is use, reducing processor energy consumption. AMD unique feature due to native core design. Feature always on/running. Enables systems to self-align to memory usage – e.g. If only doing lots of reads, then don't need to keep write powered.

Direct Connect Architecture & Integrated Memory Controller

AMD Opteron processors directly connect cores, I/O & memory, and include an integrated memory controller to eliminate performance bottlenecks seen in systems with front-side bus architectures. As virtualization is very memory-intensive, these features enable Sun's Quad Core systems to support more virtual machines per server and offer better performance of virtualized applications. These are AMD-unique features at this time.

These feature enables better scaling of more intensive workloads. Particularly on 4P and larger systems, AMD Opteron system will lead in a lot more areas, such as intensive workloads and large memory uses.

Product Family Placement

The Sun Fire X4600 M2 Server is the most powerful and expandable member in Sun's x64 server lineup. The Sun Fire X4600 M2 Server, with its 8 CPU-socket (or processor board) capacity, 256 GB of memory and eight PCI expansion slots, is a very strong alternative to the Sun Fire V40z server.

X64 Server Family Comparison

The Sun Fire X4600 M2 server is the high end system in Sun's x64 server product line. The X4600 M2 supports more AMD Opteron dual core and quad core processors than the other platforms, from 2 to 8 processors. It also supports up to 256GB of memory, doubles the amount of memory on the next high-end platforms (4-socket X4450 or Tucana or Sun Blade X8440).



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Features	Sun Fire X4600 M2 Server	Sun Fire X4420, Sun Blade 8000, X8440, Sun Blade 6480 (C48), X6440	Sun Fire X4450
Processors	2 to 8 AMD Opteron 8000 series dual-core or quad-core processors	Up to 4 AMD Opteron 8000 dual-core or quad-core processors	Up to 4 Intel dual-core or quad-core processors
CPU speed	2.4GHz to 3.2GHz dual core; 1.9GHz to 2.3GHz quad core (possible support for 2.5GHz ACP105W processors – TBD)	2.4GHz to 3.2GHz dual core; 1.9GHz to 2.5GHz quad core (some platforms)	Up to 3Ghz quad core
CPU interconnect-	HyperTransport@ 4 GB/s	HyperTransport@ 4 GB/s	Intel Front-side Bus
Max. memory - 8 DIMM slots/CPU	256 GB of DDR2/667 ECC registered DIMMs	128 GB of DDR2/667 ECC registered DIMMs	128 GB of FB DIMM (DDR2/667) ECC registered DIMMs
Internal HDDs hot-swappable	Up to four SAS (2.5") HDDs	Sun Blade 6480 has no disk; Sun Blade X8440 has 2 disks; X4420 has 8 SAS disks	Up to eight SAS HDDs
On-board RAID	RAID 0 & 1 (LSI 1064)	Mirroring, RAID 0, 1 (LSI 1064) for Sun Blade X8440 and X4420; X4420 has optional PCI-E RAID 5 controller	Mirroring, RAID 1 on board; with optional PCI-E RAID 5 controller
On-board Gigabit Ethernet	Quad gigabit Ethernet (Intel)	Quad gigabit Ethernet (Nvidia) for X4420	Quad gigabit Ethernet (Intel)
Removable media	DVD/CDRW	DVD-RW	DVD-RW
Expansion Slots	Two PCI-X 64-bit/100 MHz slots, Six 64-bit PCI-E Slots (four x8-lane, two x4-lane)	Sun Blade has 2 PCI-E hot-swap slots and 2 to 4 Network Express module options. X4420 has 6 PCI-E slots (2 x16, 4 x8)	6 PCI-E (2 x16, 4 x8)
Service Processor	ILOM	ILOM	ELOM
In-band management	IPMI v2.0 via KCS driver SNMP OS-resident agent	IPMI v2.0 via KCS driver SNMP OS-resident agent	IPMI v2.0 via KCS driver SNMP OS-resident agent
Out-of-band management	IPMI v2.0, DMTF CLI, SNMP- v1, v2c, v3, Web GUI	IPMI v2.0, DMTF CLI, SNMP- v1, v2c, v3, Web GUI	IPMI v2.0, DMTF CLI, SNMP- v1, v2c, v3, Web GUI

Features	Sun Fire X4600 M2 Server	Sun Fire X4420, Sun Blade 8000, X8440, Sun Blade 6480 (C48), X6440	Sun Fire X4450
Remote management features	Remote Keyboard, Video, Mouse (KVM), Video redirection, Remote media functionality, Remote power control remote access to BIOS, remote FRU status, monitoring. Logging, role-based access control	Remote Keyboard, Video, Mouse (KVM), Video redirection, Remote media functionality, Remote power control remote access to BIOS, remote FRU status, monitoring. Logging, role-based access control	Remote Keyboard, Video, Mouse (KVM), Video redirection, Remote media functionality, Remote power control remote access to BIOS, remote FRU status, monitoring. Logging, role-based access control
System management paths	A single dedicated management 100BaseT port, system serial port and four system Ethernet ports	Sun Blade 8000 has built-in ILOM which are aggregated into the system management modules; X4420 has a single dedicated management 100BaseT port, system serial port and four system Ethernet ports	A single dedicated management 100BaseT port, system serial port and four system Ethernet ports
RU height	4U	X4420: 2U Sun Blade 8000 is 19U with max 10 blades; Sun Blade 6000 is 10U with max 10 blades	2U
Depth	24 in. 629 mm	Est. 30 in.	Est. 30 in.
Power supply	Four 2+2, Redundant, Hot-Swappable, 89% efficiency 950W each	Redundant, Hot-Swappable	Redundant, Hot-swappable
O/S	See http://www.sun.com for latest operating system support for each product		

Key Messages

The Sun Fire X4600 M2 provides a scalable platform that is cost effective and power efficient to address enterprise server and desktop consolidation and virtualization needs. With x64 processor scalability from 4 to 32 cores, the Sun Fire X4600 M2 offers a very scalable database platform to run transaction processing and data warehousing analysis that supports a variety of database applications running on Solaris, Linux, or Windows Server. With its large 1/4 terabytes of maximum memory with high performance processors, the Sun Fire X4600 M2 also addresses complex EDA, MCAE, and other HPC applications.

The Sun Fire X4600 M2 servers with AMD Opteron processors, packs the power of two 4P x64 servers into a single compact 4 RU, energy-efficient system. Its modular design makes upgrade to future quad-core processor technologies simple and non-disruptive. The server's virtualization options enable data centers to scale several times their capacity, providing higher ROI. InfoWorld awards this server as the "Best High-Performance Server" for 2007.

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At A Glance

- Industry's first 4 RU modular x64 server expandable from 2 to 8 processors , now up to 32 processor cores
- Supports up to 256GB of memory to accelerate data access and analysis
- Server longevity with upgradeability to future quad-core processor technologies
- Designed for efficient power and cooling
- Built-in management with remote KVM
- Supports high availability clustering
- Choice of virtually any OS: Solaris, Linux, Windows, VMware
- Available as a Sun System Pack, which combines the Sun Fire X4600 with the right services as one offering
- With up to 64 memory slots, the server lowers cost by half for smaller memory deployment

Key Applications

- Server consolidation and virtualization
- Database transaction processing
- Datawarehousing and analytics
- Large memory high performance applications such as EDA, MCAE, and other HPC applications

Sun Services reinforce your investment:

Services from Sun can add incredible value to your new x64 systems by making your choice of infrastructure virtually seamless and providing a safe choice for heterogeneous computing. The right combination of x64 servers and services from Sun can help significantly decrease your operational costs, help enhance availability and capabilities and foster standardization without vendor lock-in.

Whether you're running Solaris 10 OS, Windows OS or Red Hat and/or SUSE Linux, Sun's services offer you world-class heterogeneous support. Choose from a wide range of software and hardware support plans to keep your systems and applications running reliably and smoothly.

To get it right from the start, the proper installation of your hardware and software is critical. Sun experts help ensure you get the most out of your investment and optimize your system for ongoing stability and performance.

Sun is a leader in providing quality training, which can be a strategic differentiator for your business. It can improve system availability and productivity and decrease red alerts. Choose from a wide range of courses that offer the information you need – straight from the source of the technology you are purchasing.

In addition, if you're in need of a flexible approach to remote management and support for any competent from the network through the application layer – including your new Sun Fire x64 servers – Sun Managed Operations Services provides you with ITIL-based operations multi-vendor support for heterogeneous computing environments. Sun also provides remote support for products and custom software integrated within solutions designed, developed, and implemented by Sun.

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Target Customers

The Sun Fire X4600 M2 Server is targeted at enterprise customers that want industry-standard servers running Solaris™, Linux and Windows operating systems. Ideal for customers who have server consolidation, technical computing and business processing needs.

Target Markets

- Financial Services
- Telecommunications/Service Providers
- Government
- Manufacturing
- Manufacturing
- Energy
- Education & Research

Target Applications

- Virtualization (Sun xVM, Vmware, Solaris Containers)
- Server consolidation (Vmware, xVM)
- Desktop consolidation (Vmware, xVM, Sun desktop virtualization infrastructure)
- Databases: MS SQL server, Oracle 10g, IBM DB2, Sybase, TimesTen, MySQL, Postgres
- Datawarehousing: SAS, Oracle, Greenplum
- Virtual Tape Library
- Other MS applications: Exchange Server, Sharepoint Server, etc.
- SAP
- EDA, MCAE, Oil & Gas
- HPTC/Grid computing, support large number of users for computer job processing (e.g. Program compilation and development)

Market Value Proposition

The value proposition is centered on the key capabilities of the Sun Fire X4600 M2 server: 4 to 32 x64 cores (i.e. Up to 32-way symmetric multiprocessing) supporting Solaris, Windows Server, Linux, Vmware; and up to 256GB of memory and up to 16GB/s of bi-directional I/O, with redundant hot-swap power and cooling, in a compact 4U rack-mount form factor:

1. In a single 4U rack-mount space, the Sun Fire X4600 M2 with 8 enhanced quad-core processors and VMware virtualization technologies consolidates up to 114 rackmount servers. That is less than 1/57 the power usage and 1/57 the space of 2U servers. In addition, this is significant savings in management of servers as well.

A single 42U rack cabinet can house up to 10 Sun Fire X4600 M2 servers, which could virtualize over 1000 x86 systems. With only 10 servers in a single rack to manage, this is the simplest configuration in a single rack (with the fewest number of servers) that can manage so many virtual machines. This platform reduces acquisition and operating costs, as well as energy consumption.

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2. Very scalable solution server virtualization, offering twice the scalability of competitive 4-socket x64 servers. Customers can virtualize and consolidate with up to 1/2 less servers, reducing total cost of ownership by maintaining half the number of servers and reducing power consumption by up to 1/2 of competitive servers.

Server sprawl and under utilization of resources in today's data centers are driving the need for IT managers to do more with fewer resources, while reducing cost and complexity in their data centers. Sun's new Sun Fire X4600, midrange server can help customers stay one step ahead of their competitors with disruptive technology at economic pricing. The server has demonstrated VMware scalability from 2 to 8 socket with 350% scalability. (<http://www.sun.com/servers/x64/x4600/VMScaling-Final3.pdf>)

3. Very scalable and very high performance database operations, both transaction processing and data warehousing, 2X the processor scalability than competitive 4-socket x64 servers and at less than 1/2 the costs of RISC based servers (e.g. IBM Power, HP Itanium).

The Sun Fire X4600 M2 has proven itself with customers in running database. With Oracle database for transaction processing, eHarmony found the Sun Fire X4600 M2 outperforms other 4-8-socket server at much lower cost. In running Microsoft SQL Server, the Sun Fire X4600 M2 scales 2X better than other 4-socket x64 servers, where customers are running out of head-room. Many customers have found that the X4600 M2 runs more transactions and solves bigger data warehouse cubes than competitive products on MS SQL server. The server's relatively low cost 256GB of memory allows database to run faster and process better than other x64 servers who are limited to 128GB or very expensive in supporting more than 128GB of memory.

4. Large memory and up to 32 high performance processors at relative low costs (similar pricing as 16-core X4600 in early 2007) makes the Sun Fire X4600 M2 ideal for many high performance applications, such as Electronic Design (EDA), Design/Analysis (MCAE), Oil & Gas, Financial, multi-user grid computing, Virtual Tape Library, Video streaming, and many emerging applications.

Availability

The Sun Fire X4600 M2 Server has been shipping since 2006. Enhanced Quad-Core support on the X4600 M2 is scheduled for December 10, 2008 for Revenue Release and December 17, 2008 for General Availability.

Enabling Technology

Technology Overview

The Sun Fire X4600 M2 Server is a symmetric, multiprocessor, x64-based, rack-optimized server which has the following system architectural features:

- AMD Opteron processors
- Fast and low power memory
- HyperTransport technology
- Non-volatile boot media
- Integrated Lights Out Management (ILOM) with a dedicated Service Processor

AMD Opteron Processor

The AMD Opteron processor is part of a new computing platform that extends the ubiquitous x86 architecture to accommodate x64 64-bit processing. Formerly known as x86-64, AMD's enhancements to the x86 architecture allow seamless migration to the superior performance of x64 64-bit technology. AMD's Opteron processor was designed as CMP (Chip-level Multi-processing) from the start with Crossbar Switch and System Request Interface. This approach defines a new class of computing by combining full x86 compatibility, a high-performance 64-bit architecture, and the economics of an industry-standard processor.

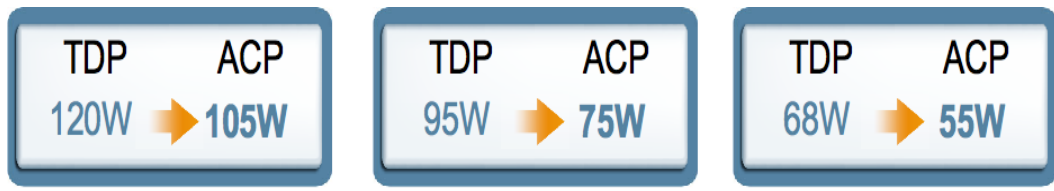


Figure 1. Power Consumption for Socket F Quad-Core AMD Processors

Socket F is not a traditional socket but a Land Grid Array (LGA). This means that there are no pins on the processor, but only small pits. These pits make contact with the slightly spring landing-points on the system board. This approach gives multiple advantages, such as a higher contact point density and better electrical properties. Socket F has 1207 lands that are used for either dual- or quad-core processors in the Sun fire X4600 M2 server. As shown in figure 1, Dual-Core socket F processors are based on the second-generation AMD Opteron processors. Quad-core uses the same socket and can be upgraded from socket F dual-core processors. It is important to note that older "Rev E" processors are not compatible because they are 940 pin processors.

Third-generation AMD Opteron processors are quad-core Barcelona processors only. All the features associated with third-generation processors as described below and only apply to quad-core processors.

Second-Generation (Dual-Core) AMD Opteron Processor

The Second-Generation AMD Opteron processors are native Dual-Core AMD Opteron processors with Direct Connect Architecture. AMD Opteron processors feature a common core architecture that is consistent across 1-, 2-, 4-, and 8-socket systems and is also consistent with previous AMD Opteron processors. This strategy helps Sun customers to minimize the cost of

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transition and maximize past investments in software and hardware optimization.

AMD Opteron processors are offered in three series: the 1000 Series (single socket), 2000 Series (up to 2 sockets), and the 8000 Series (4 to 8 sockets). The 1000 Series is built on AMD's new Socket AM2. The 2000 and 8000 Series are built on AMD's new Socket F (1207). The 8000 Series will be used exclusively in the Sun Fire X4600 M2 server.

The AMD Opteron processor has the integrated memory controller with 144 bits (128 addressable) to main memory. Also integrated on silicon are the three Hypertransport links that service inter-process and I/O communications. The two processor cores are located next to the Crossbar and System Request Interface. These two components have been in the AMD64 architecture from the first generation processors anticipating dual- and quad-core implementation. This design maintains two distinct processor cores but does not duplicate the memory controllers or HyperTransport links. The logic of how to manage inter-process communications between the cores and system resources are all managed by the Crossbar. The Crossbar runs at full core frequency to allow data to come into the processor at full speed. The Crossbar will also manage data flow to the memory controller and other Hypertransport I/O components.

The Next-Generation AMD Opteron Processor Design for Socket F (1207) (formerly known as "Rev F") is a redesign of the original AMD Opteron (formerly known as "Rev E") design and offer the following enhancements:

- New socket design, all native dual core processors
- Consistent processor power requirements
- Supports lower power DDR2 memory technology
- Consistent socket design and power requirements planned for Quad-Core AMD Opteron processors
- AMD PowerNow! Technology
- AMD Virtualization™ support (formerly known as Pacifica)

AMD Opteron processors leverage the same proven Direct Connect Architecture and CMP (Chip-level Multi-Processing) design features of the Dual-Core AMD Opteron processors, including:

AMD64 technology

- 64-bit operating systems to provide full, transparent, and simultaneous 32-bit and 64-bit platform application multitasking
- Runs existing installed base of 32-bit applications and operating systems at peak performance, while providing a 64-bit capable migration path
- Designed to enable 64-bit computing while remaining compatible with the vast x86 software infrastructure
- Enables a single architecture across 32- and 64-bit environments Direct Connect Architecture
- Helps to reduce the real challenges and bottlenecks of system architecture
- Memory is directly connected to the CPU, optimizing memory performance
- I/O is directly connected to the CPU, for more balanced throughput and I/O

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- CPUs are connected directly to CPUs allowing for more linear symmetrical multiprocessing
- Integrated Memory Controller on-die DDR2 DRAM memory controller offers available memory bandwidth up to 10.7 GB/s (with DDR2-667) per processor

Integrated DDR2 Memory Controller

- A 128-bit wide, on-chip DDR2 memory controller that supports ECC and ChipKill technologies and provides low-latency memory bandwidth which scales as processors are added
- Dedicated 1MB L2 Cache for each core

AMD HyperTransport™ Technology

- Provides a scalable bandwidth interconnect between processors, I/O subsystems and other chipsets
- The 8000 series Opteron Processor has three coherent HyperTransport technology links providing up to 24.0 GB/s peak bandwidth per processor

Quad-core upgradeability

- AMD Opteron processors with DDR2 memory are designed to offer a seamless upgrade path from dual-core to quad-core when they are available in 2008 in similar thermal envelopes to help leverage existing investments
- Maintain the same platform at similar power efficiency

AMD Virtualization™ (AMD-V™)

- Reduces overhead by selectively intercepting instructions destined for guest environments
- Direct Connect Architecture helps guests run at near native speed
- Virtualization-aware integrated memory controller provides efficient isolation of virtual machine memory

Enhanced performance-per watt

- Energy-efficient DDR2 memory uses up to 30% less power than DDR1 and up to 58% less power than FBDIMM
- AMD PowerNow!™ technology with Optimized Power Management can deliver performance on demand while minimizing power consumption
- DDR2 platforms can upgrade to quad-core AMD Opteron processors within existing thermal bands for significantly better performance-per-watt

AMD HyperTransport™ Technology

HyperTransport technology is a high-speed, low latency, point-to-point link designed to increase the communication speed between integrated circuits in computers, servers, embedded systems, and networking and telecommunications equipment. The Next-Generation AMD Opteron processor continues to use HyperTransport Technology links to provide a scalable bandwidth interconnect among processors, I/O subsystems, and other chip sets.

HyperTransport Technology:

- Helps increase overall system performance by removing I/O bottlenecks typically found in

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Front Side Bus (FSB) architectures and efficiently integrating with legacy buses, increasing bandwidth and speed, and reducing latency of processors.

- Provides up to 8 GB/sec. bandwidth per link at 16x16 bits, 1 GHz operation, providing sufficient bandwidth for supporting new interconnects, such as PCI-Express.
- Provide significantly more bandwidth than current technologies
- Use low-latency responses and low pin counts
- Maintain compatibility with legacy PC buses while being extensible to new SNA (Systems Network Architecture) buses.
- Appear transparent to operating systems and offer little impact on peripheral drivers.
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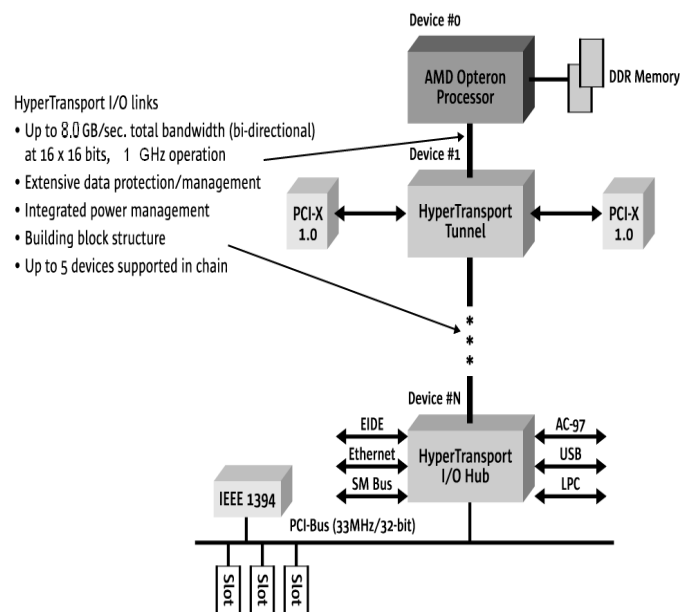


Figure 2. Sample HyperTransport Technology Interconnect Block Diagram

Third-Generation (Quad-Core) AMD Opteron Processor

AMD's native Quad-Core Opteron processors incorporate four processor cores on a single die of silicon. The Quad-Core AMD Opteron processors are electrical-, thermal-, and socket-compatible with the Next-Generation AMD Opteron Socket F (1207) processors.

AMD's Quad-Core AMD Opteron processors go far beyond simply adding two more cores, but rather presents a "native" multi-core design where all four cores are on one piece of silicon. Quad-Core AMD Opteron processors feature Direct Connect Architecture, which means you have processors directly connected to one another, and an I/O and Memory Controller directly connected to each processor to reduce bottlenecks for better performance. Furthermore, Quad-Core AMD Opteron processors are not only the industry's first native x86 quad-core processors, they are also the first quad-core processors designed within the same thermal and power envelopes as AMD's current generation of dual-core processors.

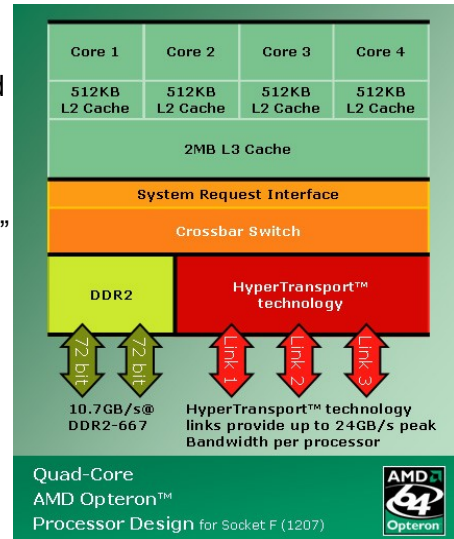


Figure 3. Third-Generation Quad-Core Processor Block Diagram

Designed from inception for the most demanding datacenters, the Quad-Core AMD Opteron processor brings significant enhancements to market in four critical areas:

Processor Design for Energy-Efficiency

- AMD CoolCore™ technology can reduce energy consumption and heat generation by turning off unused parts of the processor. Independent Dynamic Core Technology, an enhancement to AMD PowerNow! technology, allows each core to vary its clock frequency depending on the specific performance requirement of the applications it is supporting, helping to reduce power consumption.
- Dual Dynamic Power Management (formerly called "splitplane") provides an independent power supply to the cores and to the memory controller, allowing the cores and memory controller to operate on different voltages, depending on usage.

Investment Protection

- Quad-Core AMD Opteron processors maintain compatibility with the socket and thermal envelopes of Second-Generation AMD Opteron processors to enable a seamless upgrade path.

Virtualization

- Virtualization is memory intensive and the Quad-Core AMD Opteron processor provides exceptional memory throughput through its integrated memory controller.
- The Sun Fire X4600 M2 server is designed for virtualization with quad-core processors and eight memory slots per processor for memory and CPU intensive workloads.
- AMD Virtualization introduces Rapid Virtualization Indexing (formerly called "Nested Paging") and Tagged TLBs. AMD's Rapid Virtualization Indexing feature is designed to

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reduce the overhead penalty associated with virtualization technologies by moving the process of managing virtual memory from software to hardware, reducing the complexity of existing x86 virtualization solutions and enabling increased performance and efficiency for many virtual workloads, allowing for a higher performing, more flexible IT environment.

High-Performance Computing

- AMD Memory Optimizer Technology increases memory throughput by up to 50% compared to previous generations of the AMD Opteron processor.
- AMD Wide Floating Point Accelerator provides 128-bit SSE floating point capabilities, which enable each core to simultaneously execute up to four FLOPS per clock (four times the floating-point computations of previous AMD Opteron processors) for significantly improving performance in compute-intensive and workstation applications.
- AMD Balanced Smart Cache provides significant cache enhancements with 128KB L1 cache and 512KB L2 cache per core and 2MB shared L3 cache across all four cores.

Processor Design for Energy-Efficiency

Power consumption continues to be one of the top concerns for managing today's datacenters. AMD Opteron processors address this concern by providing customers with industry-leading overall power-efficiency and can deliver significant performance gains over dual-core AMD Opteron processors while operating in the same thermal infrastructure. The Next-Generation AMD Opteron processors will further define a new standard in performance-per-watt with PowerNow!(TM) capabilities and energy-efficient DDR2 memory support, while maintaining a consistent maximum 95-watt thermal design power envelope. The memory capacity offered with AMD's Direct Connect Architecture, customers can have the memory performance they require with DDR2 and avoid the premature use of memory technologies that are not yet at an optimal price-to-performance ratio and that require more power. All AMD Opteron processor series - current Dual, Quad-Core, and future AMD Opteron processors - have all been designed to a consistent power requirement (thermal window).

Processor Longevity

The AMD Opteron processor socket design is planned to remain identical as AMD transitions the Next-Generation AMD Opteron processor to its upcoming Quad-Core AMD Opteron processor. Both generations of AMD Opteron processors are planned to maintain consistent processor power requirements, utilize DDR2 memory and feature an Integrated Memory Controller.

Sun servers compatible with Next-Generation AMD Opteron processor are planned to be upgradable to Quad-Core AMD Opteron processors with only processor and BIOS changes.

Consistent processor and system architecture design reduces total cost of system ownership. Less platform churn reduces application qualification and support costs. Consistent power requirements eliminate the need to reconfigure system racking or data center power.

Thermal Design Power (TDP) will continue to be leveraged for engineering thermal design maximum limits. TDP values are conservative engineering design limits and will be used by Sun engineering in the design of servers.

Average CPU Power (ACP)

ACP is a metric that offers a relevant estimation of the power consumption for Quad-Core AMD Opteron processors. ACP is determined by breaking down multiple components of power

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consumed within the processor, including the power dedicated to the cores, the integrated memory controller, and to HyperTransport™ technology links. ACP and TDP are both indicators of processor power. TDP refers to the thermal design power processors are capable of consuming that the specification system designers follow. AMD has referenced processor power consumption based off of TDP values to date. ACP represents a relevant wattage that reflects power consumption while running server-class enterprise workloads. ACP is a useful metric for data center operators to use when estimating power budgets to size their datacenters. TDP is more useful and relevant to system designers.

AMD Opteron Processor	AMD Opteron Processor	Low Power CPU Modules HE	Standard Power Modules	Performance Optimized Power SE
Dual- Core 8200 Series	TDP	68 W	95 W	120 W
Quad-Core 8300 Series	TDP	75 W	115 W	137 W
	ACP	55 W	75 W	105 W

Figure 4. AMD Opteron Processor Power Consumption

When discussing processor power, it is very important to read footnotes on competitive information to ensure comparisons are the same. Typically, AMD conservatively uses maximum power in their marketing materials, whereas Intel often utilizes average power or the equivalent to ACP. Sun's power calculator will use Average CPU Power (ACP) rather than Thermal Design Power (TDP). TDP values are used by Sun engineering for the design of these systems.

The Quad-Core AMD Opteron™ processor architecture contains a number of key energy efficiency improvements to reduce the amount of power consumed by our processors across a wide variety of usage scenarios and workloads. A new feature called Dual Dynamic Power Management (DDPM) provides the processors with additional power rails which are dedicated to the processor cores, to the HyperTransport technology links and internal memory controller. Separating the power rails of the cores from the internal memory controller allows each of the cores to independently adjust frequency for the given workload while also allowing for voltage changes to all the cores. This technology enables considerable power savings at the processor level during non-peak workloads. The ACP values for each power band include the power for the cores, integrated memory controller and HyperTransport™ technology links.

A consistent thermal window means a customer can migrate to the Next-Generation of a product without needing to reconfigure the quantity of servers per cabinet, add cabinets to the datacenter, or increase the power grid to the datacenter.

AMD Enhanced PowerNow!™

Enhanced AMD PowerNow!™ Technology is designed to reduce power consumption of the entire quad-core processor. The native quad-core design enables enhanced power management to address each of the four cores independently.

Dual Dynamic Power Management™ (formally “splitplane”) allows each processor to maximize the power-saving benefits of AMD PowerNow! technology without compromising performance.

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Dual Dynamic Power Management can reduce idle power consumption and allow for per-processor power management in multi-socket systems to decrease power consumption.

Independent Dynamic Core Technology allows each core to vary its frequency, based on the specific needs of the application. This allows for more precise power management to reduce data center energy consumption and thereby reduce total cost of ownership (TCO).

Power consumption is related to the voltage level of the voltage supply to the processor as well as the frequency of operation. General purpose systems are designed to operate at a voltage level and frequency level that meets their peak computational performance. This level of operation will consume significant amounts of power that is not useful at times when the peak processor performance is not required. Power is typically saved by reducing the supply voltage of the processor when peak performance is not needed. In this approach, the sections of the processor which are unused have the clock frequency reduced which reduces power. As shown in Figure 5, the core frequency with the dual-core CPU is locked based on the core 0 load characteristics. Core 1 will operate at the same core frequency even though it's load characteristics are low. With Independent Dynamic Core Technology, the native quad-core processor can operate each of the cores at different frequency based on the load characteristics of that particular core.

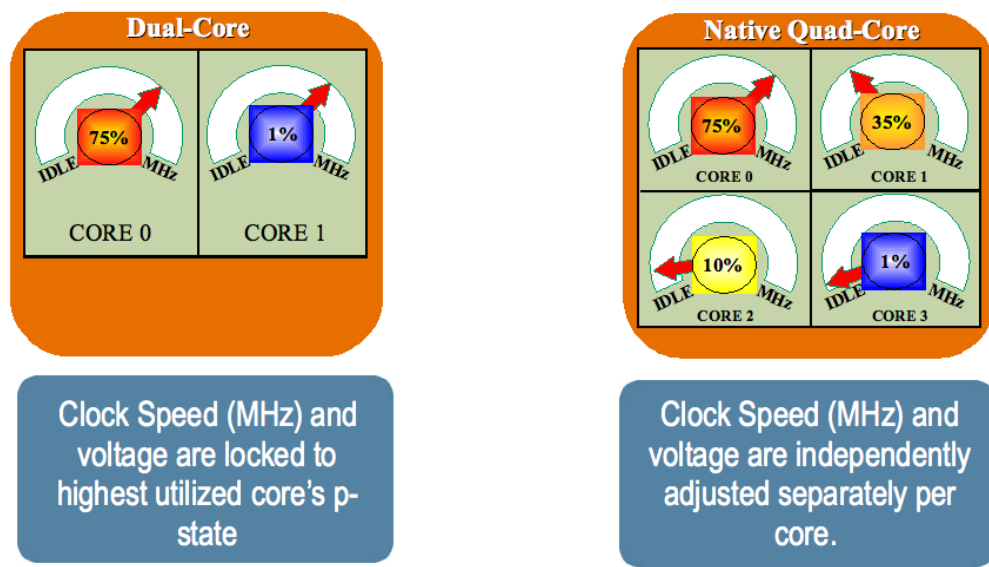


Figure 5. AMD Enhanced PowerNow! Technology – Dual core versus Quad core

Dual Dynamic Power Management™

This technology allows each processor to maximize the power-saving benefits of AMD PowerNow! technology without compromising performance. Dual Dynamic Power Management can reduce idle power consumption and allow for per-processor power management in multi-socket systems to decrease power consumption.

Today's AMD Opteron™ processor use a unified voltage plane for the memory controller and processor cores. AMD's Second-generation CPUs (Rev F) work in unified plane motherboards and will not offer the benefits of Dual Dynamic Power Management as described below.

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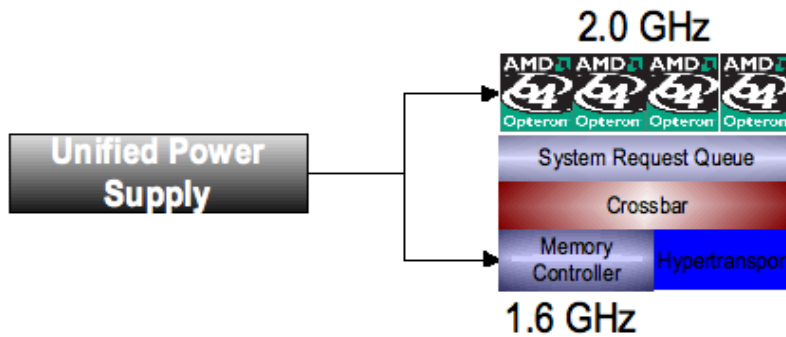


Figure 6. AMD's Unified Power Supply for Second-Generation

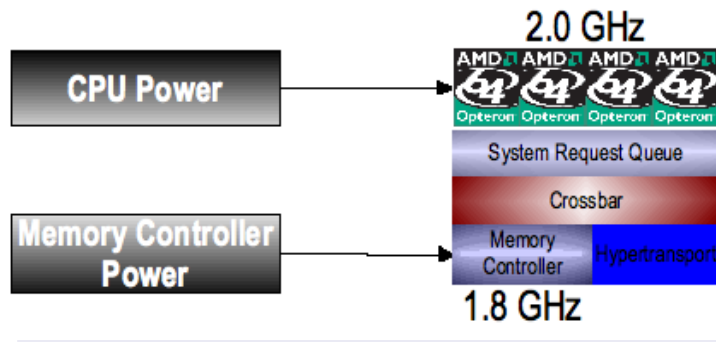


Figure 7. AMD's Independent Supply Voltage for Third-Generation

The above block diagram shows that AMD's third generation power for the CPU and Memory Controller are powered from independent voltage supplies, offering greater performance and better power management. Second-Generation AMD (Rev F) Opteron processors are still compatible with motherboards designed to support Dual Dynamic Power Management but they will deliver the same voltage to the CPU and Memory Controller power.

High Performance Computing

Sun's high performance dual- and quad-core AMD Opteron servers are used in a host of applications including data centers, research universities, oil and gas exploration, molecular modeling, video rendering, large compute clusters, and many more. Sun's significant contribution to high performance multi-core computing is mainly due to Sun's innovative design characteristics of the system.

Hypertransport Dual Link

Hypertransport Dual Link refers to a two or four socket CPU system configuration in which the processors are connected by a pair of HyperTransport™ Technology links. Each link represents a HyperTransport path that runs at speeds up to 1GHz. This means that each link has up to 8GB/s available of theoretical bandwidth between each CPU and each CPU's attached controllers. With dual link the peak available bandwidth between the two processors doubles to 16GB/s – 3-5% actual system performance gain. The Sun Fire X4600 M2 server is designed in a multi-processor configuration using four AMD's 8000 series processors. The 8000 series processor has three coherent Hypertransport links. The coherent link allows each processor to access another's memory. Dual links work together to "gang" coherent links to provide a 3-5% performance boost.

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Figure 8. Dual Link HyperTransport Technology

Memory Technology

AMD's Opteron processors integrate a DDR memory controller directly into the processor. The memory controller is running close to the processor's core frequency and greatly increases bandwidth to the processor at significantly reduced latencies. The performance-enhancing effect is even more dramatic within an AMD Opteron multiprocessing environment, because each additional processor has its own memory controller thereby scaling memory bandwidth within the server.

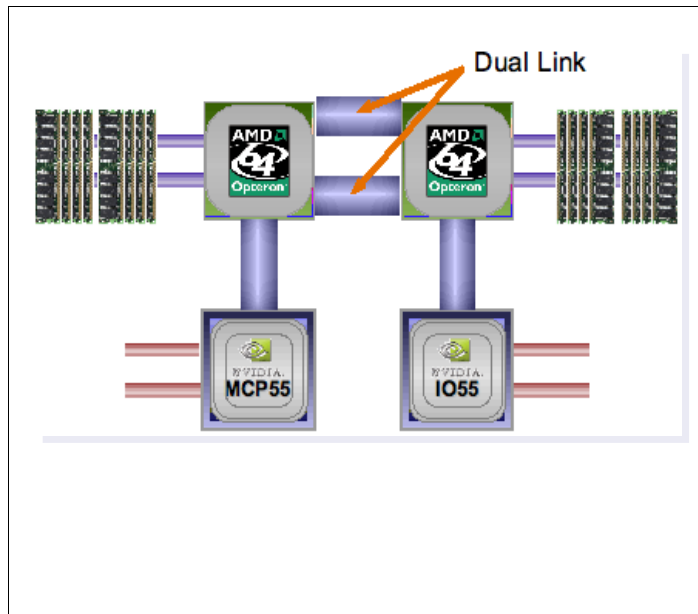
The processors in the Sun Fire X4600 M2 sever are designed to work with Double Data Rate (DDR) SDRAM.

Similar to first-generation DDR memory, DDR2 memory cells transfer data both on the rising and falling edge of the clock (a technique called "dual pumping"). The key difference between DDR and DDR2 is that in DDR2 the bus is clocked at twice the speed of the memory cells, so four words of data can be transferred per memory cell cycle. Thus, without speeding up the memory cells themselves, DDR2 can effectively operate at twice the bus speed of DDR.

The third-generation processor's monolithic design allow much faster sharing of data between all four cores, the integration of the memory controller within the processor allows for much faster data retrieval from system memory. The memory controller access external DRAM with 128-bit wide and supports up to eight (8) registered DDR DIMMs per processor on the Sun Fire X4600 M2 sever. The available memory bandwidth for each processor is up to 10.7 GB/s (with PC2-5300 memory) when the memory bus is clocked at 333 MHz (DDR2-667). If the Sun Fire X4600 M2 is configured with all eight DIMM slots occupied with DDR2-667 the memory bus will operate at 667MHz. Quad-core AMD Opteron processors will be eventually configured with 800MHz DDR2 DIMMs and will operate at 800MHz with four DIMMs per processor. However, with more than four 800 Mhz DIMMs, the bus clocks down to 667 Mhz.

The following diagram shows AMD's Opteron processor architecture featuring the cache controller and three stages of caches. The dedicated 128KB L1 cache with 64KB used for instructions and 64KB for data. Unlike Intel's processor it delivers 2 data loads per cycle instead of one. The latency for the L1 cache is three clock cycles with very fast access time.

The quad-core architecture also has dedicated 512KB L2 cache to eliminate conflicts common in shared caches. The L2 cache was designed for those applications that are running on a single core and use up all or most of the L3 2MB cache. This is a problem on other architectures that do not have three levels of cache because the shared cache is servicing one core and the others are starved. Processor threads running on other cores can run effectively from the L2 cache which is sized to accommodate the majority of working sets today. The Opteron processor is shown in the following diagram with four separate 512KB L2 caches. These caches are 16-way set associative, and the latency for each core to retrieve data from its L2 cache is 12 clock cycles.



The Sun Fire X4600 M2 processor features a large, shared L3 cache that is 2MB in size. The L3 cache is shared by all cores, whether it's a dual- or quad-core processors. The L3 cache is 32-way set associative and is based on a non-inclusive victim cache architecture. The latency for any core to retrieve data from the L3 cache is less than 38 clock cycles.

The memory controller for the Sun Fire X4600 M2 server is built directly into the Opteron 64 bit processors. Normally, memory controllers are part of the motherboard to which the processor is attached. With the memory controller built on the processor this considerably reduces the time it takes the processor to access memory, since data need only travel between the processor and the physical memory. Communication with the controller that arranges the data flow does not need to be passed outside the processor, reducing the amount of computing cycles lost while waiting for the memory to respond.

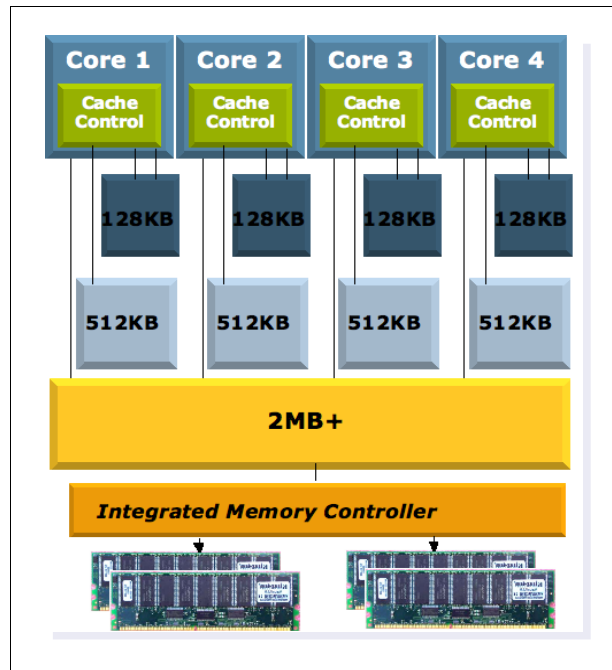


Figure 9. Third-Generation Opteron Processor Architecture

AMD has selected to support the proven technology of DDR2 memory for its Next-Generation and third-Generation Quad-Core AMD Opteron processors for both cost and technology stability reasons. DDR2 memory reduces the cost of system acquisition as DDR2 DIMMs are priced less than FBDIMM.

DDR2 memory features lower operational costs as DDR2 memory requires less power than FBDIMM. FBDIMM utilizes a first-generation memory buffer chip that draws additional power. As shown in the following table, DDR2 memory uses 30% less power¹ than DDR1 and DDR2 memory uses 58% less power¹ than FBDIMM.

Processor	Memory Type	Memory Power ¹ (W) for 8 DIMM
Single- and Dual-Core AMD Opteron (Rev. E)	DDR1	50 W
Intel Irwindale and Paxville	DDR2	35 W
Next-Generation AMD Opteron (Rev. F)	DDR2	35 W
Intel Dempsey, Woodcrest	FBDIMM	83 W
Quad-Core AMD Opteron	DDR2	35 W
Intel Clovertown	FBDIMM	83 W

(1) Measurement based on average power of DDR1, DDR2 and FBDIMM.

AMD Virtualization™ Technology

Virtualization enables data centers to achieve higher levels of efficiency, utilization and flexibility by dividing a computer into several virtual machines or consolidating many systems onto one physical machine. AMD's Virtualization (AMD-V) technology, which takes some tasks that virtual machine managers (VMMs) perform in software, through emulation, and simplifies them through enhancements to the AMD Opteron instruction set. AMD Virtualization Technology was announced in 2004, under the code-name Pacifica, and AMD released technical details in mid-2005.

Quad-Core AMD Opteron processors with Direct Connect Architecture enable industry leading virtualization platform efficiency. Featuring AMD-V technology with Rapid Virtualization Indexing, Quad-Core AMD Opteron processors can accelerate the performance of virtualized applications and improve efficiency of switching among virtual machines. This feature will allow Sun customers to host more virtual machines and users per system to maximize the consolidation and power saving benefits of virtualization.

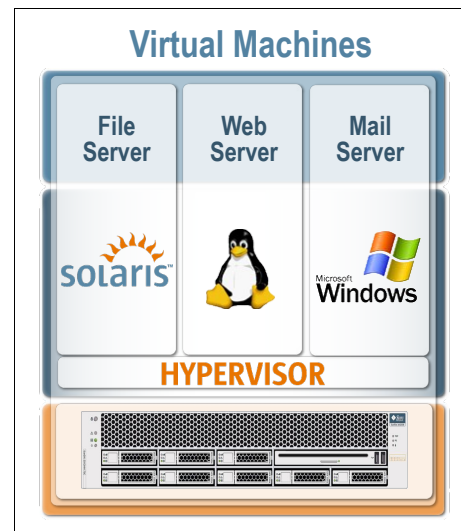


Figure 11. Virtualization on the Sun Fire X4140

Virtualization technology is a very memory intensive application that places a heavy demand on servers resources. Virtualization software must manage multiple virtual environments while still delivering application and data services to users in a timely fashion. The Sun Fire X4600 M2 server is a natural fit because of their performance within this type of environment.

Second-Generation AMD Opteron processors improve virtualization by improving system performance and security of virtual environments. AMD Virtualization technology, consisting of hardware extensions to the x64 system architecture, is designed to help virtualization software more efficiently run applications. These applications run in separate isolated environments and hide the complexity of hardware infrastructure to help simplify management. AMD-V leverages Direct Connect Architecture to provide fast and efficient memory handling, a must-have for memory intensive applications like virtualization.

Third-Generation AMD Opteron processors offer enhancements to AMD-V that provide a balanced approach to improve virtualization performance and enable near-native performance on virtualized applications. One of those enhancements, Rapid Virtualization Indexing (formally “nested paging”), will reduce the overhead of switching between virtual machines. This feature used by virtualization software will improve the performance of many virtualized applications. Some of the AMD-V enhancements that are built into the third-generation architecture:

- Silicon feature-set enhancements designed to improve performance, reliability, and security of existing and future virtualization environments supports more users
- Direct Connect Architecture host more virtual machines (Vms) per server
 - AMD’s Direct Connect Architecture helps improve application performance within a virtual machine. This architecture provides direct CPU-to-memory, CPU-to-I/O, and CPU-to-CPU connections to streamline server virtualization.

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- The Integrated Memory Controller is designed to improve performance on memory-intensive virtualization environments through high bandwidth, low latency, and scalable access to memory.
- HyperTransport technology optimizes the movement of data and the sharing of resources among Vms and I/O for greater system scalability.
- Tagged Translation Look-aside Buffer for increase responsiveness in virtualization environments
 - Unique to AMD Opteron processors, the Tagged Translation Look-aside Buffer (TLB) allows for faster switching times between virtual machines by maintaining a mapping to the VMs individual memory spaces. Competing solutions can't distinguish one VM's memory space from another's, resulting in additional memory management overhead and reduced responsiveness when switching between virtual machines.
- Device Exclusion Vector (DEV) for more efficient security
 - DEV performs security checks in hardware. Protecting memory access to un-authorized requests from external devices, such as disks, NICs, etc. The DEV acts like a traffic cop, controlling access to virtual machine memory based on permission, isolating virtual machines for secure operation.
 - The DEV performs these security checks in hardware, rather than software, for greater efficiency by creating Protection Domains that deny memory access for unauthorized requests from external devices, such as hard disks, network controllers, etc.
- Rapid Virtualization Indexing for better performance in a virtualization environment
 - Rapid Virtualization Indexing is an enhancement to AMD-V technology in Quad-Core AMD Opteron processors. It is designed to dramatically increase the performance of virtualized applications while enabling faster switching between virtual machines (Vms). This will allow users to host more VMs per server and maximize the benefits of virtualization. This feature will need to be support in the virtualization software and was formerly called Nested Page Tables.

Enhanced Third-Generation (Quad-Core) AMD Opteron Processor (Shanghai)

Building on the strengths of the original Quad-Core AMD Opteron Processor (Barcelona), the new Quad-Core AMD Opteron processor represents the most thermally efficient and highest performing processor from AMD. The new processor will consume approximately 20 percent less power at idle than Barcelona, and will offer 6MB of shared L3 cache as opposed to 2MB of shared L3 cache in Barcelona. Other features include AMD-V enhancements and support for DDR2-800 memory.

The new Quad-Core processor can be characterized as an upgrade to the Barcelona architecture with performance improvements and reduced power consumptions. Most of the information in the Third-Generation (Quad-Core) AMD Opteron Processor still apply and only the changes to the enhanced version will be covered in this section.

New in Shanghai

Quad-Core AMD Opteron Features "Barcelona"	New in Shanghai
65nm Technology	45nm Technology Immersion Lithography Better clock speed scaling
2MB of L3 cache	6MB of L3 cache Better performance
HyperTransport 1.0 @ 2GT/s (8GB/s)	HyperTransport 3.0 @ 4.4GT/s (17.6GB/s) Available April (not all platforms)
AMD Balanced Smart Cache	AMD Smart Fetch Allows cores to sleep while still providing full cache access
AMD-V with Rapid Virtualization Indexing	Designed for 25% fast "world switch" time Enhanced Rapid Virtualization Indexing (More Virt-Phys translation held in cache)
AMD CoolCore Technology	Extends power savings to L3 cache (L3 powered down when not in use)

Figure 12. Enhanced Shanghai features

AMD's native Quad-Core Opteron processors incorporate four processor cores on a single die of silicon. The Quad-Core AMD Opteron processors are electrical-, thermal-, and socket-compatible with the Next-, and Third-Generation AMD Opteron Socket F (1207) processors. The new Quad-Core Opterons clock frequency will be in the range from 2.3 to 2.7GHz and will fit into the same 75W thermal envelope. This is according to AMD's Average CPU Power (ACP) rating method.

AMD's 45-nm fabrication process will produce faster switching speeds at lower power levels as compared to the past generation 65-nm fabrication. Most of the additional transistors (versus

Barcelona) come from the expansion of the L3 cache. The expansion from 2MB to 6MB will have performance benefits for the Sun Fire servers for many server-class workloads.

Shanghai's memory controller supports memory clock frequencies from 667MHz to 800MHz. HyperTransport 3 (HT3) support will be supported by the spring of 2009 (subject to change). The first Shanghai processors will not support HT3 and therefore Sun servers will only support HT1. Sun engineering is currently working on a full validation test of HT3 on Sun platforms and changes on system board may be required. HT3 will double the available bandwidth for CPU-to-CPU communication in Opteron systems. With HyperTransport clock speeds up to 2.2GHz, HT3 will allow for up to 17.6 GB/s of bandwidth (the bidirectional total) per link.

Memory Enhancements

The enhanced Quad-Core processor has 6MB of L3 cache but the same amount of L1 and L2 cache as Barcelona - as shown in the following Figure. In order to make sure its larger caches don't cause data integrity problems, AMD has built in a new feature it calls L3 Cache Index Disable. This feature allows the CPU to turn off parts of the L3 cache if too many machine-check errors occur. This capability will apparently require OS-level support and is not supported as of this writing.

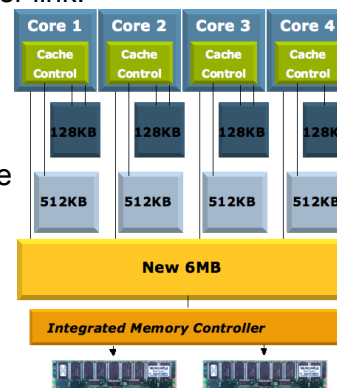


Figure 13. Shanghai memory architecture

AMD Virtualization Enhancements

One tweak in Shanghai that affects not just the cache but the entire memory hierarchy has to do with the chip's support for nested page tables, a feature that accelerates memory address translation with system virtualization software. Shanghai maintains the same basic feature set as Barcelona, but AMD claims a reduction in "world switch time" of up to 25% for Shanghai. That means the system should be able to transition from guest mode to hypervisor mode and then back to guest mode much more quickly. Hypervisors that support the AMD-V feature set could see a marked improvement in performance in cases where virtual server performance is hampered by world-switch latency. Sun has done some Vmmark performance testing between the two Quad-Core processors with VMware ESX 3.5 and the results showed dramatic performance advantages.

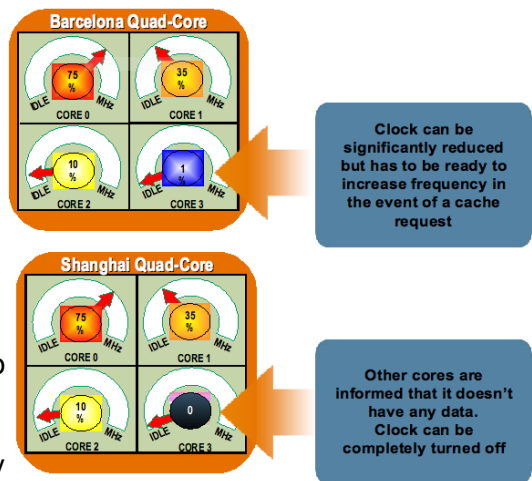
Faster World Switch means that AMD has done some tuning of its world switch. A "world switch" is when CPU control passes from one Guest OS, to the hypervisor, to another Guest OS (or back to the original one). Faster switching means the CPU can get back to work on running the virtualized application.

Rapid Virtualization Index works by caching the address translations from Guest Virtual memory to Guest Physical memory to Host Physical memory. To translate between each of these states can require dozens of incremental translations. Shanghai improves Rapid Virtualization Indexing over Barcelona by caching more of these incremental address translation steps.

These virtualization enhancements can benefit by allowing Sun servers to support more users while offering best performance. These virtualization enhancements are supported in VMware Virtual Infrastructure 3.5 Update 1, Microsoft Hyper-V, and Xen.

AMD Smart Fetch Technology

Smart Fetch is primarily a power-saving feature intended to work around the fact that AMD's caches are exclusive in nature. That is, the lower-level caches don't replicate the entire contents of the higher-level caches. In Barcelona, for instance, a completely idle core would have to continue operating, though at a lower frequency, in order to keep its caches active and their contents available. Shanghai, by contrast, will dump the contents of that core's L1 and L2 caches into the L3 cache and put the core entirely to sleep, essentially reducing its clock speed to zero. A flag (bit) is set to notify the other cores that it does not have any data they need. This can dramatically reduce idle power draw on a server. One core in the system must remain active at all times, but in a four-socket system, only a single core in one socket must stay active.



Sun Integrated Lights-Out-Manager (ILOM)

Sun Integrated Lights-out Manager is driven by an integrated system service processor that follows x86 standards. It provides for full remote KVMS (Keyboard, Video, Mouse, Storage) support together with remote media functionality. Lights-out management (LOM) is achieved using a new on-board, independently powered AST2000 service processor with its own robust, security hardened OS. ILOM provides remote administration via an intuitive browser-based GUI, DTMF CLI, remote console, SNMP V1, v2c, v3 or IPMI v2.0 protocols using the out-of-band management Ethernet, or using in-band communication through the server's operating system. With out-of-band management, the system administrator can remotely control power of the system, monitor system FRU status, and load system firmware. With in-band management, the system administrator can monitor system status and control system power down.

The Service Processor (SP) provides the following functions:

- Capability to remotely manage the server through remote keyboard, video, mouse, and storage redirection
- Extensive control and reporting over environmentals, power, hardware and BIOS/OS features
- Remote flash upgrades of system BIOS and service processor software
- Remote diagnosis of failed components allows for rapid correction
- User configurable serial console accessible via a physical port or re-directed through the management network

System Architecture

Overview

The Sun Fire X4600 M2 Server features up to eight processor boards. Please see Figure for a top view of Sun Fire X4600 M2 Server containing eight processor boards. The processor boards with AMD Opteron processors are interconnected by dedicated 8.0 GB/sec HyperTransport links. The processor boards must be added in pairs. 2, 4, 6, or processors can be supported; all processors must be the same type (dual core or quad core), same stepping, same frequency. The 2-processor configs require no filler boards and only 5 PCI slots are available for use. With 4 processor boards in slots A, D, E, H; and the remaining slots with filler boards, all 8 PCI become available. In a four processor board configuration, in order to maintain the HyperTransport link, the remaining four empty slots are filled with the processor filler boards. The Sun Fire X4600 M2 server in a four processor board configuration will be shipped with the processor filler boards. 6-processor config requires 2 filler boards and 8-processor configs require no filler board. An odd number of processor boards or the mixing of CPU speeds is not supported.

The Sun Fire X4600 M2 processor board consists of one AMD Opteron processor and four or eight DIMM slots. Some dual-core processors (8216, 8224SE) are supported on a board with 4-DIMM slots; other dual-core processors are supported on the 8-DIMM board (4-DIMMs run at 667MHz, whereas 8-DIMMs run at 533MHz). All quad core processors are supported on the “quad-core-processor” board that has 8-DIMM slots, and these all run at 667MHz for DDR2/667MHz DIMMs. The quad-core processor board also supports 800MHz memory when that's available.

Sun Fire X4600 M2 Block Diagram

The I/O architecture for the Sun Fire X4600 M2 Server is designed to provide expansive I/O capability with eight PCI slots with two 100 MHz PCI-X slots and six PCIe slots (four 8-lane and two 4-lane). Figure 4 illustrates Sun Fire X4600 M2 Block Diagram. The Hypertransport PCI-X bridge connects via HyperTransport to CPU0 and an Nvidia CK8-04P chip. The Hypertransport PCI-X bridge provides two PCI-X busses – one for PCI-X and the other for four onboard Gigabit s. The first PCI-X bus is shared between the embedded LSI 1064 SAS controller and the two 100 MHz/64bit PCI-X expansion slots. Because the bus is shared, PCI-X cards running slower than 100 MHz should not be placed in this slot. The second PCI-X bus is 133MHz bus dedicated to the four on-board Gigabit Ethernet network interface cards.

An Nvidia IO-04 provides three of the PCIe segments while an Nvidia CK8-04P provides the remaining three PCIe segments, the four USB 2.0 interfaces as well as interfaces to the ATI Rage XL chip and to the integrated Service Processor (SP).

On-board management for the Sun Fire X4600 M2 Server is provided by a Service Processor (SP) based on a Motorola MPC8248 micro-controller that communicates with the main system processor and the rest of the system. Accessible to the end user through a serial port and a dedicated 10/100 Ethernet NIC, ILOM provides the administrator with full lights-out manageability of these servers which includes the ability to power cycle, setup, manage, monitor and maintain the system locally or remotely. ILOM supports both local and remote management, including remote KVM and media connectivity. ILOM also provides industry standard GUI and CLI interfaces. IPMI 2.0 and SNMP V1, v2c, V3 support also enable fast integration into a customers' existing monitoring schema.

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Front and Back of Sun Fire X4600 M2 Server

Figure 5 shows a front view of the Sun Fire X4600 M2 server. As can be seen, for better serviceability, there are status indicator LEDs located on the front panel of the Sun Fire X4600 M2 servers. These status indicator LEDs are:

- Locate button/LED
- Service action require/LED
- Power/OK LED
- Power Button
- Front fan fault LED
- Power supply/rear fan tray fault LED
- System overheat fault LED

For easy access, the hot-plug RAID SAS drives and the DVD-ROM drive are also located in the front of the Sun Fire X4600 M2 server. The SAS drives also have status indicator LEDs which show whether the hard disks are operating normally or they have failed. For more detailed information, please see the Sun Fire X4600 M2 Maintenance Manual, Appendix C.

Figure 6 shows a rear view of the Sun Fire X4600 M2 server. As can be seen, the I/O connectors, PCI slots, and the 2+2 hot plug power supplies are located at the back of the Sun Fire X4600 M2 server. The PCI slots are compatible only with the low profile (half height) I/O cards. The following I/O connectors are located at the back of the Sun Fire X4600 M2 servers:

- Dedicated 10/100 management port
- PCI-X slots (2 slots)
- PCIe slots (6 slots)
- Built in graphics connector
- RJ-45 Serial I/F
- 2-USB ports
- 4 onboard GbE standard ports

The following status indicator LEDs also located at the rear of the Sun Fire X4600 M2 server:

- Power/OK LED
- Service action required LED
- Locate button LED
- 10/100/1000 Ethernet ports (two LEDs on each connector)
- 10/100 Ethernet management port (two LEDs on connector)
- Power supply LEDs on each power supply

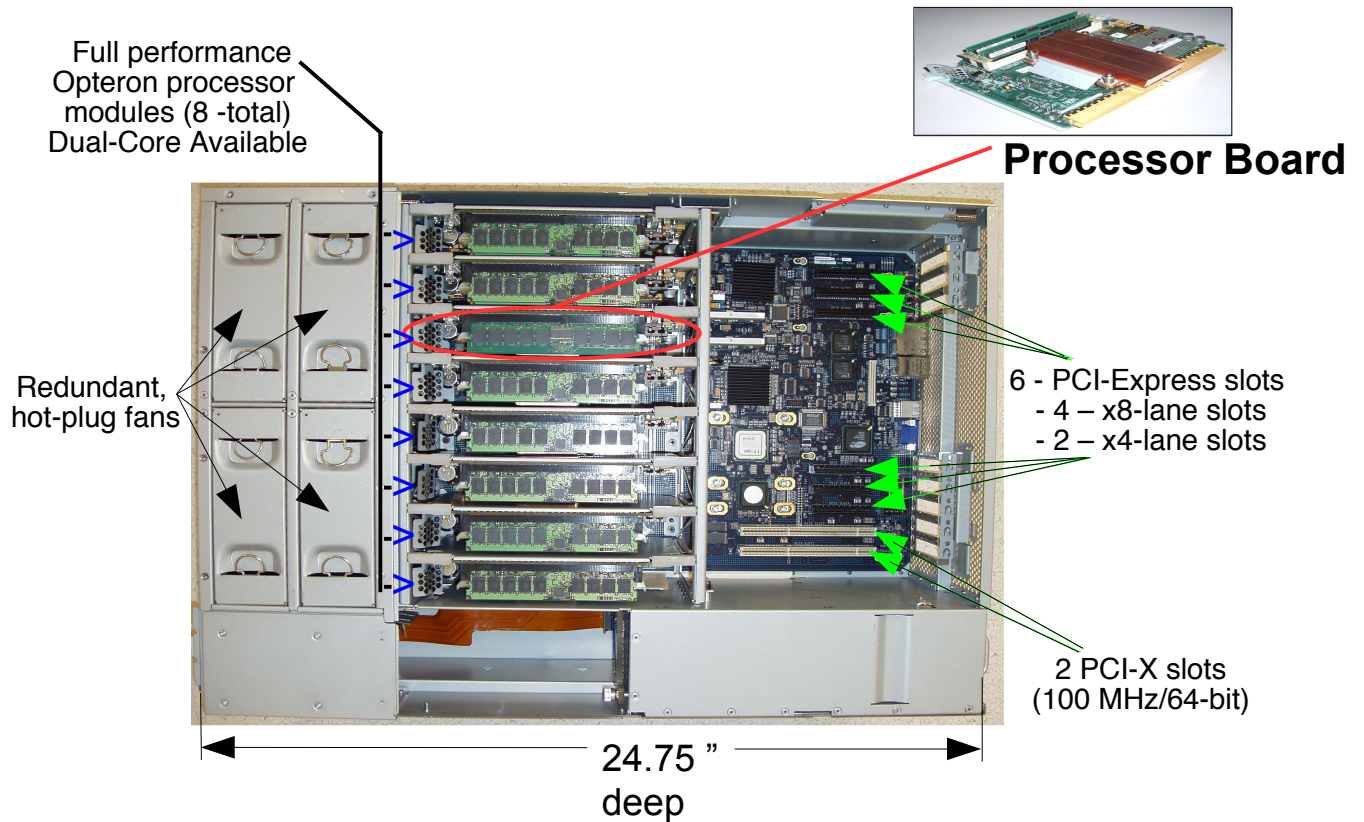


Figure. Sun Fire X4600 M2 Server Top View

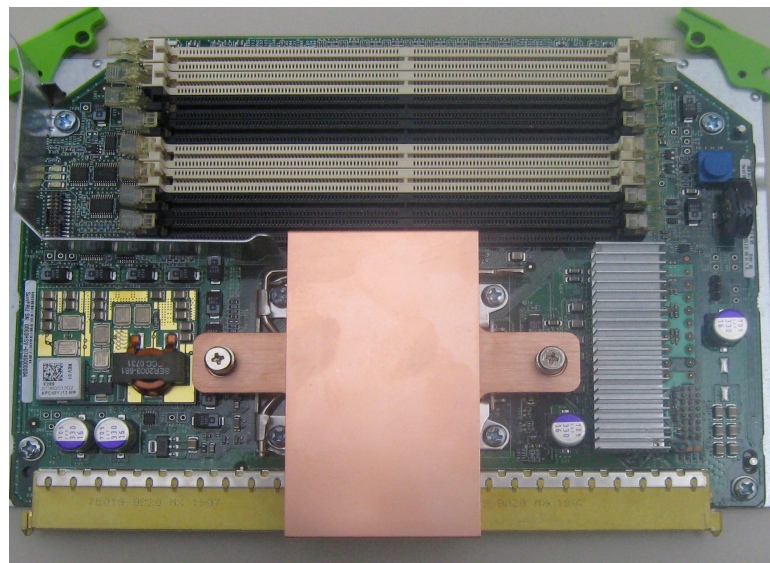


Figure. Quad-core Processor module ("Vortex")

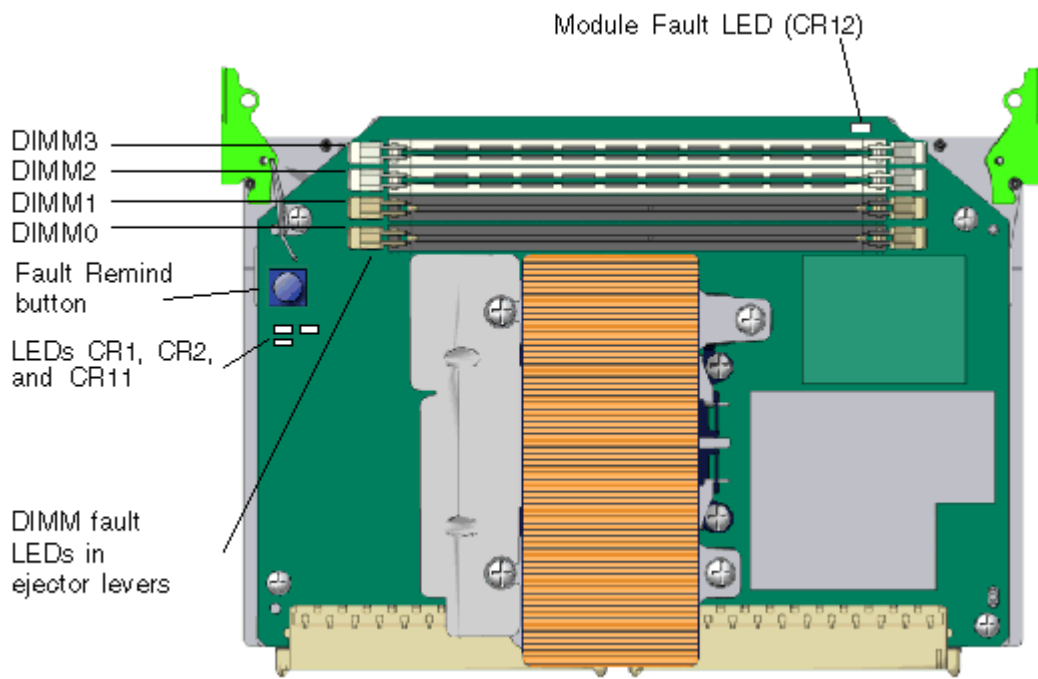


Figure. Sun Fire X4600 M2 Processor Board with 4 DIMM slots

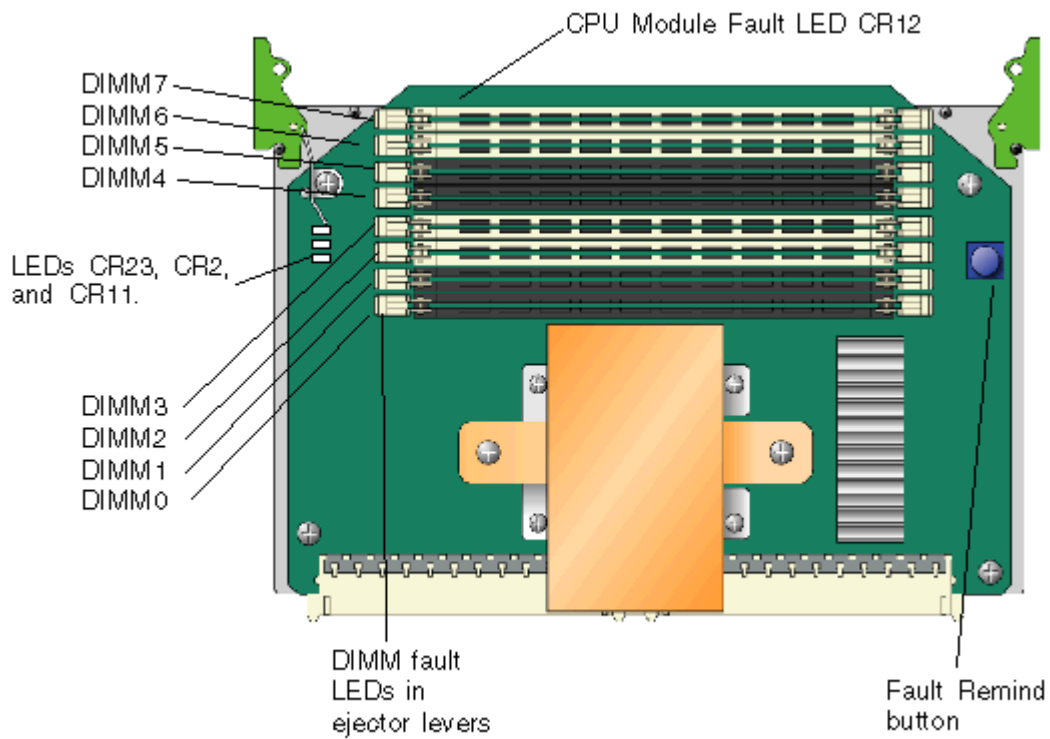


Figure. Sun Fire X4600 M2 Processor Board with 8 DIMM slots

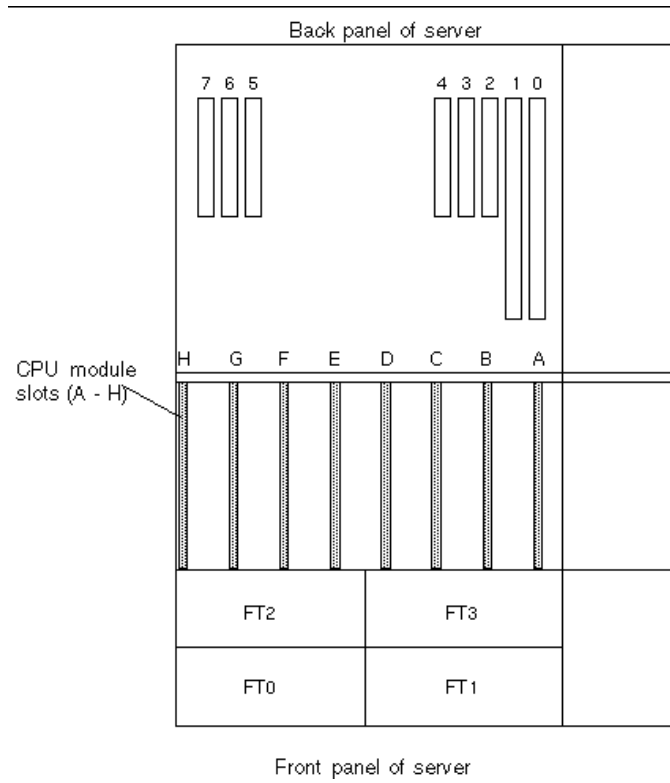


FIGURE. Fans, CPU Module slots, PCI I/O slots in Sun Fire X4600 M2

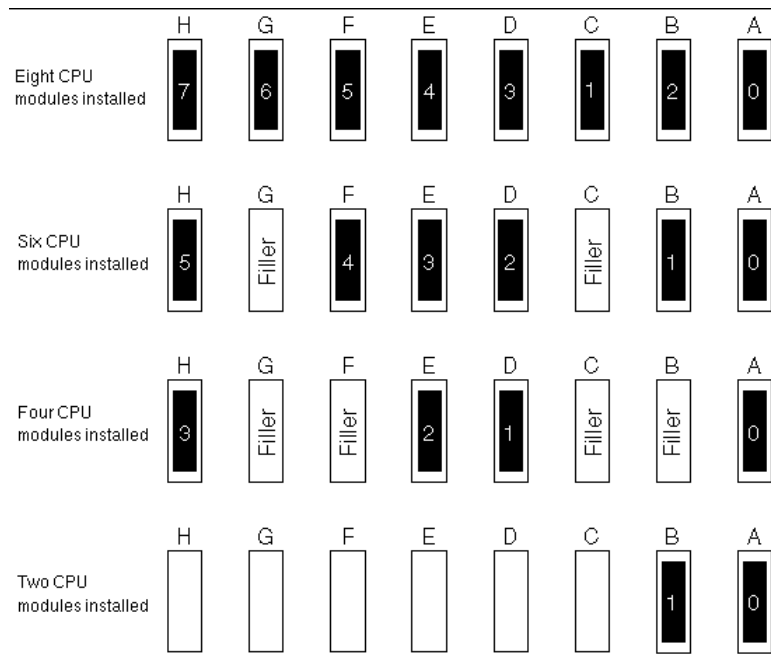


FIGURE. CPU Module Population rules and numbering

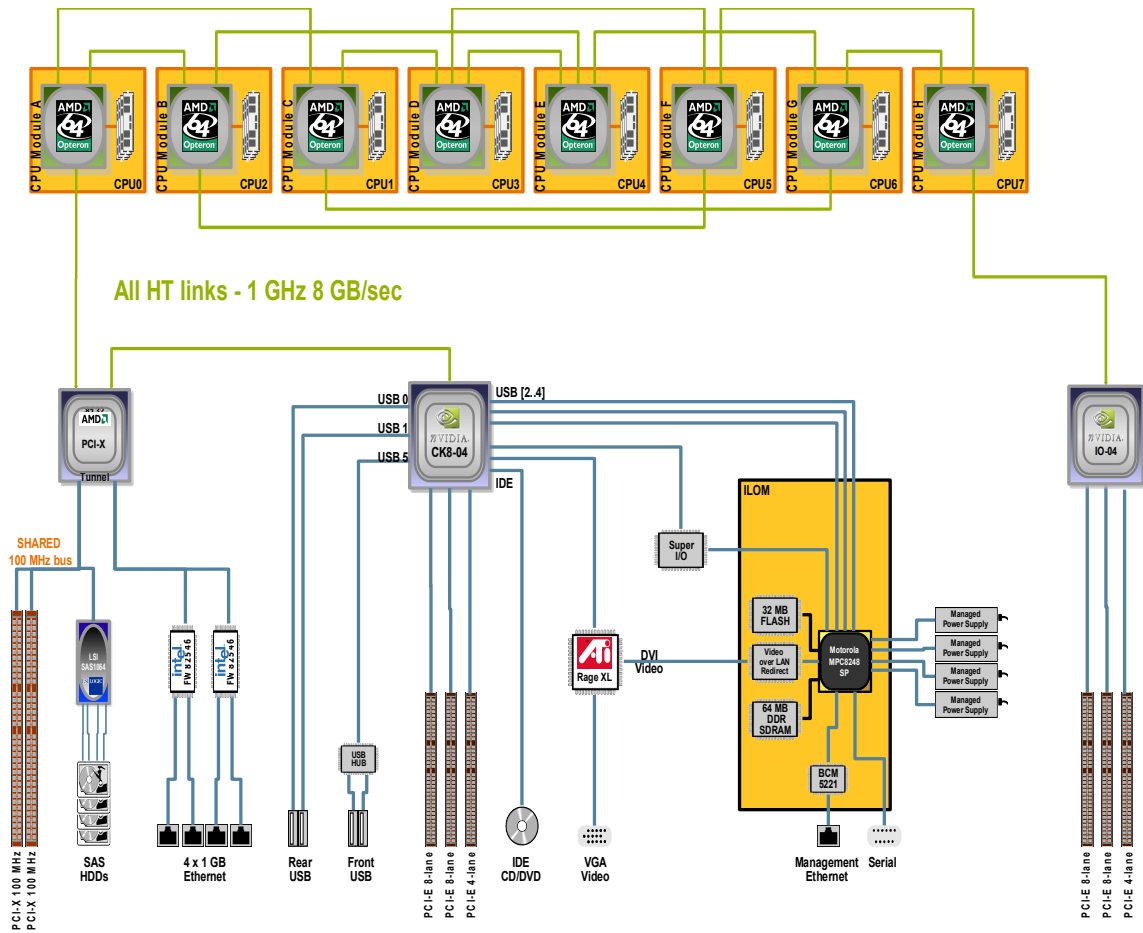


Figure 3. Figure Sun Fire X4600 M2 Server Block Diagram



Figure 5 Sun Fire X4600 M2 Server Front View

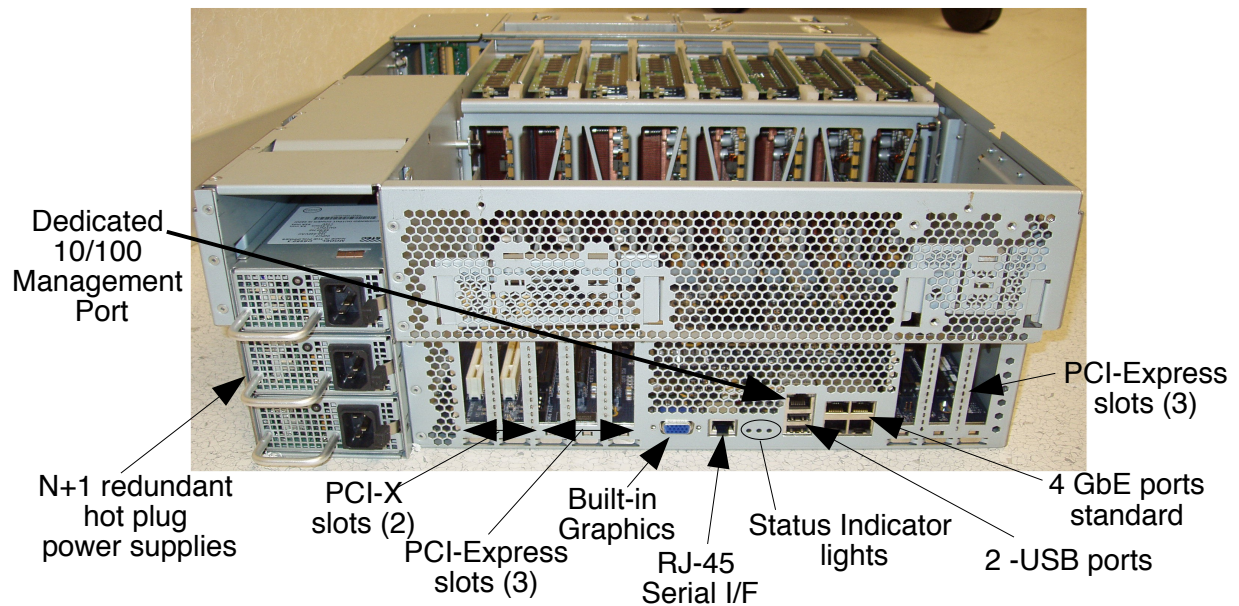


Figure 6 Sun Fire X4600 M2 Server Rear View

Reliability, Availability, and Serviceability (RAS)

- Simplicity of design with the AMD Opteron processors and HyperTransport requires less components and thus provides higher reliability
- ECC memory with ChipKill supported
- Redundant (2+2) hot-swappable power supplies and fan modules allow for system service without downtime.
- RAID 0, 1 for the on-board SAS disks.
- Built-in Quad Gigabit Ethernet ports provide redundancy.
- **Solaris Fault Manager** proactively handles system problems by removing components before failure. (For more details, please see Solaris in the Operating System section.)
- Front-accessible, hot-swappable disk drives.
- Direct-access fan modules can be replaced without power down or complete removal of system from rack.
- Identical Indicator LEDs on the front and back of the chassis allow problems to be detected and isolated easily.
- A fault indicator LED stays on following a fault even if the system has been powered off (but still connected to the power source).
- Diagnostic LEDs are included on the motherboard and the following replaceable components:
 - Hard Disk Drives
 - Ethernet LEDs
 - CPU modules
- Diagnostic LED on CPU modules provide the overall status of the module, CPUs and DIMMs.
- Front power switch (toggles between standby and power-on) provides easy access.
- Rackmount slide rails for easy installation and removal of a unit are available as an X-option.
- Single-step power supply removal: Power-supplies can be serviced without sliding the servers out of the rack.
- Remote KVMS

High Availability and Business Continuity

Sun Java™ Availability Suite - is an integrated software platform from Sun that delivers best-in-class high availability to business services, keeping global enterprises running 24x7 through planned maintenance, failures, wide area outages or disasters. [(Note: Sun Java Availability Suite supports Solaris only.)

Sun Java Availability Suite consists of four components:

- **[Sun\(TM\) Cluster software](#)** -- Provides application and service failover to help ensure high availability for mission-critical services running across up to 16 nodes.
- **[Sun\(TM\) Cluster Geographic Edition software](#)** -- Delivers multisite disaster tolerance (for business continuity), connecting clusters across unlimited distances.

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(NOTE: Sun Cluster Geographic Edition support for Sun Fire X4600 M2 is pending.)

- **Sun Cluster Agents** -- Manages the availability of applications. The Java Availability Suite offers the largest number of prebuilt agents for industry applications, as well as a toolkit to build agents for custom applications. [
- **Developer Tools** -- The Java Availability Suite contains the developer tools within the Sun Java™ Studio Enterprise and Sun Java™ Studio Creator.
- **Highlights:**
 - Simple employee/year pricing subscription model
 - Delivers HA to both Solaris SPARC and x64-based platforms
 - Room, campus-level, and geographic clustering options
 - Industry's largest portfolio of agents (50+) for applications
 - Advanced technology offerings for Oracle
- **For more information, please see:**
 - Internal: <http://suncluster.eng/JavaAvailabilitySuite/>
 - External: <http://www.sun.com/software/javaenterprisesystem/availabilitysuite/index.xml>

Microsoft Windows Clustering

Windows Server 2003 clusters provide failover support for back-end applications and services that require high availability and data integrity. These back-end applications include enterprise applications such as database, file server, enterprise resource planning (ERP), and messaging systems.

Vmware High Availability Infrastructure

Vmware High Availability provides protection against server failures in a network of systems configured to run the Vmware virtualization infrastructure software. Features include:

- Automatic detection of server failures. Virtual machines with VMware HA provide an easy to use and cost-effective failover solution to protect against server failures.
- Automatic restart of virtual machines. Protect any application with automatic restart in a different physical server in the resource pool.
- Virtual machine failure monitoring (experimental mode). Detect operating system failures within virtual machines through monitoring heartbeat information. Automatically restarts affected virtual machines based upon user-defined time intervals.
- Proactive monitoring and health checks. VMware HA helps users identify abnormal configuration settings detected within HA clusters. This keeps unhandled failure conditions and errors from happening more than once. The VMware Infrastructure client interface reports relevant health status and potential error conditions and suggested remediation steps.
- Scalable high availability across multiple physical servers. Support up to 32 nodes in a cluster for high application availability.
- Resource checks. Ensure that capacity is always available in order to restart all virtual machines affected by server failure. HA continuously monitors capacity utilization and “reserves” spare capacity to be able to restart virtual machines.
- Smart failover of virtual machines (when used with VMware Distributed Resource Scheduler). Automate the optimal placement of virtual machines to servers with best available resources after server failure.

Veritas Cluster Server (VCS)

Veritas Cluster Server is a high availability software product from Symantec. With Veritas Cluster Server, customers can protect their data center from a single point of failure by setting up a highly available cluster which has redundant servers, I/O connections, and storage arrays. As mission critical/business critical application running on one server fails, VCS will automatically failover the application to another server in the cluster. This helps to reduce application downtime when unplanned outages are encountered.

For more information on VCS, please see

<http://www.symantec.com/Products/enterprise?c=prodinfo&refId=20&cid=1019>

VCS is included in the Veritas Foundation Suite. The Veritas Foundation Suite includes the following key products:

- Veritas Volume Manager
- Veritas File System
- Veritas Cluster Server
- Dynamic Multi-Pathing, etc.

The Veritas Foundation Suite is expected to get supported on Sun Fire X4600 M2 at its General Availability. Please check <http://www.sun.com/servers/X64/X4600>

For more information on Veritas Storage Foundation, please see

<http://www.symantec.com/Products/enterprise?c=prodinfo&refId=203>

VCS provides high availability for a single site. For disaster recovery, customers must purchase the Global Cluster option and Veritas CommandCentral Availability.

RedHat Cluster Suite

Red Hat Cluster Suite is a high availability software product from Red Hat which makes customer's Data Center highly available by providing protection from a single point of failure. This makes it safe to run mission critical/business critical applications in a Data Center which has deployed Red Hat Cluster Suite. The two types of clustering provided by Red Hat Cluster Suite are:

- Application/service failover
- IP load balancing

The support for Red Hat Cluster Suite on Sun Fire X4600 M2 is currently being investigated.

For more information on Red Hat Cluster Suite, please see

<http://www.redhat.com/solutions/clustersuite/>

Operating System

Sun Fire X4600 M2 Server Operating Systems

A world-class performance platform, the 64-bit Sun Fire X4600 M2 Server allows customers to run the operating system that best fits their needs. Check the following web site for the latest supported OS: <http://www.sun.com/servers/x64/x4600/os.jsp>

Operating Systems		Dual Core Support	Quad Core Support	Factory Installed	Sold by Sun	Supported by Sun
Solaris 10 OS	64-bit	Yes	Yes, requires U4 or higher	Yes	Yes	Yes
Windows® Server 2003 Enterprise and Standard Editions ²	32-bit/64-bit	Yes	SP2 required	Option	Yes	Yes
Windows Server 2008	32-bit/64 bit	Yes	Yes	TBD	Yes	Yes
VMware ESX 3.5 update 1	64bit	Yes	Yes	No	Yes ³	Yes
Vmware ESX 3.03 (when available)	64bit	Yes	Yes	No	Yes	Yes
Red Hat Enterprise Linux 3, U8 and higher	64-bit	Max 4 processors (max 8 cores)	No	CRS ¹	Yes	Yes
Red Hat Enterprise Linux 4, U4 and onward ¹	32-bit	Yes	No	CRS ¹	Yes	Yes
Red Hat Enterprise Linux 4.6, and onward ¹	64-bit	Yes	Yes	CRS ¹	Yes	Yes
Red Hat Enterprise Linux 5.1	64-bit	Yes	Yes	CRS ¹	Yes	Yes
SUSE Linux Enterprise Server ¹ (SLES) 10 sp1	64-bit	Yes	Yes	CRS	Yes	Yes

1. Red Hat Enterprise Linux 4, SUSE Linux Enterprise Server 9, and Solaris OS on x64 can be ordered from Sun. Systems can be preloaded by CRS. Support contracts are also available at an additional cost.

2. The Sun Fire X4600 M2 Server requires Windows Server 2003 SP1 or later

3. The product and service can be purchased from Sun's Client Solutions Organization

Latest OS Information

For more information on the latest OS support for the Sun Fire X4600 M2 Server, see

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Solaris 10 OS – The most advanced operating system on the planet

Key Messaging

In a class by itself, the Solaris Operating System is a significant leap forward from the Solaris 9 OS, establishing it in a class by itself when compared to competing operating systems. It offers many innovative technologies that fundamentally change the equation for organizations needing to reduce costs, reduce complexity, and minimize risk. The new features in the Solaris 10 OS bring mainframe-quality software to even the smallest single-processor servers and provide a stepping stone into tomorrow's data center.

For CIOs and Line of Business Managers dissatisfied with high infrastructure costs and security vulnerabilities in their workgroup server environments, the Solaris 10 OS brings a proven, enterprise-class OS at 1/11th the cost of Microsoft and 20-60% off the cost of Red Hat over three years.

The Solaris 10 OS is designed to help organizations optimize system utilization levels, deliver extreme performance and provide unparalleled security – all with relentless, around-the-clock availability.

- **Optimal Utilization** of computing systems is a priority for IT managers where server consolidation is a common approach and is improved in the Solaris environment by:
 - **Solaris™ Containers** enable as much a 4x increase in system utilization by making it possible to efficiently and securely support thousands of applications per system. Highly configurable, Solaris Containers can dynamically adjust system resources to business goals within and across Containers with the added benefit of isolating applications from each other and from system faults, so a problem in one application cannot affect the system or other applications.
 - **Solaris™ ZFS** (zettabyte file system) ZFS integrates devices, storage and filesystems into a single management structure and reduces the amount of effort involved in managing data. ZFS is integrated with the Fault Management Architecture to proactively identify potential faults in the data path and if problems are detected ZFS can initiate corrective action before the data is put at risk.
- **Extreme Performance** through:
 - **DTrace**, designed for live use in production situations, is a powerful tool for analyzing and diagnosing elusive problems and increasing system performance. It is non-invasive and has no system overhead when not in use, but with its pervasive coverage, root cause for intermittent system problems can be found quickly; real-world applications have been optimized to run anywhere from 30 to 50 times faster.
 - **An Optimized TCP/IP Stack** where the TCP and IP layers are partially merged, delivers a 30- to 50-percent improvement in network throughput with a 10- to 15-percent lower CPU load than previous Solaris OS versions. There are also massive improvements in the UDP stack under Solaris 10

with performance gains of 30-120%.

- **Unparalleled Security** continues to be a focus as Solaris 10 OS adds significant features that can help defend against attacks by preventing unauthorized access to data and applications with:
 - **Process Rights Management** replaces the traditional UNIX “all or nothing” root mechanism with a fine-grained set of privileges for control over the resources and objects that processes can manipulate.
 - **Solaris Cryptographic Framework** secures data flows by providing a set of programming interfaces for application-level and kernel-level cryptographic operations, allowing developers to utilize highly optimized cryptographic algorithms and providing transparent access to the same hardware encryption acceleration devices used by the operating system kernel.
- **Relentless Availability – As customers have come to expect** in a Solaris environment, resiliency remains a top priority. Predictive self-healing technologies provide new levels of application availability with:
 - **New predictive self-healing for Opteron based systems** extends Solaris fault manager functionality to integrate automatic monitoring of AMD64 CPU and system resources, and supports advanced features like realtime core & memory offlining.
 - **Solaris Fault Manager** proactively handles system problems by removing components before failure. CPU, memory and I/O problems are diagnosed and corrected – before they can cause downtime.
 - **Solaris Service Manager tracks** dependencies among application software, OS facilities and system states (“milestones”) , monitoring applications and restarting entire application trees if failures are detected.

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 and x86 systems, including optimized support for AMD Opteron 64-bit processors.
- **Solaris Application Guarantee Program.** This program allows binary compatibility between versions of Solaris on each platform and has been extended to include source code compatibility between SPARC and x86 systems .
- **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.
 - **Standard Free/Open Source Software (F/OSS) libraries included in Solaris software include:** Glib, Gtk+, JPEG, PNG, TIFF, and XML2
 - **Hundreds of F/OSS additional applications and libraries** are provided with the Solaris OS, including the GNOME desktop, Apache, Perl, and Postgres
 - **Solaris Containers for Linux Applications**, currently under development and available as part of the OpenSolaris initiative, allows Linux applications to run unchanged on the Solaris OS when coupled with a Linux distribution.

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- **Linux Compatibility Assurance Toolkit (LinCat)** helps to simplify the process of porting Linux applications to run natively on the Solaris OS.

Pricing/Support

Solaris 10 OS is free to end-users and is available via free download at sun.com/solaris. Media kits are available for purchase. Support is available at an additional charge.

Linux - Complementing Sun's Solaris OS Strategy

Key Messaging

"Sun is key to Linux and Linux is key to Sun."

-- Sun is both a large contributor to GNU/Linux and also greatly benefits from it.

- Sun is one of the largest contributors to the GNU/Linux operating systems. Key areas of support are OpenOffice.org, Mozilla, GNOME, X.org
 - OpenOffice.org: Began life as StarOffice™. Sun set it free in 2000 and now it is the standard Linux office suite.
 - Mozilla™: Sun has been a major contributor providing both staff and funds helping to drive 508 accessibility and L18N (internationalization).
 - GNOME: Sun contributed most of the documentation and online help. Sun's contribution of the accessibility framework to GNOME allows desktop Linux to meet 508 compliance.
 - X.Org: Sun has been a long term contributor. Hosted the X consortium on its campus this year. A Sun employee has been elected to their Board of directors.
- Linux is essential to Sun's being able to provide its customers with the ability to choose the OS platform that best meets their needs. Sun brings a comprehensive systems approach to Linux-based operating systems. Sun provides Java technology, x64-based servers and workstations, Red Hat Enterprise Linux, and SUSE Linux Enterprise Server along with Sun's Java Enterprise System and suites all supported by Sun services.

Sun resells and supports the following industry leading Linux OSs:

- Red Hat Enterprise Linux
- SUSE Linux Enterprise Server
- Sun certifies and supports its x64 based systems for Linux
 - Sun Fire X2100/X4100/X4200/X4600 M2 and V40z/V20z servers
 - Sun™ Grid Rack System
 - Sun Ultra™ 20 and 40 Workstations
 - Sun Java™ Workstations W1100z/W2100z
- Sun's key software offerings are available on Linux:
 - StarOffice/StarSuite™ Office Suite Software
 - Sun Ray™ Server Software
 - Sun Secure Global Desktop Software
 - Sun N1 Software
 - Java Desktop Powered Program

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- Dev. Tools: Sun Studio, Java Studio Creator, NetBeans™ IDE, N1 Grid Toolkit
- The Java Enterprise System and most of the Sun Java Suites are certified for Red Hat Enterprise Linux.
- All Java technology offerings for the server and desktop: J2SE™, J2EE™, Java™ Web Services Developer Pack, and the Jini™ Technology Starter Kit.

Red Hat Enterprise Linux and SUSE Linux Enterprise Server - Resale/Support Details

- Sun resells and supports the exact same versions of both Red Hat Enterprise Linux (RHEL) and SUSE Linux Enterprise Server (SLES) that are sold by Red Hat/Novell or their distributors.
- When a customer purchases a Red Hat or SUSE subscription from Sun, Sun will support the entire Linux solution including RHEL/SLES. Sun will be the single point of contact for customer support. Sun will handle all front line support and, if necessary, transparently to the customers seeking support from Sun.
- Red Hat issues new updates approximately every four months and SUSE issues new service packs every six months.
- If a new version of RHEL or SLES is introduced during the term of the support agreement, then customers are entitled to the newer version.
- For up-to-date roadmaps and other details, please see:
 - <https://onestop.sfbay.sun.com/redhat/>
 - <https://onestop.sfbay.sun.com/SUSE/>

Microsoft® Windows®

The Sun Fire X4600 M2 Server is certified to run Microsoft Windows Server 2003 Enterprise and Standard Edition operating systems . Support is available from Sun Microsystems at an additional charge. Please see the “Services” section for more details. Windows Server can also be ordered and pre-installed on the Sun Fire X4600 M2 as an option.d

Please bookmark and refer to the following Windows on Sun sites for frequently updated information:

External: <http://www.sun.com/software/windows/>

Internal: <https://onestop.central.sun.com/windows/>.

Key Messaging

- **Windows support and pre-installed option**
 - Sun provides support for Windows Server 2003 and pre-installed option on the Sun Fire X4600 M2. Windows Server 2008 TBD.
- **Designed For Windows**
 - Sun’s x64 servers and workstations, as well as most of Sun's storage products, have passed Microsoft’s stringent compatibility testing suite and are listed in the Windows

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Catalogs.

- Sun systems have thus earned the “Designed for Windows”(TM) certification, demonstrating Sun’s commitment to providing the best platforms to run not only Solaris and Linux, but Windows as well.
- Windows Server is sold by Sun and can be pre-installed on the Sun Fire X4600 M2 as an option.

- **Flexibility for Sun's Heterogeneous Customers**

- To provide customers freedom to choose solutions that best meet their business needs, Sun supports the Microsoft Windows operating environment on select new Sun x64 systems.
- The ability to run Solaris, Microsoft Windows, or Linux software on Sun x64 servers and workstations allows customers to use a single vendor to meet a wide range of requirements.
- Sun’s support for multiple operating systems enables customers to deploy their choice of operating system without having to change hardware platforms when their requirements change. This helps reduce the cost and complexity required to support and manage multiple vendors, in turn helping to increase return on investment while reducing risk.

Other Windows on Sun Activities

- Please bookmark and refer to the external and internal url's listed above in this section for frequent updates on other Windows on Sun activities, including:
 - Up to date Windows on Sun certification tables
 - Microsoft Cluster certification listings
 - Windows System and option card drivers posted on Sun's website.
 - World record Windows on Sun x64 system benchmarks
 - Windows FAQ's and sales tools
 - Documentation and tools for installing and running Windows on Sun

VMware Infrastructure 3

VMware Infrastructure 3 software transforms physical resources such as Sun Fire x64 servers into multiple virtual operating system environments. VMware technology, operating as a Hypervisor, encapsulates operating systems and applications into virtual machines (VMs), providing a standard, hardware-independent environment that can be provisioned anywhere.

- ESX Server—ESX Server abstracts processor, memory, storage and networking resources into multiple virtual machines, giving organizations greater hardware utilization and flexibility.
- Virtual Center—Achieve the highest levels of efficiency, automation, simplicity and security in managing a virtualized IT environment of any size with VMware VirtualCenter

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- VMotion—Move running virtual machines from one physical server to another with no impact to end users
- VMServer (formally know as GSX— Reduce TCO across computing infrastructure by maximizing the Server utilization and simplifying the system manageability. Also it achives faster failover with pre-configured and tested servers in VMs
- VMFS (VMware ESX Server File System—Simple, high-performance file system, used for storing large files such as the virtual disk images for ESX Server VMs and, the memory images of suspended VMs
- VSMP (VMware Virtual SMP)—Add-on module to VMware ESX Server, to allow a single virtual machine to span multiple physical processors ideal for scaling your virtual infrastructure to handle the most resource-intensive applications.
- HA (High Availability Services)—Provides high availability by clustering and detects failed virtual machines and automatically restarting them on alternate ESX Server hosts.
- DRS (VirtualCenter Distributed Resource Scheduler)—Allows a collection of ESX Servers to be managed as a single pool of resources and automates dynamic Vmotion of virtual machines to balance the load across servers. Also, it enforces resource allocation policies.
- Consolidated Backup—Simplifies and accelerates backup with host-free, LAN-free, agentless backup of Windows virtual machines.

External: [http://www.sun.com/software/vmware \(coming soon\)](http://www.sun.com/software/vmware (coming soon))

Internal: <https://onestop.central.sun.com/vmware>.

Key Message for VMware ESX

- Sun offers support and factory installation of VMware ESX and Virtual Infrastructure on the Sun Fire X4600 M2 server.
- The Sun Fire X4600 M2 is the best server to run VMware infrastructure to the scalability that can be achieved with VMware: 2 to 8-socket with 350% VM support scalability
- Sun offers unique solutions for enterprise consolidation and virtualization with one of the fastest, energy-efficient and reliable industry-standard Sun Fire x64 servers with VMware ESX. This helps IT organizations to streamline their infrastructures, thus reducing costs, improving manageability, and delivering predictable service levels.

Key Highlights of using VMware ESX with Sun Fire x64 Server

- Consolidation is the goal for IT organizations and using VMware's ESX with Sun Fire x64 systems are the means.
- Consolidate multiple x86 servers onto a smaller number of high performance Sun Fire x64 servers, to help IT organizations to cut cost and complexity associated with power, cooling, physical space and manageability.
- Sun Fire x64 servers now with single and dual configurations gives IT organizations a multi-OS platform with a choice of running the Solaris Operating system, Linux and MS Windows with a virtualized multi-OS platform.
- IT organizations can consolidate multiple Solaris OS, Linux and MS-Windows applications onto a single high performance Sun Fire x64 server using VMware's ESX virtualization technology.
- Provide IT organizations ability to support for legacy OSs and their applications, which allows them to maintain and old application environment while running on a new

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- hardware without any changes to OSs or the applications.
- Increased flexibility to deploy applications using VM cloning and moving VMs from server to server.



Installation Data

Sun Fire X4600 M2 Server Specifications

Sun Fire **X4600 M2** Server is RoHS 5 compliant.

Processor Options

Processor	Up to eight AMD Opteron Processor 8000 Series: Enhanced Quad-Core Processor 8384 (2.7GHz/75W)/8DIMM Enhanced Quad-Core Processor 8380 (2.5GHz/75W)/8DIMM Quad-Core Processor 8356 (2.3GHz/75W)/8DIMM Quad-Core Processor 8347 HE (1.9GHz/55W)/ 8DIMM Quad-Core Processor 8360 SE (2.5GHz/105W)/ 8DIMM Dual-Core 8216 (2.4GHz/75W) /4-DIMM (EOL Q1FY09) Dual-Core 8224 SE (3.2GHz/105W)/4DIMM (EOL Q1FY09) Dual-Core 8220 (2.8GHz/75W)/8DIMM (EOL Q2FY09) Dual-Core 8222 (3.0GHz/75W)/8DIMM (EOL Q2FY09)
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Main Memory

4 or 8 DIMM slots per CPU socket, DDR2/667 ECC registered DIMMs (128 bit plus ECC databus), max possible 64 DIMM slots.
1GB DIMMs are supported only on 4-DIMM boards
2GB and 4GB DIMMs are support on 8-DIMM boards as well as 4-DIMM boards.

Standard/Integrated Interfaces

On-board Gigabit Ethernet	Four 10/100/1000Base-T Ethernet ports, RJ45 connectors (Intel network controller)
Network management	One dedicated 10/100Base-T Ethernet port , RJ45 connector
Serial	RS-232 Serial Interface, RJ45 Connector
SAS	Four channel SAS interface
USB	Two USB 2.0 ports (Front), Two USB 2.0 ports (Rear)
Expansion bus	8 Low Profile PCI Expansion Slots: Six PCIe slots (4 x 8-lane PCIe slots, 2x 4-lane PCIe slots) and Two 64-bit/100 MHz PCI-X slots,

Mass Storage and Media

Hot-swappable, 2.5" SAS Internal disk	Up to four HDD
Internal DVD-ROM	One EIDE DVD-ROM
External disk	See http://www.sun.com/servers/X64/X4600/storage.html

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Software

Operating environment	See above OS supported list
Management	CLI (in-band and out-of-band), IPMI 2.0 (in-band and out-of-band), SNMP (out-of-band only)

Power Supplies

Four hot -swappable power supplies, redundant in 2+2 configuration	
Power Source	100 - 240 VAC – 50/60 Hz input
UL Maximum (DC output)	950 W PSU, each has 89% efficiency 1133W PSU for Enhanced Quad-Core and SE processor
Typical Power Consumption	Check power calculator

Power Consumption (max power anticipated to be higher in quad core, details tbd)

Configuration: 4xCPU/2 HDD/4x2GB/7 PCI cards (dual-core)	
Power Results ¹	1137 W; 3880 BTU/HR; .32 Tons of Air Conditioning
Configuration: 8xCPU/2 HDD/8x2GB/7 PCI cards (dual-core)	
Power Results ¹	1603 W; 5470 BTU/HR; .46 Tons of Air Conditioning
1 The power result represents the worst-case, maximum sustained total server power for room temperatures below 23 degrees C. See the BTU Information and Power Calculator Section.	

Quad core average power consumption is similar to dual-core average power consumption. Max power consumption for quad core (75W ACP rated processors) is approximately 22W more per processor.

Environment

AC power	90–264 V AC (47–63 Hz)
Operating temperature/humidity (single, non-rack system)	5 °C to 32 °C (41 °F to 90 °F), 10% to 90% relative humidity, non-condensing, 27 °C max wet bulb
Non-Operating (single, non-rack system)	-40 °F to 149 °F (-40 °C to 65 °C), up to 93% relative humidity, non-condensing, 38 °C max wet bulb
Operating Altitude (single, non-rack system)	32 °C up to 900 meters and a derating of 1 °C for every 300 meters in altitude up to 3048 meters maximum
Non-operating altitude	Up to 12,000 meters
Air Flow: CFM per X4600 M2 server	400

Acoustic Noise Emissions

Declared noise emissions in accordance with ISO 9296, A-weighted, operating and idling:	
Measure & Environment	
LwAd (1B = 10dB) at or below 25C at max ambient	8.1 B 8.9 B
LpAm bystander at or below 25C at max ambient	66 dB 74 dB

Regulations

Meets or exceeds the following requirements:	
Safety	IEC60950, UL/CSA60950-1, EN60950, CB Scheme with all country differences
RFI/EMI	FCC Class A, Part 15 47 CFR, EN55022, CISPR 22, EN300-386:v1.3.2, ICES-003
Immunity	EN55024, EN300-386:v1.3.2
Certifications: Safety EMC	cULus Mark, CE Mark, CCC, GOST R, S-Mark CE Mark (93/68/EEC), Emissions and Immunity Class A Emissions Levels: FCC, VCCI, C-Tick, MIC, *CCC, *GOST R, *BSMI * = Applicable at GA
Other	Labeled per WEEE (Waste Electrical and Electronic Equipment) Directive

Dimensions and Weight

Chassis	
Height	176 mm (6.9 in.)
Width	445 mm (17.5 in.)
Depth	629 mm (24.75 in.)
Weight	Maximum standalone server: 40 Kg (88 pounds) Maximum with orderable rack-mount kit and cable management arm: 48 kg (106 lb.)

System Requirements, Configuration and Management

The Sun Fire **X4600 M2** Server runs the Solaris 10 1/06 Operating System on x64 as well as standard Linux distributions and Microsoft Windows Server 2003, Enterprise and Standard Editions. For a list of supported OS versions, please refer to section “Sun Fire **X4600 M2** Server Operating Systems Support “

System Configuration

The Sun Fire X4600 M2 Server has the following standard components:

- Support up to eight CPU modules, with each module consisting of one AMD Opteron Processor 8000 Series – a dual-core AMD Opteron Processor Series (82xx) or a quad-core AMD Opteron (83xx) – the processor modules are different for 82xx and 83xx. Key difference is support for AMD Dual Dynamic Power Management (“split-plane”) feature in the 83xx based module.

Note: 2, 4, 6, and 8 CPU module configurations are supported.

- Eight DIMM slots per CPU module supporting DDR2/667 MHz Registered ECC DIMMs. An 8 CPU module system has 64 memory slots and can support up to 256GB of main memory
- Four disk drive bays and DVD-ROM
- Four 10/100/1000Base-T Ethernet ports
- Four USB 2.0 ports, 2 front, 2 rear
- Eight MD2 Low Profile 64-bit PCI expansion slots
 - Six PCIe slots. Four x8-lane slots, Two x4-lane slots
 - Two 64-bit PCI-X slots @ 100 MHz
- Redundant hot-swappable fan modules
- AC power supplies, (hot-swappable in 2+2 redundant configuration)
- Integrated Lights Out Manager (ILOM) with dedicated 10/100BaseT Ethernet port
- 19-inch rack-mount kit
- cable management arm (optional)

Licensing/Usage

The Sun Fire X4600 M2 Server comes pre-installed with Solaris 10 OS on x64 edition server with Sun Java Enterprise System. There is no charge for the Solaris 10 OS on X64 RTU. Linux can be ordered pre-installed on the Sun Fire X4600 M2 server by Sun’s Customer Readiness System (CRS) group. Windows must be purchased from Microsoft or their partners/resellers.

MTBF Information

The MTBF (Mean Time Between Failure) for the Sun Fire X4600 M2 Server varies depending upon configuration. More information will be provided when it becomes available.

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BTU Information and Power Calculator

Sun Fire X4600 M2 Server Power Calculator can be used to determine the power consumption of a Sun Fire X4600 M2 Server for a given standard configuration or for a system configured by a customer. Please go to the following URL to see the power calculator.

<http://www.sun.com/servers/X64/X4600/calc/index.jsp>

The intent of the power calculator is to provide guidance for estimating the electrical and heat loads per server for racking and facilities planning. The power results below represent the worst-case, maximum sustained total server power for room temperatures below 25 degrees C. The results represent CPU under maximum possible stress and 100% utilization.

The actual or precise power (in BTUs/hr or Watts) for the Sun Fire X4600 M2 Server will vary depending upon hardware configuration, OS, application, and environmental conditions. Using the power calculator, the power consumption for a system with the following configuration can be determined.

Sun Fire X4600 M2 Configurations (baed on dual-core processors)		
Processors	4	8
HDD	2	2
2 GB DIMM	8	16
PCI Cards	7	7
Power Supplies	4	4
Fans	4	4
Power Results		
Watts (max) for quad core, add 22W/proc for 75WACP rated quad core	1137	1603
BTU/Hr	3879.6	5469.66
Tons of Air Conditioning	0.32	0.46

Rack Mounting

The Sun Fire X4600 M2 server is approximately 6.92 inches (176 mm) high, 17.5 inches (445 mm) wide and 24 inches (609 mm) deep. The air-flow direction in both configurations is from front to back. I/O ports are located on the front (USB only) and rear panels. Informational LEDs are located on the front panel. Access to the power connection is at the rear of the chassis.

Every current Sun Rack is supported for in-field installation and for shipment pre-installed by Sun Customer Ready (CRS) program. Field installation in the Sun Fire Hardware Expansion Cabinet, the Sun StorEdge(TM) Array Cabinet as well as 3rd party ANSI/EIA 310-D-1992 or IEC 60927 compliant cabinets is supported with the optional Slide Rail Kit (X8095A-Z) and optional Cable Management Arm (X8094A-Z).

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The optional slide rail kit is a 4-point mounted slide rail kit and is designed to enable Sun Fire X4600 M2 Server to be racked in the Sun Rack 900 hardware (-38 and -36N), the Sun Rack 1000 hardware (-38 and -42), and 3rd party ANSI/EIA 310-D-1992 or IEC 60927 compliant racks in the 19-inch/482.6 mm panel width series. No other kits will be available to allow 2 point, front-mount, nor mid-mount configuration. The slide kit will include hardware that enables mounting to any of the following types of rack rails :

- M6 threaded holes
- #10-32 threaded holes
- #10 to M6 clearance holes
- square unthreaded holes per EIA and IEC standards listed above

Rack requirements to support installation are:(

- rack horizontal opening and unit vertical pitch conforming to ANSI/EIA 310-D-1992 and/or IEC 60927
- four-post structure (i.e. mounting at both front and rear)
- four rack units (4U) of available vertical space per X4600 M2 server
- distance between front and rear mounting planes between 610mm and 915mm (24 to 36 inches)
- clearance depth (to front cabinet door) in front of front rack mounting plane at least 25.4mm (1 inch)
- clearance depth (to rear cabinet door) behind front rack mounting plane at least 850mm (33.5inches), or 700mm (27.5inches) without cable management arm
- clearance width (between structural supports, cable troughs, etc.) between front and rear mounting planes at least 456mm (18 inches)
- perforated front and rear cabinet doors to at least 18 square inches (120 square cm) opening per rack unit (about 60% open), or no doors, or engineered cabinet air supply and exhaust of 400 cfm (680 cmh) per X4600 M2 server

Please note that not all 3rd party racks meet these parameters and are not compatible with these slide rail kits. Also, some third-party rack vendors do not support a completely filled rack with this type of server, due to the amount of power required.

Rack Density

Sun Fire X4600 M2 Server rack density will vary widely based on systems installed, power distribution installation (in-cabinet, external), power source (single-phase, three-phase) and whether redundant power is required. The table below lists the most recent racking limits for the Sun Fire X4600 M2 server.

SUMMARY: GALAXY4 SERVER QUANTITY LIMITS IN NGR RACKS			
(based on server engineering measurements and published rack capacity specifications)			
All numbers represent the max number of configured systems in the indicated rack type and rack power system type:			
	SR1000-42	SR900-38/SR1000-38	SR900-36N
4-socket X4600 M2 configuration			
No installed power system	10	9	9
PDS: Global by External Cord Choice	4	4	4
MPS 30A Single-Phase: Americas, Japan, Taiwan	4	4	n/a
MPS 30A Three-Phase: Americas, Japan, Taiwan	6	6	n/a
MPS 60A Three-Phase: Americas, Japan, Taiwan	10	9	8
MPS 32A Three-Phase: EMEA, APAC-Japan-Taiwan	10	9	8
Note: None of the above configurations provide external-AC redundancy, because the current G4 PSU system is not symmetric.			
All of the above configurations provide 3+1 internal-PSU redundancy.			

Power Constraints for Quad Core Processors

Sun Fire X4600 M2 Server has the following constraints in running 2+2 power redundancy for Quad core processor at ACP Power 75W. Operation of ACP Power 105 processors in X4600 M2 is still to be determined.

CPU Allocated Power(W)	DIMM # per CPU	PCI slot Allocated Power (W)	PSU scheme	PSU Power(w)
115W x 8	8	80	2+2	950
115W x 8	4 (32 total)	200	2+2	950
115W x 8	6 (48 total)	200	2+2	950
115W x 8	8	200	3+1	950
115W x 8	8	200	2+2	1120

Origin statement

The Sun Fire X4600 M2 Server has components from various countries of origin. The motherboard is manufactured by BEI in Thailand. The CPU comes from Singapore. The final system assembly and integration is performed by BEI in Huntsville, Alabama.

Hardware Global compliance

Hardware Global compliance for this product complies with the guidelines as specified for hardware at: <http://global.eng/compliance/i18nl10nbigrules.html>

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The localized documents will be located at:
<http://www.sun.com/products-n-solutions/hardware/docs/Servers/>

At Revenue Release, the Sun Fire X4600 M2 servers will not be available for delivery in the following countries, since we are still working to obtain Regulatory Compliance status in those countries.

- Korea
- Taiwan
- Russia

At General Availability, the Sun Fire X4600 M2 should be deliverable to virtually all the countries in the world.

Ordering Information

Sun Fire **X4600 M2** Server Factory Standard Configurations: Please make sure that customers order a complementary slide rail kit option when they place an order for a Sun Fire X4600 M2 Server factory standard configurations. The slide rail kit X-option part number is X8095A-Z. For more information, please see the Options table listed below.

X4600 / X4600 M2 products	Marketing Part Numbers	Stepping	Presto Intro Date	EOL Date
2X8347HE QC 8-DIMM, 4X2GB (1GB Based) DDR2-667, 1X146G HDD, DVD	A67-RUZ2-8H-08CLA1	B2	8/19/08	Active
4X8356 QC 8-DIMM, 8X2GB (1GB Based) DDR2-667, 2X146G HDD, DVD	A67-RSZ4-8H-16CLB1	B2	8/19/08	Active
8X8356 QC, 16X4GB DDR2-667, 2X146G HDD, DVD, 4X 950W PSU	A67-RSZ8-8H-064LB1	B2	5/2708	Active
8x8384 QC, 16x4GB DDR2-667, 2x146GB HDD, DVD	A67-ZWZ8-8H-064LB1	S	12/9/08	Active
4x8384 QC, 8x2GB (1GB Based) DDR2-667, 2x146GB HDD, DVD	A67-ZWZ4-8H-16CLB1	S	12/9/08	Active
4x880/8x2GB/1x73GB/DVD/850W PSU	A67-QJZ4-4S-016CA1	E	7/11/06	5/8/07
4x856/8x2GB/2x73GB/DVD/850W PSU	A67-MQZ4-4S-016CB1	E	5/23/06	5/8/07
4x885/8x2GB/2x73GB/DVD/850W PSU	A67-QGZ4-4S-016CB1	E	5/23/06	5/8/07
8x885/16x2GB/2x73GB/DVD/850W PSU	A67-QGZ8-4S-032CB1	E	5/23/06	5/8/07
8x885/16x2GB/2x73GB/DVD/850W PSU VMWARE PROMO	A67-QGZ8-H-032CB1P	E	11/7/06	2/1/07
4X8218/8x2GB/2x73GB/DVD/850WPSU (F2)	A67-HGZ4-4S-016CB1	F2	11/7/06	8/07
4X8220SE/8x2GB/2x73GB/DVD/850WPSU (F2)	A67-HPZ4-4S-016CB1	F2	11/21/06	5/8/07
8X8218/16x2GB/2x73GB/DVD/850WPU S (F2)	A67-HGZ8-4S-032CB1	F2	11/7/06	8/07
4x8218/16x4GB/2x73GB/DVD/850WPSU PROMO	A67-HGZ4-H-064CB1P	F2	11/21/06	5/21/07
4X8220/8X2GB/2X73GB/DVD/850WPSU (F3/4DIMM)	A67-HPZ4-4H-016CB1	F3	2/6/07	10/9/07
2X8216/4x1GB/1x73GB/DVD/850WPSU (F3/4DIMM)	A67-HJZ2-4H-004CA1	F3	4/17/07	8/5/08

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3-for-2 PROMO: (4X8220/8X2GB/2X73GB/DVD/850WPS U (F3/4DIMM))	A67-HPZ4-4H016CB1P	F3	4/17/07	EOL
4X8220/8x2GB/2x146GB/DVD (F3/8DIMM) / 950W PSU	A67-HPZ4-8H-016LB1	F3	5/8/07	9/2/08
8X8220/16x2GB/2x146GB/DVD* (F3/8DIMM) / 950W PSU	A67-HPZ8-8H-032LB1	F3	5/8/07	9/2/08
4xquad(2.3GHz)8356/ 8x2GB/ 2x146GB/DVD	A67-RSZ4-8H-016LB1	B2	5/27/08	9/2/08
2X8347HE QC, 4X2GB DDR2-667, 1X146G HDD, DVD, 4X 950W PSU	A67-RUZ2-8H-008LA1	B2	5/2708	9/2/08
1x Model 8384 (2.5GHz Quad Core) /8 DIMM Processor Board	X8476A-Z, 8476A-Z	S	12/9/08	Active
1x Model 8380 (2.5GHz Quad Core) /8 DIMM Processor Board	X8474A-Z, 8474A-Z	S	12/9/08	Active
1x Model 8356(2.3GHz Quad Core) / 8 DIMM Processor Board	X8229A-Z, 8229A-Z	B2	5/27/08	Active
1x Model 8347 HE(1.9GHz Quad Core) / 8 DIMM Processor Board	X8226A-Z, 8226A-Z	B3	5/27/08	Active
1x Model 8360 SE(2.5GHz Quad Core) / 8 DIMM Processor Board	X8233A-Z, 8233A-Z	B3	7/22/08	Active
X4600 proc board w/ 1xOpteron 856 E4 (3.0GHz), VRMs (DDR1-400), heatsink	X8103A-Z, 8103A-Z	E	5/23/06	10/07
X4600 proc board w/ 1xOpteron 880 E6 (dual core 2.4 Ghz),VRMs (DDR1- 400),heatsink	X8104A-Z, 8104A-Z	E	7/11/06	10/07
X4600 proc board w/ 1xOpteron 885 E6 (dual core 2.6 Ghz),VRMs (DDR1- 400),heatsink	X8105A-Z, 8105A-Z	E	5/23/06	10/07
X4600 proc board-4DIMM w/ 1xOpteron 8218 F2 (dual core 2.6 GHz),VRMs (DDR2-667),heatsink	X8108A-Z, 8108A-Z	F2	11/7/06	10/07
X4600 proc board-4DIMM w/ 1xOpteron 8220SE F2 (dual core 2.8 GHz),VRMs (DDR2-667),heatsink	X8109A-Z, 8109A-Z	F2	11/21/06	10/07
X4600 proc board-4DIMM w/ 1xOpteron 8220 F3 (dual core 2.8 GHz),VRM (DDR2-667),heatsink	X8110A-Z, 8110A-Z	F3	2/6/07	10/07
X4600 proc board-4DIMM w/ 1xOpteron 8216 F3 (dual core 2.4 GHz),VRMs (DDR2-667),heatsink	X8107A-Z, 8107A-Z	F3	4/17/07	9/30/08

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X4600 proc board-8DIMM w/ 1xOpteron 8222 F3 (dual core 3.0 GHz),VRMs (DDR2-667),heatsink	X8111A-Z, 8111A-Z	F3	8/7/07	10/28/08
X4600 proc board-8DIMM w/ 1xOpteron 8220 F3 (dual core 2.8 GHz),VRMs (DDR2-667),heatsink	X8113A-Z, 8113A-Z	F3	5/8/07	10/28/08
X4600 proc board-4DIMM w/ 1xOpteron 8224SE F3 (dual core 3.2 Ghz/120W), VRMs (DDR2-667),heatsink	X8115A-Z, 8115A-Z	F3	10/9/07	9/30/08
X4600 processor filler board	X8096A-Z, 8096A-Z	-	4/3/07	Active
2GB DDR1/400 Registered ECC DIMMs (2x1G)	X8120A-Z, 8120A-Z	-	5/23/06	10/07
4GB DDR1/400 Registered ECC DIMMs (2x2G)	X8121A-Z, 8121A-Z	-	5/23/06	10/07
2GB DDR2/667 Registered ECC DIMMs (2x1G)	X8122A-Z, 8122A-Z	-	11/7/06	8/5/08
4GB DDR2/667 Registered ECC DIMMs (2x2G) – Dual Rank	X8123A-Z, 8123A-Z	-	11/7/06	9/2/08
4GB DDR2/667 Registered ECC DIMMs (2x2G) – Single Rank	X8123A-C-Z, 8123A-C-Z	-	8/19/08	Active
8GB DDR2/667 Registered ECC DIMMs (2x4G) for DUAL-CORE (only) ... NOT supported on QUAD-CORE systems	X8124A-Z, 8124A-Z	-	11/21/06	9/30/08
8GB DDR2/667 Registered ECC DIMMs (2x4G)	X8098A, 8098A	-	6/10/08	Active
73GB 10K RPM SAS Hard Drive (2.5") ROHS-6	XRA-SS2CD-73G10KZ	-	2006	Active
146GB 10K RPM SAS Hard Drive (2.5") ROHS-6	XRA-SS2CD-146G10KZ, RA-SS2CD-146G10KZ	-	2006	Active
73GB 15K RPM SAS Hard Drive (2.5") ROHS-6	XRA-SS2CD-73G15K	-	2007	Active
X4600 XATO chassis (with 4 x 850W power supplies, 4 fans, DVD)	A67-AVV	E	7/11/06	7/07
X4600 M2 XATO chassis (with 4 x 850W power supplies, 4 fans, DVD)	A67-AVM2	F	11/21/06	10/07
X4600 M2 XATO chassis (with 4 power supplies, 4 fans, DVD), 950W PSU	A67-AVM2-950	F	5/8/07	Active

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X4600 M2 XATO chassis (with 4 power supplies, 4 fans, DVD), 1133W PSU	A67-AVM2-1133	-	9/16/08	Active
X4600 4 x 950W PSU upgrade kit	X4094A-Z	F	5/8/07	Active
X4600 4 x 1133W PSU upgrade kit	X5009A-Z	-	9/30/08	Active

Due to regulatory requirements of other countries, Sun Fire X4600 M2 Server Standard Configurations are required to bundle their power cord separately. These are shippable virtually anywhere in the world.

Each Geography must select their specific Country Power cord kit as listed in table to be included with each system or chassis.

Part Number	Description
X311L	(US/Asia (except China) Localized power cord kit
X312E	(China) Localized power cord kit
X312F	(Brazil) Localized power cord kit
X312G	(Korea Localized power cord kit
X312L	(Continental Europe) Localized power cord kit
X314L	(Switzerland) Localized power cord kit
X317L	(U.K.) Localized power cord kit
X332A	(Taiwan) Localized power cord kit
X383L	(Danish) Localized power cord kit
X384L	(Italian) Localized power cord kit
X386L	(Australian) Localized power cord kit

Sun Fire X4600 M2 Server CRS Systems:

The CRS systems are “Customer Ready Systems” have same part numbers as standard configs.

Sun Fire X4600 M2 Server PCI-X and PCIe card support by OS

Part numbers are designated as X-option/XATO. For more information on individual cards, please visit: <http://www.sun.com/servers/X64/X4600/optioncards.html>

Storage Support by OS and PCI/PCI-X cards

Part numbers are designated as X-/XATO options – (X)9265A represents X9265A (X-option) and 9265A (XATO option). (Note: XATO not supported till Q1FY07)

<http://www.sun.com/servers/x64/x4600/storage.jsp>

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Services

Warranty Support

The Sun Fire X4600 M2 Server has a three year, next business day warranty.

Duration:	3 years Next Business Day
HW Coverage Hours:	Business Hours
HW Response Times:	Next Business Day
Delivery Method:	Parts Exchange or Onsite
HW Phone Coverage:	Business Hours
HW Phone Response Time:	8 hours

Sun Service Plans

Sun Global Services^(sm) program offers a full range of services to assist customers who deploy the Sun Fire X4600 M2 server. 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 virtually every customer's needs: the SunSpectrum(SM) Service Plan for full system support ranging from basic to mission critical service levels, the Sun Hardware Only Service Plan, and Sun Software Service Plan. All three Service Plans are available for the Sun Fire X4600 M2 Server.

- SunSpectrum Service Plans: Get integrated hardware and software support.
- Hardware Service Plans: Provide an affordable, convenient way to help maintain your Sun systems. With easy access to Sun technical support and quick system repair or replacement.
- 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 your production system software.

Why the Warranty Isn't 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. It's just that 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: www.sun.com/comparewarranty

SunSpectrum Service Plans

SunSpectrum Service Plans provide integrated hardware and Solaris OS 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

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SunSpectrum Service Plans

Features	Platinum Service Plan Mission-critical Systems	Gold Service Plan Business-critical Systems	Silver Service Plan Basic System Support	Bronze Service Plan Self-Maintenance Support
Telephone and Online Technical Support	24/7 Live transfer	24/7 Live transfer	8-8, M-F Live transfer	8-5, M-F 4hr response
One-stop Interoperability Assistance	Yes	Yes	No	No
Hardware Service Coverage	24/7 2hr On-site Service	8-8, M-F 4hr On-site Service	8-5, M-F 4hr On-site Service	Replacement parts 2nd business day
Solaris™ Releases	Yes	Yes	Yes	Yes
On-demand Solaris™ Updates	Yes	Yes	Yes	Yes
Online System Admin Resources	Yes	Yes	Yes	Yes
Support Notification Services	Yes	Yes	Yes	Yes
SunSpectrum™ eLearning Library	Yes	Yes	Yes	Yes
System Health Check Subscription	Yes	No	No	No
Additional Services for Qualifying Sites	Customer sites meeting an annual SunSpectrum contract minimum (approximately \$160,000 USD) can receive additional services including the creation of a personalized support plan, periodic support reviews, patch assessments and educational services. For local qualification criteria, visit sun.com/service/support/localinfo.html			

- Availability of specific features, coverage hours and response times may vary by location or product.
- Response times are determined by customer-defined priority. The response times shown are for service requests designated by the customer as "Priority 1."
- To receive the best support, Sun recommends that customers install Sun Net Connect software on SPARC®-based systems. This software creates a secure, customer-controlled link to the Sun Solution Center which helps enable expedited Solaris OS troubleshooting, remote diagnostics, and a number of customer-enabled alerting and reporting functions.



Sunsm System Service Plans for Windows OS

The Sunsm System Service Plans for Windows OS are designed to be flexible enough to cover most customers requirements for support:

Highlights:

- Integrated whole-system support for Sun's X64 systems running Microsoft Windows
- All the essentials for one great price
- Priority service
- No "per incident" limits

Warranty Upgrade to Sunsm System Service Plans for Spectrum, Windows OS and Vmware for Sun Fire X4600 M2 Server

X4600 1-4 Processors, Spectrum for Solaris or Hardware Only Support

IWU-A67-4-22-1H PLAT-HW-SVC A67-4
IWU-A67-4-22-2H PLAT-HW-SVC A67-4
IWU-A67-4-22-3H PLAT-HW-SVC A67-4
IWU-A67-4-24-1H GOLD-7X24-HW-SVC A67-4
IWU-A67-4-24-2H GOLD-7X24-HW-SVC A67-4
IWU-A67-4-24-3H GOLD-7X24-HW-SVC A67-4
IWU-A67-4-SD-1H SLVR-HW-SVC A67-4
IWU-A67-4-SD-2H SLVR-HW-SVC A67-4
IWU-A67-4-SD-3H SLVR-HW-SVC A67-4

IWU-A67-4-1P PLAT-SYS-SVC A67-4
IWU-A67-4-2P PLAT-SYS-SVC A67-4
IWU-A67-4-3P PLAT-SYS-SVC A67-4
IWU-A67-4-24-1G GOLD-7X24-SYS-SVC A67-4
IWU-A67-4-24-2G GOLD-7X24-SYS-SVC A67-4
IWU-A67-4-24-3G GOLD-7X24-SYS-SVC A67-4
IWU-A67-4-1G GOLD-SYS-SVC A67-4
IWU-A67-4-2G GOLD-SYS-SVC A67-4
IWU-A67-4-3G GOLD-SYS-SVC A67-4
IWU-A67-4-1S SLVR-SYS-SVC A67-4
IWU-A67-4-2S SLVR-SYS-SVC A67-4
IWU-A67-4-3S SLVR-SYS-SVC A67-4

X4600 5-8 Processors, Spectrum for Solaris or Hardware Only Support

IWU-A67-8-22-1H PLAT-HW-SVC A67-8
IWU-A67-8-22-2H PLAT-HW-SVC A67-8
IWU-A67-8-22-3H PLAT-HW-SVC A67-8
IWU-A67-8-24-1H GOLD-7X24-HW-SVC A67-8
IWU-A67-8-24-2H GOLD-7X24-HW-SVC A67-8
IWU-A67-8-24-3H GOLD-7X24-HW-SVC A67-8
IWU-A67-8-SD-1H SLVR-HW-SVC A67-8
IWU-A67-8-SD-2H SLVR-HW-SVC A67-8
IWU-A67-8-SD-3H SLVR-HW-SVC A67-8

IWU-A67-8-1P PLAT-SYS-SVC A67-8

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IWU-A67-8-2P PLAT-SYS-SVC A67-8
 IWU-A67-8-3P PLAT-SYS-SVC A67-8
 IWU-A67-8-24-1G GOLD-7X24-SYS-SVC A67-8
 IWU-A67-8-24-2G GOLD-7X24-SYS-SVC A67-8
 IWU-A67-8-24-3G GOLD-7X24-SYS-SVC A67-8
 IWU-A67-8-1G GOLD-SYS-SVC A67-8
 IWU-A67-8-2G GOLD-SYS-SVC A67-8
 IWU-A67-8-3G GOLD-SYS-SVC A67-8
 IWU-A67-8-1S SLVR-SYS-SVC A67-8
 IWU-A67-8-2S SLVR-SYS-SVC A67-8
 IWU-A67-8-3S SLVR-SYS-SVC A67-8

X4600 1-4 Processors, Windows Support

IWU-A67-4W-1P PLAT-WINDOWS-SVC A67-4
 IWU-A67-4W-2P PLAT-WINDOWS-SVC A67-4
 IWU-A67-4W-3P PLAT-WINDOWS-SVC A67-4
 IWU-A67-4W-1G GOLD-WINDOWS-SVC A67-4
 IWU-A67-4W-2G GOLD-WINDOWS-SVC A67-4
 IWU-A67-4W-3G GOLD-WINDOWS-SVC A67-4
 IWU-A67-4W-1S SLVR-WINDOWS-SVC A67-4
 IWU-A67-4W-2S SLVR-WINDOWS-SVC A67-4
 IWU-A67-4W-3S SLVR-WINDOWS-SVC A67-4

X4600 5-8 Processors, Windows Support

IWU-A67-8W-1P PLAT-WINDOWS-SVC A67-8
 IWU-A67-8W-2P PLAT-WINDOWS-SVC A67-8
 IWU-A67-8W-3P PLAT-WINDOWS-SVC A67-8
 IWU-A67-8W-1G GOLD-WINDOWS-SVC A67-8
 IWU-A67-8W-2G GOLD-WINDOWS-SVC A67-8
 IWU-A67-8W-3G GOLD-WINDOWS-SVC A67-8
 IWU-A67-8W-1S SLVR-WINDOWS-SVC A67-8
 IWU-A67-8W-2S SLVR-WINDOWS-SVC A67-8
 IWU-A67-8W-3S SLVR-WINDOWS-SVC A67-8

VMware 2-processor license (perpetual) with 1 year subscription and service

IS-VMW29-ENT-9999P Vmware Virtual Infrastructure 3 Enterprise/Premium, 2-processor license
 IS-VMW29-ENT-9999S Vmware Virtual Infrastructure 3 Enterprise/Standard, 2-processor license
 IS-VMW29-STD-9999P Vmware Virtual Infrastructure 3 Standard/Premium, 2-processor license
 IS-VMW29-STD-9999P Vmware Virtual Infrastructure 3 Standard/Standard, 2-processor license
 IS-VMW29-VCM-9999P Vmware Virtual Center, per server, Premium support
 IS-VMW29-VCM-9999P Vmware Virtual Center, per server, Standard support



Glossary

1U or RU	One rack unit as defined by the Electronic Industries Alliances (EIA). A vertical measurement equal to 1.75 inches.
ATA	AT-Attachment. A type of hardware interface widely used to connect hard disks, CD-ROMs and tape drives to a PC.
ChipKill™	ChipKill, or advanced ECC memory, is an IBM xSeries memory subsystem technology that increases memory reliability several times over, helping to reduce the chances of system downtime caused by memory failures.
ECC	Error Correcting Code. A type of memory that corrects errors on the fly.
Ethernet 10/100/1000Base-T	The most widely used LAN access method defined by the IEEE 802.3 standard; uses standard RJ-45 connectors and telephone wire. 100Base-T is also referred to as Fast Ethernet. And 1000Base-T is also referred to as Gigabit Ethernet.
FRU	Field Replaceable Unit.
Hot-pluggable	A feature that allows an administrator to remove a component without affecting hardware system integrity.
Hot-swappable	A feature that allows an administrator to remove and/or replace a device without affecting software integrity. This means that, while the system does not need to be rebooted, the new component is not automatically recognized by the system.
EIDE	See ATA.
IKE	Internet Key Exchange. A method for establishing a security association that authenticates users, negotiates the encryption method and exchanges the secret key. IKE is used in the IPSec protocol.
I/O	Input/output. Transferring data between the CPU and any peripherals.
IPSec	IP Security. A security protocol from the IETF (Internet Engineering Task Force) that provides authentication and encryption over the Internet. Unlike SSL, which provides services at layer 4 and secures two applications, IPSec works at layer 3 and secures everything in the network.
IPMI	Intelligent Platform Management Interface. System management architecture for providing an industry-standard interface and methodology for system management.
L2 cache	Also referred to as Ecache or External Cache. A memory cache external to the CPU chip. The AMD Opteron processor integrates 1 MB of L2 cache per CPU.
MTBF	Mean Time Between Failures. The average time a component works without failure.
SAS	Serial Attached SCSI. A serial hardware interface that allows the connection of up to 128 devices and point-to-point data transfer speeds up to 3 Gbits/sec.
SNMP	Simple Network Management Protocol. A set of protocols for managing complex networks. The first versions of SNMP were developed in the early 80s. SNMP works by sending messages, called protocol data units (PDUs), to different parts of a network. SNMP-compliant devices, called agents, store data about themselves in Management Information Bases (MIBs) and return this data to the SNMP requesters.
X86	Refers to the Intel 8086 family of microprocessor chips as well as compatible microprocessor chips made by AMD and others.

Materials Abstract

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

Collateral	Audience	Purpose	SunWIN Token #
Product Literature			
• <i>Sun Fire X4600 M2 Server Datasheet</i>	Customer	Sales Tool, Training	470889
• <i>Services for Sun Fire x64 Servers Datasheet</i>	Customer	Sales Tool, Training	470904
• <i>Sun Fire X4600 M2 Server Architecture White Paper</i>	Customer	Sales Tool, Training	470898
• <i>Sun Fire X4600 M2 Pocket Card</i>	Customer	Sales Tool, Training	470900
• <i>Sun Fire X4600 M2 Server Reviewer's Guide</i>		Sales Tool, Training	470899
Sales Tools			
• <i>Sun Fire X4600 M2 Server, Just the Facts</i>	Sales, SEs, Partners	Sales Tool, Training	470891
• <i>Sun Fire X4600 M2 Server, NDA Presentation</i>	Sales, Ses, Partners, Customers under NDA	Sales, Tool, Training	473805
• <i>Sun Fire X4600 M2 Server Technical Presentation</i>	Sales, SEs, Partners, Customer	Sales Tool, Training	470896
• <i>Sun Fire X4600 M2 Server Customer Presentation</i>	Customer Presentation	Sales Tool, Training	470893
• <i>Sun Fire X4600 M2 Server Sales Training Presentation</i>	Sales, SEs, Partners	Training	470897
Competitive Information			
• <i>Beating HP with the Sun Fire X4600 M2 Server</i>	Sales, SEs	Sales Tool, Training	470901
• <i>Beating Dell with the Sun Fire X4600 M2 Server</i>	Sales, SEs	Sales Tool, Training	470902
• <i>Beating IBM with the Sun Fire X4600 M2 Server</i>	Sales, SEs	Sales Tool, Training	470903
External Web Sites			
• <i>Sun Fire X4600 M2 Server Web Site</i>	http://www.sun.com/servers/entry/X4600		
Internal Web Sites			
• <i>Sun Fire X4600 M2 Server Internal Web Site</i>	http://onestop.central/		
Reseller Web Site			
• <i>Sun Reseller General Information</i>	http://reseller.sun.com		

Internal Only Information

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Competitive Information

Competitive beat sheets are posted regularly to <http://competitive.central>. These reports contain information about competitor's products, the strengths and weaknesses of the Sun Fire X4600 M2 Server versus competitors' products, and positioning information.

A summary of the Sun Fire X4600 M2 Server vs. the leading competition is shown below.

Sun Fire X4600 M2 Server

	<i>Sun Fire X4600 M2 Server</i>	<i>IBM x3950/x460</i>	<i>Dell PowerEdge R905</i>	<i>HP DL785 G5</i>
Max. # Sockets	4 and 8 Sockets Up to 32 cores	4 per drawer (4 cores per socket) Up to 15 drawers	4 Up to 16 cores	Up to 4 Up to 8 cores
CPU	AMD Opteron	Intel Xeon MP	Intel Xeon MP	AMD Opteron
CPU interconnect	3 available HyperTransport links per CPU	Not Available	Not Available	3 available HyperTransport links per CPU
DIMM Slots	8 per processor, up to 64	16	32	8 per processor, up to 64
Min/max memory	8-256 GB	256 GB	8-256GB* *with 4GB DIMMs	512 GB
OS	Solaris/Linux/Windows/VMware	Windows/VMware/Linux	Linux/Windows/VMware	Solaris/Linux/Windows/VMware
Disk number	4 SAS Hot-pluggable	6 per drawer, SAS	Up to 5(Ultra320 SCSI) Hot-pluggable	16 SAS
Raid	RAID 0/1	RAID 0/1/5	Optional	Optional RAID 0/1/5
Expansion slots	2 PCI-X slots, 6 PCIe slots	6 PCI-X	7 PCIe	11 PCIe
Ethernet ports	Quad Gigabit	Dual Gigabit	Quad Gigabit	Dual Gigabit
Height	4U	3-24U	4U	4U
Power Supply	Up to four redundant (2+2), hot-swappable 850 W	Redundant, hot-swappable	Redundant, hot-swappable	Redundant, hot-swappable
Remote Mgmt	ILOM	RSA-II Bundled	Optional	Integrated Lights Out
Warranty	3 year NBD	3 year NBD	3 year NB	3 year NBD

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Sun Fire X4600 M2 vs. HP DL785 G5

	SF X4600 M2	HP DL785 G5
Rack Space	4U	7U
CPU Type	AMD Dual / Quad	AMD Quad (only)
Max Socket	8 Sockets	8 Sockets
Modular Increment	2 processors	4 processors
SMP Design	Enhanced Twisted Ladder	To be confirmed
DIMMs/Chassis	64 DDR2	64 DDR2
Max Memory	256GB	512GB
Future max memory	512GB	512GB
Memory speed, >128GB	667 million data transfers per second or 5333MB/s	533 million data transfers per second or 4266MB/s
Disk Drives	4x2.5" SAS	16x2.5" SAS
Max internal storage capacity	600GB	2.3TB
Onboard RAID	RAID 0,1	RAID 0,1,5, 6
GbE Ports	4xGbE	2xGbE
Expansion Slots	6xPCIe, 2xPCI-X	11 x PCIe
Hot Swap PSUs	4x950W	To be confirmed
Hot Swap Fans	Yes	Yes
Management	ILOM	ILO 2
Warranty	3 Yr NBD	3 Yr NBD

Positioning vs. the HP DL785 G5:

When setting up RFPs or competing, sell on the following advantages:

- Higher performance, Optimum shared memory design on the X4600 M2
X4600 M2 with quad core processors run memory at 667 million data transfers per second even to 256GB of memory, whereas the DL785 G5 runs at 533 million data transfers per second when the memory is higher than 128GB. Depending on how memory intensive the application is, the Sun Fire X4600 M2s ability to support memory at 667 data transfers per second can result in an increase in performance
- Better CPU flexibility and modularity.
Sun Fire X4600 M2 servers support 2, 4, 6, or 8 processor configs whereas the new HP DL785 G5 forces customers to choose either 4 or 8 processors
X4600 M2 servers offers an overall lower price point when adding more performance, with increments of 2 processors
X4600 M2 servers are designed so customers can upgrade. Customers who purchased the original single core AMD processors were able to easily upgrade to dual core AMD processors when AMD made them available without having to buy a new server. The same is true when AMD quad core becomes available on the X4600 M2. The Sun Fire X4600M2 will still be offering the fastest dual core as well as quad core processors whereas DL785 G5 is quad core only server.
- Compact size
Sun Fire X4600 M2 is 2X denser than HP DL785 G5.
A customer can put 10 Sun Fire X4600 M2 servers in a 40U rack, but only 5 HP DL785 G5 servers in that same rack. In other words, 1 rack of Sun Fire X4600 M2 servers will deliver up to 256 CPU cores vs. only 128 CPU cores in a rack filled with HP DL785G5 servers.

Sun Fire X4600 M2 is 4U vs HP DL785 G5 is 7U
- Lower Power Draw
Sun Fire X4600 M2 runs with max power of 1600W vs HP DL785 G5 at *estimated* 2000W+ per server (the power overhead required to support more I/O and more disks)
- Established and proven 8-socket design
Sun Fire x4600 M2 servers have been shipping for the last 2 years and have offered upgrades from single core to dual core and now to quad core, in the

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same chassis.

Sun has qualified and verified the viability of Sun Fire X4600 M2 servers running virtualization, database and high performance computing and have sold tens-of-thousands of these servers in these compute intensive environments.

In the first installation of Sun Fire X4600 M2 servers, Sun installed over 650 Sun Fire x4600 M2 servers at TITECH (Tokyo Institute of Technology), in one data center. Even today TITECH runs Japan's fastest supercomputer.

6) Importance of integrated 4GbE port integration

The SF X4600 M2 offers two additional, independent 2GbE ports (4 total ports) vs. the HP DL785 G5. To obtain 4 GbE ports on an HP DL360 G5, the customer must purchase an additional Dual GbE card for their server.

> \$259 Card from HP (Dual Port Gigabit Server

Adapter)

Other Points Your Customer should be considering prior to investing in any HP DL785 G5 server for virtualization:

VMware will excel and run better on the Sun Fire X4600 M2 given its optimal memory design

The additional PCIe I/O in DL785 G5 is only useful in certain, niche environments and applications; VMware is not likely to be able to take advantage of this

The HP DL785 G5 hosts a lot of over-engineered features that are not useful for virtualization: HTx option, lots of disks, when VMware virtual infrastructure requires a SAN

When to walk away from selling the SF X4600 M2 against the HP Graphics deployment if external graphics solution on X4600 M2 would not work

The customer has an environment where they need to insert > 8 PCI cards

More than 4 disk drives are required and the use of an external JBOD or RAID array (or X4120/X4440/X4450/X4500) can not be deployed

Sun Fire X4600 M2 vs. IBM X3950 M2

	SF X4600 M2	IBM X3950 M2
Rack Space	4U	4U to 16U
CPU Type	AMD Dual / Quad	Intel Dual / Quad
Max Socket	8 Sockets	4 sockets/chassis: 4 to 16 sockets
Modular Increment	2 processors	2 processors
SMP Design	HyperTransport	and IBM eX4 architecture chipset on ScaleXpand option for 2 to 4 nodes
DIMMs/Chassis	64 DDR2	32 DDR2/chassis, max 128 DDR2 for 4 chassis
Max Memory	256GB	256GB/chassis, max 1TB for 4 chassis
Future max memory	512GB	No change from above
Memory speed	per second or 5333MB/s	533 million data transfers per second or 4266MB/s
Memory mirroring / hot swap	-	Yes
Disk Drives	4x2.5" SAS	4x2.5" SAS per chassis, 16x2.5" SAS/4 chassis
Max internal storage capacity	600GB	600GB/chassis, 2.4TB/4 chassis
Onboard RAID	RAID 0,1	RAID 0,1
RAID option	-	Battery backup RAID; PCIe RAID 0, 1, 5, 6, 10, 50, 60
GbE Ports	4xGbE	2xGbE/chassis, 8xGbE/4 chassis
Expansion Slots	6xPCIe, 2xPCI-X	7 x PCIe 8X / chassis, 28 x PCIe 8X / 4 chassis
Hot-swap cards	-	2 hot-swap PCIe per chassis
Hot Swap PSUs	4x950W	2x1440W/chassis, 8x1440W/chassis
Hot Swap Fans	Yes	Yes, requires entire chassis to be pulled out
Management	ILOM	Light path diagnostics, BMC, Remote Supervisor Adapter II
Warranty	3 Yr NBD	3 Yr NBD

Positioning vs. the IBM X3950 M2:

When setting up RFPs or competing, sell on the following advantages:

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- 1) Higher performance, Optimum shared memory design on the X4600 M2
X4600 M2 with quad core processors run memory at 667 data transfers per second even to 256GB of memory, whereas the IBM X3950 M2 runs at 533 data transfers per second. Depending on how memory intensive the application is, the Sun Fire X4600 M2s ability to support memory at 667 data transfers per second can result in an increase in performance
- 2) Better CPU flexibility and modularity.
Sun Fire X4600 M2 servers support 2, 4, 6, or 8 processor configs whereas the IBM X3950 M2 scales by adding up to 4 processor in one system, and then add up to 4 nodes with cabling between nodes.
- 3) Compact size
Sun Fire X4600 M2 has 2X higher compute density than IBM X3950 M2.
X4600 M2 is 4U vs X3950 M2 requires 8U to offer 8 processors.
In a 40U rack, a customer can put 10 Sun Fire X4600 M2 servers with 80 processors, whereas the same would only house 40 processors for IBM X3950 M2.
- 4) Lower Power Draw
Sun Fire X4600 M2 runs with max power of 1600W with 8 processors vs 2 x IBM X3950 M2 that could consume power up to 2800W.
- 5) Much better memory latency
For 2 to 4 nodes of IBM X3950 M2, the interconnect cabling induce significant shared memory latency that slows the entire system down
- 6) Much lower costs
X4600 M2 with 8 processors is lower priced than 2 x IBM X3950 M2 each with 4 processors.
X4600 M2 with 256GB of memory is much lower priced than IBM X3950 M2, which either have to provide 2 X3950 M2 systems using 64 x 4GB DIMMs or a single X3950 M2 with 32 x 8GB DIMMs

When to walk away from selling the SF X4600 M2 against the IBM

Windows Data Center – IBM offers this support. X4600 M2 with Windows Server Enterprise edition is quite sufficient in most cases
Support for 1TB of memory in a single system