



Xserve

Technology Overview
January 2008



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Introduction

What's new?

- Quad-Core Intel Xeon 5400 series “Harpertown” processors with 12MB L2 cache per processor
- Up to 3.0GHz 8-core processing
- Dual independent 1600MHz system buses for up to 25.6GB/s throughput
- Up to 32GB of 800MHz DDR2 ECC FB-DIMM memory
- Two PCI Express 2.0 expansion slots, one 16-lane and one eight-lane, providing up to 8GB/s bandwidth
- Up to 3TB of internal SATA/SAS storage capacity¹
- Optional hardware RAID card with 256MB cache and 72-hour battery backup
- Mac OS X Server v10.5 Leopard unlimited-client license, optimized for multicore Intel processors

In August 2006, Apple introduced the first Intel-based Xserve, receiving high praise for its smart design, comprehensive capabilities, and excellent performance. Now in its sixth generation, Xserve blasts ahead again with 8-core Intel Xeon processing, a leading-edge system architecture, and Apple’s latest server operating system, Mac OS X Server version 10.5 Leopard. Still astonishingly simple to deploy and manage, the new Xserve offers a dramatic performance improvement along with innovative software services that change the way people and groups work together.

The new Xserve may look the same on the outside, but don’t be fooled. Under the hood, Xserve has been rebuilt to tackle the most rigorous server tasks at maximum speed. Its outstanding performance starts, of course, with the latest-generation Quad-Core Intel Xeon 5400 series processors, code-named “Harpertown.” A new system architecture boosts bandwidth at every interface, from dual 1600MHz frontside buses to faster 800MHz FB-DIMM memory and faster storage and expansion slots. Add to these an operating system that’s optimized for multicore processing, and Xserve delivers up to a 2x performance gain.²

Without sacrificing affordability, Xserve comes fully equipped for deployment in demanding businesses and institutions. An unlimited-client license for Mac OS X Server—integrating a host of powerful network services and intuitive management and monitoring tools—adds unparalleled value at no extra cost. For increased uptime, robust hardware features like ECC memory and lights-out management are standard on all systems, with dual power supplies and hardware RAID available as configure-to-order options. And for even greater peace of mind, Apple offers enterprise-class service and support products that cover both Xserve hardware and Mac OS X Server software, with only one number to call.

Xserve with Mac OS X Server is ideal for traditional server applications, including cross-platform file and print, managing Mac desktops in workgroups or classrooms, web and application serving, and media streaming. Innovative new communication tools in Leopard Server—such as group calendaring, wiki-based collaboration, and a media workflow engine called Podcast Producer—give workgroups the power to interact like never before. And with 8-core processing and a 64-bit operating system, Xserve has the horsepower for compute-intensive environments, such as rendering farms and computational clusters.

Xserve. Providing the power and versatility to meet the needs of businesses, education institutions, creative departments, and research centers everywhere.

Product Overview



Xserve

Xserve packs the computing power of Quad-Core Intel Xeon processors plus fast, affordable storage into a 1U rack-optimized enclosure. With a single base configuration and a wide range of build-to-order options, customers can configure an Xserve to meet their specific needs.



Leopard Server. Simply powerful.

With advanced services like iCal Server, Podcast Producer, Wiki Server, and a simplified setup and administration interface, Mac OS X Server makes it easy, even for server novices, to deploy and manage a server. Tuned for multiple cores, it unleashes the performance of the Quad-Core Intel Xeon processors in Xserve.

Key Features

Apple's sixth-generation rackmount server, Xserve combines cutting-edge Quad-Core Intel Xeon processors, an ultrafast server architecture, flexible storage features, and powerful remote management capabilities with Apple's legendary ease of use and the innovative server features of Mac OS X Server. The following features make Xserve a robust, versatile server solution for business and institutions everywhere.

Quad-Core Intel Xeon processors. Xserve incorporates Quad-Core Intel Xeon 5400 series "Harpertown" processors with a 1600MHz frontside bus for a massive processing gain. Each 64-bit Xeon processor, built using an advanced 45-nanometer production process for reduced die size and power consumption, has 12MB of shared L2 cache, enhanced floating-point units, and 128-bit SSE4 vector engines.

New system architecture. Featuring two independent frontside buses running at 1600MHz, providing up to 25.6GB/s of throughput to the rest of the system, and 800MHz DDR2 Error Correction Code (ECC) memory, the new system architecture in Xserve is ideally matched to feed the fast Quad-Core Intel Xeon processors with data. The advanced 256-bit-wide memory controller uses four FB-DIMM (fully buffered DIMM) channels to provide up to 32GB of capacity while providing a 64 percent improvement in memory bandwidth over the previous generation.³

PCI Express 2.0 expansion. To deliver exceptional server performance, Xserve provides enhanced I/O bandwidth to match the increase in processing performance. Two PCI Express 2.0 expansion slots—one 16-lane, one eight-lane—provide up to 8GB/s of throughput to support the latest Apple and third-party high-bandwidth I/O cards, including dual- and quad-port 4Gb Fibre Channel and 10Gb Ethernet networking.

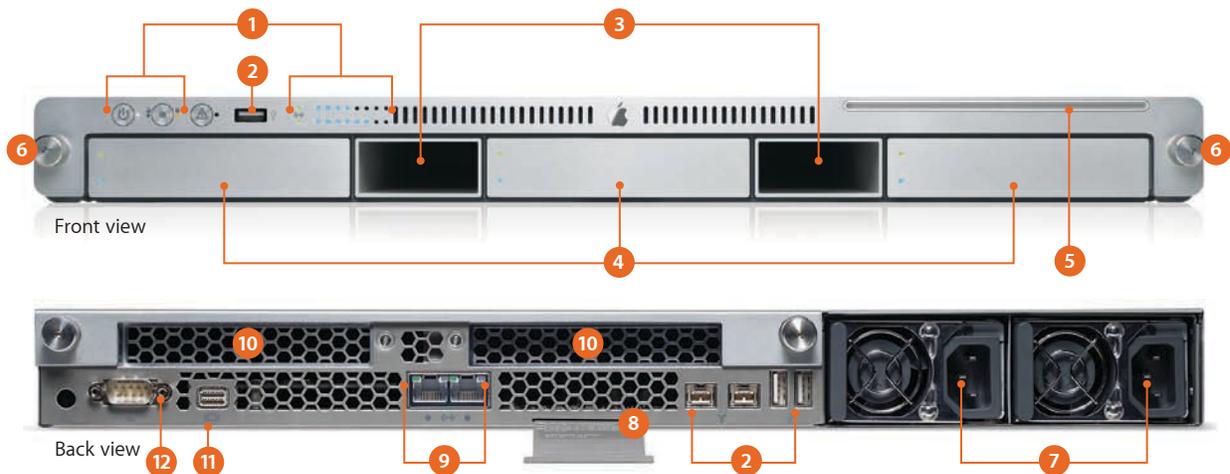
Flexible advanced storage. With three drive bays, Xserve provides up to 3TB of internal storage capacity through an advanced storage controller that supports SATA (Serial ATA) and SAS (Serial Attached SCSI) drives.¹ Enterprise-class SAS hard drives deliver phenomenal performance—up to 125MB/s with seek times as low as 3.5 ms—and are ideal for demanding applications.⁴ An optional Xserve RAID card provides internal hardware RAID 0, 1, and 5 with 256MB of cache plus a 72-hour cache battery backup for advanced data protection.

Built-in lights-out management. As long as the electrical power cord and Ethernet cable are plugged in, built-in remote management capabilities allow control of an Xserve system from anywhere on the network—even if the system isn't turned on. Easy-to-use Server Monitor software provides remote monitoring and control of Xserve with an intuitive graphical interface.

Powerful UNIX®-based operating system. Included with Xserve at no extra cost is an unlimited-client license for Mac OS X Server v10.5. This native version—built on open standards and optimized to take advantage of the multicore computing power of the latest Intel Xeon processors—comes complete with easy-to-use workgroup, media, and Internet services. It integrates seamlessly into enterprise infrastructures and never requires additional client access license (CAL) fees.

Server-class support products. To minimize downtime, Apple offers a suite of enterprise-class support products, including onsite hardware repairs, advanced software support, and convenient spares kits.

Xserve System



- 1 Indicator lights.** Indicator lights show system activity and also provide continuous feedback on health and status, including power, enclosure lock, drives, Ethernet links, and processor.
- 2 FireWire and USB ports.** Two back-panel FireWire 800 ports provide high-speed connectivity to storage, backup devices, and other servers. Two back-panel and one front-panel USB 2.0 ports provide easy connectivity to industry-standard peripherals.
- 3 Air ducts.** An intelligent cooling system—with large air ducts and seven high-performance double-blade fans, each individually managed by a microcontroller—provides front-to-back airflow over system components. For minimal noise and power use, the fans run only as fast as needed to cool the system effectively. If one fan fails, the others will speed up to compensate.
- 4 Drive bays.** Three bays support SATA and SAS internal storage on three independent channels. Hot-plug support allows storage to be added without bringing down the server. Apple Drive Module LEDs indicate drive activity and health using Self-Monitoring, Analysis, and Reporting Technology (SMART) data. The optional Xserve RAID card provides RAID 0, 1, and 5 data protection.
- 5 Optical drive.** The 8x double-layer SuperDrive (DVD+R DL/DVD±RW/CD-RW) permits quick and easy software loading as well as archive and backup.
- 6 Simplified rapid-mounting system.** An easy-to-use rackmount system with quick deployment rails simplifies and speeds installation of one or hundreds of systems, while supporting a wide range of racks and cabinets.
- 7 Redundant power supplies.** Hot-swappable and load-sharing, an optional second power supply for Xserve provides enhanced redundancy and easy serviceability in case one power supply fails.
- 8 System information tag.** A slide-out card provides key system information, including system configuration, serial number, and Ethernet MAC (Media Access Control) addresses in text and bar-code formats. An open area provides room for site-specific information or an organization's asset tag.
- 9 Gigabit Ethernet interfaces.** Dual independent Gigabit Ethernet links on the main logic board increase deployment and management flexibility.
- 10 PCI Express slots.** Two independent PCI Express 2.0 expansion slots (one x16, one x8) provide up to 8GB/s of throughput to support the latest I/O and networking cards. The x8 slot can be configured to support a PCI-X card.
- 11 Internal graphics.** Built-in graphics facilitate easy management of the system through a keyboard, mouse, and display without taking up a valuable expansion slot. Applications can take advantage of the 2D/3D acceleration of the GPU to enhance rendering and video processing. A mini-DVI output drives up to a 23-inch Apple Cinema HD Display, and the included VGA adapter supports connection to standard VGA devices and KVM (keyboard-video-mouse) switches.
- 12 Serial port.** A DB-9 serial port allows for system access through a serial console session, even when the network is down.

Performance Overview

The Xserve system is designed to deliver phenomenal performance with industry-leading ease of use and massive internal storage capacity. Thanks to its 64-bit Quad-Core Intel Xeon processing power, advanced memory technology, and high-bandwidth architecture, Xserve easily handles demanding server operations. To assess its performance gains, Apple compared preproduction 8-core Xserve units with production quad-core Xserve systems.

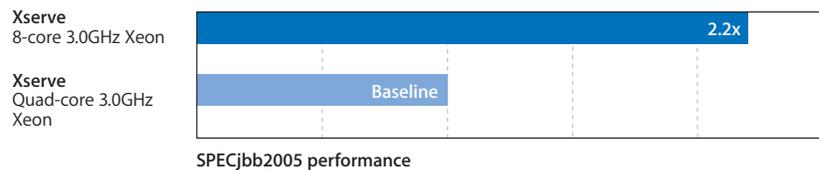
Java™ Server Performance

Leveraging the high throughput delivered by two Quad-Core Intel Xeon processors, fast dual-independent 1600MHz system buses, and fast 800MHz DDR2 ECC memory, the 8-core Xserve delivers twice the performance of the previous-generation quad-core Xserve.²

SPECjbb2005

SPECjbb2005 measures the performance of server-size Java by emulating a three-tier client/server system. The benchmark stresses the performance of the processors, caches, and memory hierarchy, as well as the SMP performance and Java Virtual Machine (JVM) of the operating system.

The new 8-core Xserve is more than two times faster than the quad-core Xserve.



Based on industry-standard SPECjbb2005 benchmark testing conducted by Apple in December 2007 using a preproduction 3.0GHz 8-core Xserve (2 chips, 8 cores, 4 cores per chip, 3.0GHz; SPECjbb2005 bops = 103,886, SPECjbb2005 bops/JVM = 25,972) and a shipping 3.0GHz quad-core Xserve (2 chips, 4 cores, 2 cores per chip, 3.0GHz; SPECjbb2005 bops = 47,195, SPECjbb2005 bops/JVM = 23,598). SPEC® and SPECjbb® are registered trademarks of the Standard Performance Evaluation Corporation (SPEC); see www.spec.org for more information. Competitive benchmark results stated above reflect internal Apple testing and have been submitted to SPEC in December 2007. For the latest SPECjbb2005 benchmark results, visit www.spec.org/osg/jbb2005. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

To demonstrate the improved performance of the new Xserve, Apple tested the system against the previous generation—the quad-core Xserve—using popular computing benchmarks. The results are based on benchmark testing performed in December 2007 by Apple in a laboratory setting using publicly available software. The server configurations tested were as follows:

- **Apple Xserve with two Quad-Core Intel Xeon processors.** Two 3.0GHz Quad-Core Intel Xeon 5400 series processors, 4GB of 800MHz DDR2 ECC FB-DIMM memory, single 80GB SATA Apple Drive Module, dual Gigabit Ethernet, and Mac OS X Server v10.5.
- **Apple Xserve with two Dual-Core Intel Xeon processors.** Two 3.0GHz Dual-Core Intel Xeon 5100 series processors, 4GB of 667MHz DDR2 ECC FB-DIMM memory, single 80GB SATA Apple Drive Module, dual Gigabit Ethernet, and Mac OS X Server v10.5.

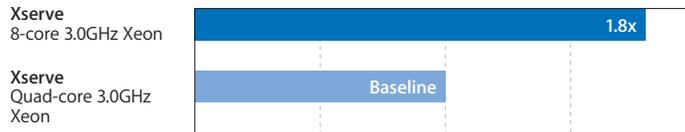
Processor Performance

Leveraging the high throughput delivered by two 64-bit Quad-Core Intel Xeon processors and an enhanced 128-bit SSE4 vector engine, Xserve excels at managing the complex calculations crucial to users in business or scientific computing environments, image processing, and media encoding.

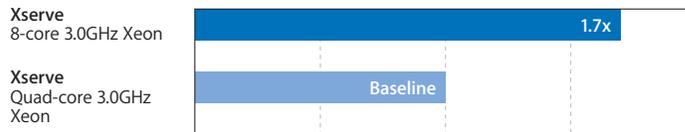
SPEC CPU2006

SPEC rate metrics recognize multiple-core processors by running multiple copies of the benchmark code concurrently, allowing all cores to work in parallel. SPECfp_rate2006 and SPECint_rate2006 measure the number of times a system can complete a suite of floating-point and integer-math-based benchmarks, respectively, over a period of time.

The 8-core Xserve is 1.8 times faster than the previous quad-core Xserve with integer calculations and 1.7 times faster with floating-point calculations.



SPECint_rate2006 integer calculation (estimate)



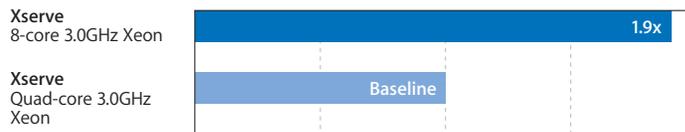
SPECfp_rate2006 floating-point calculation (estimate)

Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xserve units and shipping 3.0GHz quad-core Xserve units. SPEC® is a registered trademark of the Standard Performance Evaluation Corporation (SPEC); see www.spec.org for more information. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

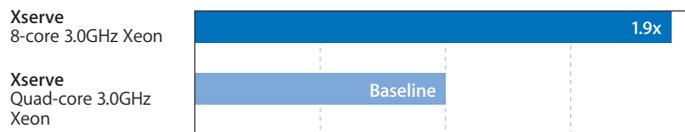
Linpack

Computers use double-precision floating-point mathematics to perform calculations requiring great numerical magnitude or extremely high decimal accuracy. Apple used the Linpack benchmark to illustrate the benefits of the Quad-Core Intel Xeon processor's two floating-point units per core. Linpack measures both single- and double-precision floating-point performance running a program that solves a dense system of linear equations.

The 8-core Xserve is 1.9 times faster than the quad-core Xserve with both single-precision and double-precision floating-point calculations.



Double-precision results



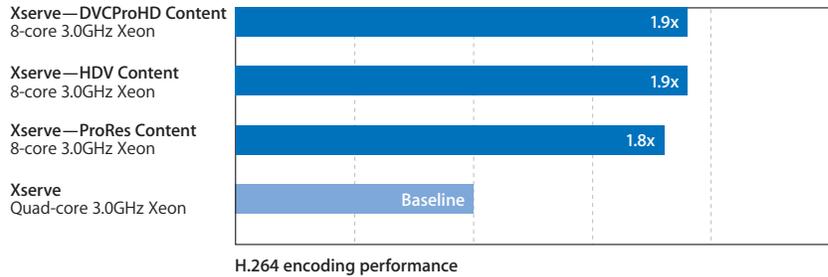
Single-precision results

Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xserve units and shipping 3.0GHz quad-core Xserve units. All systems were configured with 8GB of RAM. Results are based on the 1000s and 1000d Linpack benchmarks available from www.netlib.org/benchmark using a matrix size of 23,000 for the single-precision results and 16,000 for the double-precision results. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

Video compression

Compressing video into popular delivery formats takes a tremendous amount of processor performance. To simplify and automate content compression and delivery, organizations can leverage batch processing software such as Apple's Compressor application, part of Final Cut Studio 2. Apple's test measured Compressor performance encoding a variety of video formats using the H.264 codec.

The 8-core Xserve performs H.264 compression up to 1.9 times faster than the previous-generation quad-core Xserve, depending on the source footage format.



Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xserve units and shipping 3.0GHz quad-core Xserve units. Content was encoded using Compressor's H.264 for iPod Video 640x480 preset, and Qmaster with 8 instances for the 8-core system and 4 instances for the quad-core system. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

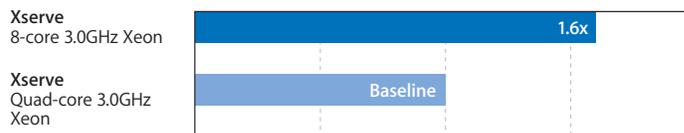
Memory Performance

The new Xserve incorporates a faster 800MHz memory subsystem, delivering more memory bandwidth with continued high reliability. Using four channels of 800MHz DDR2 ECC fully buffered DIMMs, Xserve has a maximum memory bandwidth of 25.6GB/s. Coupled with the faster 1600MHz frontside bus and massive 12MB L2 cache per processor, this added bandwidth supports the additional cores in the new Xserve. A wide range of network services as well as graphics, video, and scientific applications run dramatically faster as a direct result of more and faster RAM.

STREAM

The STREAM benchmark is a simple synthetic benchmark program that measures sustainable memory bandwidth, rather than bursts or peak performance. Since the STREAM benchmark is specifically designed to work with data sets that are much larger than the available processor cache on any given system, the results are more indicative of the performance of applications using very large data sets.

The 8-core Xserve delivers a 64 percent boost in memory bandwidth over the previous-generation Xserve.



Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xserve units and shipping 3.0GHz quad-core Xserve units. All systems were configured with 8GB of RAM. Results are based on the STREAM v. 5.6 benchmark (www.cs.virginia.edu/stream/ref.html) using OMP support for multiprocessor-compiled builds. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

Storage Performance

While processor performance is a critical factor in scientific applications, most server workloads require a balance of processor, memory, disk, and network operations to deliver outstanding overall performance. Xserve delivers flexible storage capabilities by using a 3Gb/s-per-channel storage controller that supports both SATA (Serial ATA) and SAS (Serial Attached SCSI) hard drives. When configured with SATA drives, Xserve delivers tremendous value with excellent storage performance. When configured with 15,000-rpm SAS drives—the fastest and most reliable currently available in the industry—Xserve delivers maximum performance with ultrafast seek times for demanding applications. The optional hardware RAID controller provides hardware RAID 0, 1, and 5 with 256MB of cache and a 72-hour cache battery backup for performance and data protection that are ideal for server deployments.

Iometer

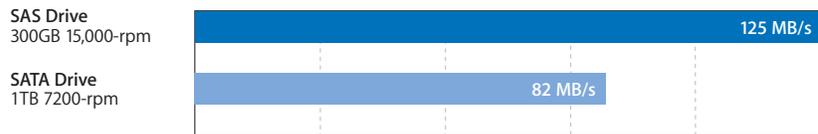
Iometer is an I/O performance analysis tool for servers that was originally developed by Intel and later released as an open source benchmarking tool. It measures system I/O performance—both throughput and latency—while stressing the system with a controlled server workload.

When configured with the 1TB 7200-rpm SATA drive, Xserve delivers an outstanding 82MB/s per drive while supporting up to 3TB in a three-drive 1U enclosure. When configured with the 300GB 15,000-rpm SAS drive, Xserve delivers a breakthrough 125MB/s per drive with an average random access seek time of 3.5 ms—ideal for high-workload applications like databases and mail servers.



SATA and SAS drive technologies

For internal storage, Xserve offers both SATA (Serial ATA) and SAS (Serial Attached SCSI) drive technologies. Very reliable and delivering great performance, SATA is the better choice when high capacity and cost per gigabyte are of primary and equal importance. When the ultimate in performance and reliability is required, SAS is preferred, providing the industry's highest reliability and performance.



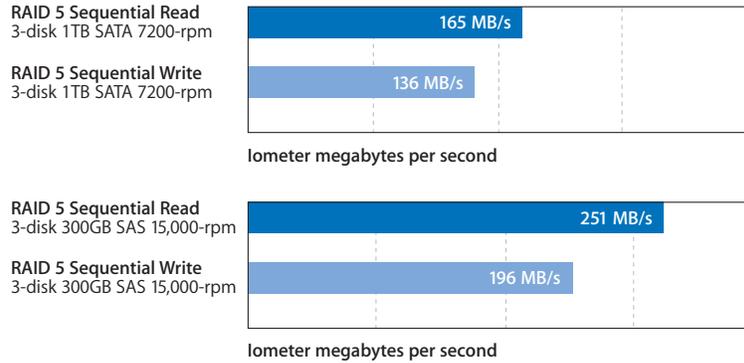
Bandwidth: megabytes per second



Average seek time (shorter is better)

Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xeon-based Xserve units configured with Xserve RAID card. Testing conducted using Iometer 2006.0727 with a 30-second ramp-up, 5-minute run duration, 512KB request size, 4 outstanding I/Os, and using non-OS-cached reads and writes. System configured with the operating system and test volume on a single RAID volume. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve RAID card.

RAID 5 provides enhanced data protection against drive failure while ensuring excellent read and write performance. When configured with the optional Xserve RAID card—offering internal hardware RAID levels 0, 1, and 5 with 256MB of cache and a 72-hour cache battery backup—Xserve delivers up to 251MB/s of sequential read performance using three 15,000-rpm SAS drives. Using three 1TB SATA drives, Xserve delivers up to 165MB/s and 2TB of RAID 5 protected storage.



Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xeon-based Xserve units configured with Xserve RAID card. Testing conducted using lometer 2006.0727 with a 30-second ramp-up, 5-minute run duration, 512KB request size, 4 outstanding I/Os, and using non-OS-cached reads and writes. System configured with the operating system and test volume on a single RAID volume. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve RAID card.

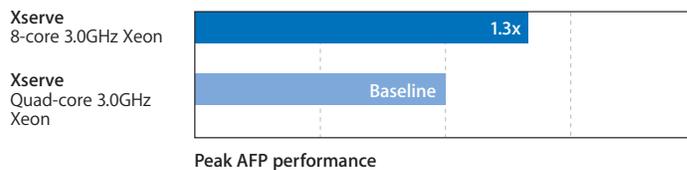
File Server Performance

The balanced hardware architecture of Xserve delivers a robust mix of processor, memory, storage, and network performance. Running Mac OS X Server v10.5, optimized for the Quad-Core Intel Xeon processor and multiple network interfaces, Xserve can provide critical network and file services to large client populations—no matter whether Macintosh, Windows, or Linux clients. The advanced architecture and operating system provide a dramatic increase in server performance.

AFP services

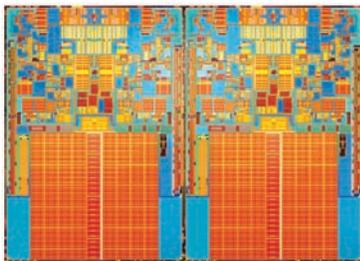
Delivering outstanding file server performance requires more than fast processors. The server system must also provide outstanding storage and network performance. Apple tested the 8-core Xserve and quad-core Xserve using an internal AFP testing tool against the AFP services in Mac OS X Server.

The new Xserve delivers up to a 33 percent improvement in the network file server performance running AFP services.



Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xserve units and shipping 3.0GHz quad-core Xserve units. Each system was configured with 8GB of RAM and 3-disk RAID 0 (using the Xserve RAID card and 15,000-rpm SAS disk drives). Results are based on the AFPBench benchmark, using 100 virtual clients, running on 29 physical systems, and making requests simulating typical home-directory usage. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

Quad-Core Intel Xeon Processors



Key features

- Enhanced Intel Core microarchitecture
- 12MB on-die L2 cache
- Dual independent 1600MHz system buses
- Reduced idle power
- High-performance floating-point division
- Enhanced 128-bit SSE4 SIMD engine
- Mac OS X Server v10.5 Leopard

Inside every Xserve are one or two powerful new Quad-Core Intel Xeon 5400 series processors running at up to 3.0GHz. Informally known during development as “Harpertown,” these second-generation quad-core processors are built with Intel’s state-of-the-art 45-nm process using the enhanced Intel Core microarchitecture. Combining high performance in a power-efficient design, the Xeon 5400 series processors help make the new Xserve the most powerful Apple server ever.

Enhanced Intel Core Microarchitecture

The Xeon 5400 series introduces an enhanced Core microarchitecture featuring larger on-die caches, improved power management, and a new instruction set. The result is a second-generation quad-core processor that delivers superior performance and energy efficiency to a broad range of 32-bit and 64-bit applications and services.

These enhancements represent another milestone in Intel’s continuous development of next-generation silicon processes and processor architecture. A wide range of applications will benefit, including web and application servers, database servers, scientific applications, graphics processing, and video encoding.

12MB On-Die L2 Cache

The Intel Xeon 5400 series processor features a large 12MB level 2 cache, configured as two 6MB banks of Advanced Smart Cache. The larger L2 cache, a key processor subsystem aided by the 45-nm process size, increases the efficiency of the processing cores by reducing memory access latency and keeping more data closer to the processor.

Intel’s Advanced Smart Cache is a multicore-optimized cache. It improves performance and efficiency by increasing the probability that each execution core of a multicore processor can access data from a higher-performance, more efficient cache subsystem. To accomplish this, the Quad-Core Intel Xeon processor shares 6MB of L2 cache between cores. Unlike most multicore implementations, which leave each execution core to store data in its own L2 cache, Advanced Smart Cache optimizes cache resources by storing data in a single place that each core can access. By sharing L2 caches among multiple cores, the Intel Advanced Smart Cache also allows each core to dynamically utilize up to 100 percent of available L2 cache—6MB in the case of the Xeon 5400 series. When one core has minimal cache requirements, other cores can increase their percentage of L2 cache, reducing cache misses and increasing performance.

Dual Independent System Buses

A faster 1600MHz system bus complements the Xeon 5400 microarchitecture. Dual independent buses, one per processor, support a wide and fast path to system memory—ideal for intense computing environments, 32-bit and 64-bit business-critical applications, and robust server platforms.



Mac OS X Server and multiple cores

Mac OS X Server v10.5 features improved processor scheduling, thread management, and affinity algorithms to take advantage of the latest generation of multicore Intel processors.

Reduced Idle Power

The Xeon processors in the new Xserve consume a maximum of 80W per processor, providing more computation capability in the same thermal profile as the previous-generation Xserve—for a tremendous boost in performance-per-watt. In addition, the Xeon 5400 series processor has enhanced power management features that, in conjunction with the power management of Mac OS X Server, reduce the idle power to as low as 4W. Spread across the typical daily workload of an Xserve, lower idle power can greatly reduce average server power consumption, lowering both power and cooling bills.

High-Performance Floating-Point Division

The Xeon 5400 series processor implements a new radix 16 divider that nearly doubles the speed of floating-point division over the previous-generation Xeon, improving the performance of scientific, 3D, and other mathematically intensive workloads.

Enhanced 128-Bit SSE4 SIMD Engine

SIMD (single instruction, multiple data) processing accelerates data manipulation by simultaneously applying a single instruction to multiple pieces of data. The Quad-Core Intel Xeon processor incorporates an enhanced 128-bit Streaming SIMD Extensions (SSE) vector engine. Supporting SSE2 and SSE3 instructions, the Xeon 5400 series adds SSE4 extensions that incorporate 47 new instructions tailored for media and high-performance computing applications.

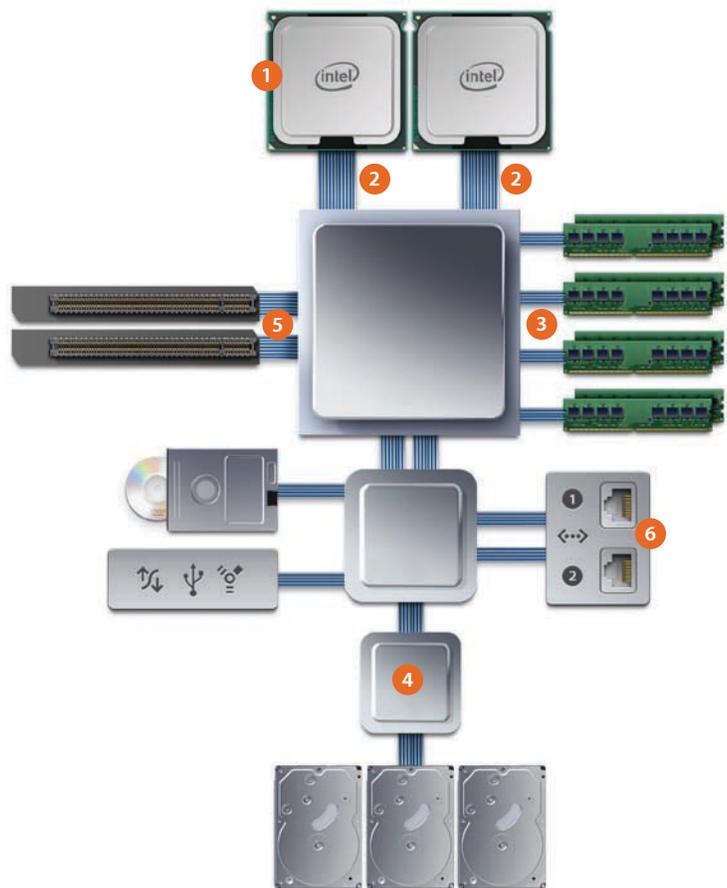
Also new to the Xeon 5400 series processor is the Super Shuffle Engine—a 128-bit-wide single-pass shuffle unit that can perform full-width byte shuffles in a single cycle. Similar to the vector permute instruction in the Velocity Engine of the PowerPC, the Super Shuffle Engine can boost performance for numerous data movement operations, including pack, unpack, and shifts used in algorithms such as image analysis, video compression and decompression, data analysis, and high-performance computing.

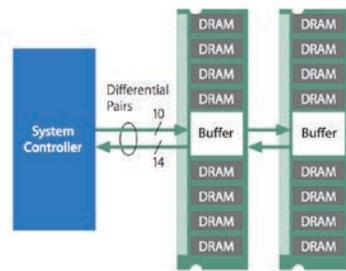
High-Bandwidth Server Architecture

The Quad-Core Intel Xeon processor is only part of the Xserve performance story. Dual independent frontside buses keep data moving in and out of each processor, and a super-efficient system controller keeps data moving between all subsystems. Bandwidth is further enhanced by a 256-bit-wide memory controller and a PCI Express 2.0 I/O architecture. Together, these advanced technologies provide the performance and throughput for demanding Internet applications, robust network infrastructure solutions, and high-performance computational clustering environments.

Server-Optimized Architecture

- 1 One or two Quad-Core Intel Xeon processors.** Deliver industry-leading performance in a power-efficient design.
- 2 Dual independent 1600MHz frontside buses.** Complement the quad-core processors by providing a wide and fast path to system memory.
- 3 256-bit-wide memory controller with 800MHz DDR2 ECC FB-DIMM memory.** Provides up to 25.6GB/s bandwidth and up to 32GB capacity.
- 4 High-performance SATA/SAS storage controller.** Supports SATA drives or—for the most demanding applications—15,000-rpm SAS drives. Delivers up to 3Gb/s of storage performance per channel and up to 3TB of hot-plug internal storage.¹
- 5 Dual PCI Express 2.0 expansion.** Supports two independent PCI Express 2.0 expansion slots—one eight-lane and one 16-lane—for bandwidth of 4GB/s or 8GB/s; the 8x slot can be configured to support a PCI-X card.
- 6 Dual onboard Gigabit Ethernet.** Provides two independent ports as well as hardware support for VLAN tagging, jumbo frames, and TCP, IP, and UDP hardware checksum.





What is a fully buffered DIMM?

A fully buffered DIMM, or FB-DIMM, is a new kind of high-performance computer memory module that helps increase a system's reliability, speed, and memory density while keeping down costs. Based on a high-speed point-to-point interface, it works with an Advanced Memory Buffer ASIC that allows full-speed, simultaneous reads and writes using industry-standard DRAM chips.

Dual Independent 1600MHz Frontside Buses

Xserve features dual independent 64-bit frontside buses—one bus per processor—to support a wide and fast path to system memory. The parity-protected buses feature a unique power-saving capability that powers down part of the bus when full bandwidth is not being utilized. Each channel runs at 1600MHz independent of processor speed; combined, they provide up to 25.6GB/s bandwidth.

Advanced FB-DIMM Memory Technology

The fully buffered DIMM (FB-DIMM) is the next evolution in memory technology for servers and workstations that value both capacity and bandwidth. With older memory technologies, as signaling rates increase, the number of DIMMs supported per channel decreases. The result has been a trade-off between overall memory capacity and bandwidth. FB-DIMMs evade this trade-off by providing maximum capacity at the highest bandwidth.

The FB-DIMM is based on a high-speed point-to-point interface that uses an Advanced Memory Buffer (AMB) between the memory module and the memory controller. With high-speed serial communications, the number of wires needed to connect the chipset to the memory module is significantly lower. FB-DIMM memory channels require just 69 pins from the memory controller, compared with 240 pins for traditional parallel DDR2 memory. This efficiency allows more memory channels from the memory controller, increasing memory performance.

Previous memory technologies used a shared parallel interface with all DIMMs on the same bus. The AMB decouples the memory interface from the DRAM components, allowing the memory bus to run at high speed with more DIMMs. This also allows simultaneous reads and writes using industry-standard DDR2 DRAM chips.

The comparison of FB-DIMM communications to parallel memory communications is similar to the comparison of PCI Express communications to PCI or PCI-X parallel communications. PCI Express and FB-DIMMs use high-speed serial interfaces for communications and feature a reduced pin count and higher signaling rates. Both provide separate channels for data transmission and data reception, supporting simultaneous read and write operations. Both also provide higher bandwidth than their predecessors, use fewer communications lines (pins), take less space on the main logic board, and result in significantly greater system flexibility and increased capability for the end user.

Quad-channel 256-bit-wide memory controller

Xserve incorporates a new 256-bit-wide memory controller that allows for higher speed, greater capacity, and improved reliability. Using fast 800MHz DDR2 FB-DIMM memory gives an immediate boost to application performance. When sets of four matched DIMMs are installed in Xserve, the memory controller utilizes all four memory channels for synchronized 256-bit memory transactions, further increasing performance.

Memory capacity up to 32GB

Xserve provides memory capacity up to 32GB for the most demanding applications and data sets.

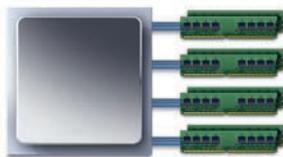
Advanced error protection

FB-DIMM technology offers higher reliability and better availability and serviceability. That includes powerful, enhanced data ECC protection, such as single-bit error correction and detection of multiple-bit errors. It also includes various other complementary high-availability features, such as ECC on-demand scrubbing, CRC on all transactions, SDDC algorithms to detect and correct a single device failure, and on-DIMM embedded diagnostics.



4GB DIMM support

Xserve supports 4GB DIMMs, allowing the system to accommodate up to 32GB of main memory.



Maximizing memory performance

Using four memory channels and 256-bit-wide memory architecture, Xserve can achieve bandwidth up to 25.6GB/s. For the best system performance, memory should be installed in sets of four identical FB-DIMMs.

- **Error Correction Code protection with on-demand scrubbing.** ECC automatically detects a single-bit error when read from main memory and detects (but doesn't correct) multiple-bit errors. When a cache line is read from main memory and a single-bit ECC error is detected, the memory controller will trigger an interrupt and log the error (including the DIMM number, which remote monitoring tools will also display), while automatically correcting it and passing its data along to the processor cache. As part of the correction process, a hardware memory scrubber immediately rewrites the value to correct the memory error in main memory. This feature prevents any future read of the same memory location from taking an ECC interrupt and impacting performance, while also trying to prevent a single-bit error from degenerating into a multiple-bit error.
- **Enhanced CRC (cyclic redundancy checking) protection.** CRC checks the transfer of all addresses, commands, and data, and automatically retries the transaction when an error is detected, assuring uninterrupted operation in case of transient errors. Without the advanced error detection capabilities of FB-DIMMs, errors such as this would normally halt the system.
- **Single Device Data Correction (SDDC).** For even higher memory availability, the memory controller in Xserve implements an advanced error detection and correction algorithm called Single Device Data Correction (SDDC), which detects and automatically corrects the failure of a single x4 or x8 memory DRAM on a fully buffered DIMM. It also supports detection of a two-wire fault on the DIMM connector or main logic board.
- **On-DIMM embedded diagnostics.** The Advanced Memory Buffer (AMB) ASIC on every FB-DIMM contains embedded diagnostics features, including error detection, error injection, and Built-In Self-Test (BIST). The features do not provide error protection during system runtime; rather they allow for extensive and quick diagnostics during system Power-On Self-Test (POST), during hardware testing with diagnostics software, and during factory testing and system qualification. These capabilities help ensure that system memory does not suffer from any hard failures in the AMB or DRAM components, or from any communications problems between the FB-DIMM and memory controller.

High-Performance PCI Express Expansion

Xserve features PCI Express 2.0 expansion slots with up to four times the bandwidth of the previous generation—ideal for connecting to high-performance networking, storage, cluster interconnect, graphics, and backup devices using optional expansion cards. Two independent PCI Express 2.0 slots provide 4GB/s or 8GB/s of bandwidth each. Slot 1 can be configured to support a PCI-X expansion card through an optional expansion riser, preserving customer investments in expensive or custom cards and devices. An easy-access riser with captive screws makes installing or removing expansion cards quick and easy, while increasing strength and support for larger cards.

	Technology	Length support	Power
Slot 1	x8 PCI Express 2.0 (with PCI Express riser) 133MHz PCI-X (with optional PCI-X riser)	6.6 inches (16.76 cm)	25 watts
Slot 2	x16 PCI Express 2.0 (with PCI Express riser)	9.25 inches (23.49 cm)	25 watts

Apple offers a wide range of expansion cards for Xserve, including Dual- and Quad-Channel 4Gb Fibre Channel PCI Express, Ultra320 SCSI PCI-X, and Dual-Channel Gigabit Ethernet PCI Express Cards.

Industry-Standard Connectivity

Dual onboard Gigabit Ethernet

Apple extends the networking performance of Xserve with a high-performance Ethernet controller integrated into the I/O chipset. This advanced controller includes two independent 10/100/1000BASE-T Ethernet interfaces, each configurable for independent networks or teamed with 802.3ad link aggregation built into Mac OS X Server. The result is tremendous networking bandwidth and no contention for data with the I/O subsystems.

In addition, the Gigabit Ethernet controller provides these networking features:

- Hardware-generated TCP, IP, and UDP checksum detects packet corruption and transmission errors.
- 802.1q VLAN (virtual LAN) tags allow Xserve to be a member of multiple virtual networks and to provide unique network services to each one.
- A 48Kb buffer supports jumbo frames, or packets up to 9KB, to reduce system overhead and increase throughput of all network activities.

Dual Gigabit Ethernet ports deliver near-line-rate throughput of up to 980Mb/s per port, alleviating bottlenecks even with very large files, and expediting mail, web, file-sharing, and printer-sharing services. Together with the multihoming function in Mac OS X Server, dual network ports enable Xserve to serve more client systems; provide redundant links; support a dedicated metadata network for Xsan; and support an isolated management network that is independent of a client services network.

Internal graphics

Administrators often need a quick way to plug in a display to access their servers. The base configuration of Xserve now offers built-in graphics, no longer requiring an additional card in a valuable expansion slot. The built-in graphics controller provides 64MB of RAM and applications, and takes advantage of its 2D/3D graphics acceleration to enhance rendering and video processing. A mini-DVI output makes it possible to drive up to a 23-inch Apple Cinema HD Display, and a mini-DVI to VGA adapter is included for connection to standard VGA devices and KVM (keyboard-video-mouse) switches.



Dual power supplies

Hot-swappable and load-sharing, the redundant power supply option for Xserve provides greatly enhanced reliability. The power supplies are also easily serviceable in case of failure.

Additional connectivity

Xserve offers industry-standard interfaces for a range of connecting I/O devices:

- **Dual FireWire 800 ports.** Two FireWire 800 ports on the back panel connect to high-bandwidth FireWire (IEEE 1394) devices, such as storage devices and audio and video input devices. In addition, TCP/IP over FireWire can be used to create small clusters or an IP failover back-channel network, while FireWire target disk mode allows easy data migration and cloning of system configurations.
- **DB-9 serial port.** An industry-standard 9-pin serial port allows for system access through a serial console session.
- **Three USB 2.0 ports.** Two USB 2.0 ports on the back panel and one on the front connect to keyboards, mice, speakers, and other industry-standard peripheral devices.
- **Optical drive.** For software installation and recovery, an 8x double-layer-burning SuperDrive (DVD+R DL/DVD±RW/CD-RW) is standard, permitting data archival and backup to DVD-R and DVD+R DL media.

Flexible Storage Options



0 to 1TB with perpendicular recording

The “bits” that constitute data have typically been recorded end to end, or longitudinally in a single plane on the surface of a hard drive’s recording platter. The 1TB SATA drives offered with Xserve use state-of-the-art perpendicular recording technology to stack the bits vertically and in multiple planes, thereby achieving much greater capacity in a given area. Xserve accommodates three such drive modules to provide an astounding amount of internal storage—up to 3TB—in a 1U form factor.

Large databases, digital video footage, immense scientific data sets, and uncompressed video all place enormous demands on server storage resources. Addressing these growing requirements by providing an industry-leading capacity of up to 3TB of affordable internal storage,¹ Xserve offers characteristic storage performance and flexibility with three drive bays accepting hot-plug Apple Drive Modules. The new Xserve continues to offer both SATA (Serial ATA) drive support—upgraded to include the latest SATA hard drives with increased performance, capacity, and value—as well as SAS (Serial Attached SCSI) hard drives for the highest performance and most demanding applications. The optional Xserve RAID card adds internal hardware RAID 0, 1, and 5 to the three drive bays in Xserve.

With each Apple Drive Module on an independent drive channel and connected to a 3Gb/s SATA/SAS storage controller, the Xserve storage subsystem scales without compromising performance. This unique architecture delivers the best balance of performance, reliability, capacity, and price.

SATA Drive Technology

Xserve makes significant advances in built-in server storage with features such as a sophisticated 3Gb/s SATA/SAS storage controller with a dedicated bus to each Apple Drive Module. Xserve continues to deliver incredible internal storage capacity and value, now supporting up to 3TB using new 7200-rpm 1TB Apple Drive Modules that employ state-of-the-art perpendicular recording technology.

Every SATA drive in Xserve is rated 24/7 server class for reliability and performance. The independent drive architecture in Xserve isolates the drives electrically, preventing a single drive failure from causing unavailability or performance degradation of the surviving drives—a common problem with multidrive parallel SCSI implementations. The end result is a storage architecture that provides tremendous throughput and excellent storage scalability.

SAS Drive Technology

Serial Attached SCSI storage, the next generation of SCSI technology, is designed for the most demanding storage applications. Providing higher sequential performance—over 125MB/s with 3.5-ms seek time—and far higher random performance than SATA drives, the SAS capabilities are nothing short of phenomenal.⁴

The 15,000-rpm Apple SAS drives provide the highest storage performance available today. Rated enterprise class, they have best-in-class MTBF (mean time between failures) ratings. That means you can trust Xserve to deliver ultimate reliability for critical server environments and applications such as email and database serving.

Because SAS has the same physical interface as SATA and leverages the hot-plug Apple Drive Module carrier, Xserve users can make a per-bay choice between the SATA or SAS drive. This unusual degree of flexibility means that Xserve can be configured for a broader range of applications and specific requirements, making the platform a better long-term choice for corporations and data centers.



Apple Drive Modules

Xserve uses reliable, easy-to-install, high-performance Apple Drive Modules to provide cost-effective, high-capacity system storage.

Apple Drive Modules

In Xserve, the three 3.5-inch hard drive bays support greater internal capacity and more flexible RAID options than offered by other servers in the same class. Apple Drive Modules are affordable and simple to add. Choose 80GB or 1TB SATA Apple Drive Modules running at 7200 rpm, or 73GB or 300GB SAS Apple Drive Modules running at 15,000 rpm.¹

Robust hot-plug connectors in Apple Drive Modules protect the connecting pins from bending when drives are inserted or removed. Hot plugging allows administrators to add storage without bringing down the server. Insert a new Apple Drive Module at any time and it's instantly available to the server. This convenience is made possible by tight integration between system hardware and software.

Apple Drive Modules feature a unique handle design for fast and easy installation; a positive locking mechanism holds them tightly in place after insertion. The drive carrier employs a drive mounting technique that increases drive isolation and reduces vibration, especially important for high-performance 15,000-rpm drives. Carefully tested and qualified to ensure maximum performance and superior reliability, Apple Drive Modules work seamlessly with the sophisticated Xserve monitoring sensors and Server Monitor remote monitoring software.

Monitoring of drive health

Xserve hardware and software work together to provide industry-leading remote monitoring and alert capabilities. The server operating system reads Self-Monitoring, Analysis, and Reporting Technology (SMART) data from each hard drive. SMART data allows the drive to report its health and enables Server Monitor software to warn the administrator of a prefailure condition—providing the opportunity to back up critical data and replace the hard drive before a failure occurs. For local monitoring, each Apple Drive Module has two LEDs, one for drive activity and one for drive health.

Software and Hardware RAID Options

Affordable and easy-to-install drive modules make it simple to expand Xserve systems to meet growing storage needs over time. For even greater storage capacity or to share storage among multiple servers, high-throughput PCI Express 2.0 slots enable users to connect to external rackmount storage and backup systems, including Fibre Channel and SCSI devices.

Software RAID in Mac OS X Server

Using software RAID built into Mac OS X Server, the three Apple Drive Modules can be striped or mirrored for improved performance or data redundancy.

- **RAID 0, or striping.** Increases storage performance dramatically by distributing data across two or three Apple Drive Modules and enabling the drives to read and write data concurrently. Drive striping takes full advantage of the three independent drive channels and utilizes the I/O capabilities of Mac OS X Server.
- **RAID 1, or mirroring.** Provides a high level of data protection by creating a real-time, exact duplicate of the contents of one Apple Drive Module on a second drive. With the volume promotion feature in Mac OS X Server, you can upgrade a single drive to a



Internal hardware RAID

The Xserve RAID card provides internal hardware RAID supporting RAID 0, 1, and 5 with 256MB of cache and a 72-hour cache battery backup.

RAID 1 mirror without needing to reformat the drive and reinstall the operating system. If a mirrored drive fails, the system can rebuild the array in the background, while continuing to serve data. The independent drive architecture and software RAID combine to provide RAID 1 protection with no performance penalty.

For additional protection or higher performance, Mac OS X Server can boot from a mirrored or striped volume.

Xserve RAID card

For the ultimate in data protection, add the optional Xserve RAID card to Xserve. With 256MB of RAID cache and hardware RAID levels 0, 1, and 5, the Xserve RAID card delivers up to 251MB/s RAID 5 performance for the most demanding server workloads⁴—without taking up a valuable PCI Express expansion slot. With a built-in battery that protects the RAID cache for up to 72 hours, your data is further protected from unexpected power outages. The easy-to-use RAID Utility software provides a graphical interface to set up, manage, and maintain your internal hardware RAID volumes.



Apple 4Gb Fibre Channel PCI Express Cards

Use the Apple Dual- or Quad-Channel 4Gb Fibre Channel PCI Express Card to connect to an Xsan network and high-performance external storage systems.

Fibre Channel

Fibre Channel is the most sensible and reliable networking choice for any organization or business with growing data storage needs. Ideal for server applications, it has become the industry's de facto fast-switching system standard for moving highly scalable volumes of data at multi-gigabit speeds between computers, servers, disk arrays, and other devices. In addition, Fibre Channel is the only storage connectivity technology available today that guarantees bandwidth as well as in-order delivery of data packets—key requirements for streaming media such as video.

Xserve supports Apple's Dual- or Quad-Channel 4Gb Fibre Channel PCI Express Cards, providing a high-speed storage interface with a dedicated bandwidth and throughput of up to 400MB/s per channel. Fibre Channel supports multiple topologies, further increasing storage options with Xserve. When used with the included SFP-to-SFP cables in a point-to-point configuration, Fibre Channel can directly connect external Fibre Channel storage at up to 400MB/s per channel.

Adding a Fibre Channel switch allows multiple Fibre Channel storage subsystems to be connected to a single Xserve, or multiple Xserve systems to be connected to one or more Fibre Channel storage subsystems—creating a simple storage area network (SAN). The addition of Apple's Xsan software results in a shared storage architecture that supports large, flexible storage pools with multiple servers and workstations sharing access to the same volumes and files.

Apple 4Gb Fibre Channel PCI Express Cards

The Dual- and Quad-Channel 4Gb Fibre Channel PCI Express Cards offer dedicated bandwidth with a throughput of up to 400MB/s per channel. Fibre Channel interconnect technology supports multiple application environments, using point-to-point, loop, and fabric topologies. Each card comes with a 2.9-meter (9.5-foot) SFP-to-SFP 4Gb active copper cable per channel.

Xsan

Xsan is a 64-bit cluster file system designed for both small and large computing environments that demand the highest level of data availability. This specialized technology enables multiple Xserve systems, as well as Mac Pro workstations, to share RAID storage volumes over a high-speed Fibre Channel network. Each client can read and write directly to the centralized file system, scaling storage bandwidth while improving workgroup collaboration.

Enterprise-class features—such as metadata controller failover, Fibre Channel multipathing, and built-in volume management—make Xsan an ideal choice for storage consolidation and NAS replacement in data centers. Xsan is designed to provide file-level locking with concurrent read and write access, volume sizes up to 2 petabytes, and fine-grained permissions using access control lists (ACLs). Such robust features allow Xsan to scale out file services for a large number of users and to accelerate high-bandwidth workflows in film and video. In addition, thanks to groundbreaking prices, Xsan meets the low-cost requirements of computational clusters.

Whether in data centers, video post-production facilities, or high-performance computing environments, Xsan delivers these important benefits:

- **Storage consolidation.** Pools data across multiple RAID arrays for better performance and more efficient storage utilization.
- **High throughput.** Eliminates the bottlenecks of Ethernet-based networks.
- **Simultaneous read/write access.** Enables workgroups to collaborate easily and accomplish results faster than ever with concurrent file access.
- **Easy volume scalability.** Plugs in more RAID devices as storage requirements grow—expanding the shared volume easily.
- **Increased data availability.** Eliminates single points of failure through metadata controller failover and Fibre Channel multipathing.

Xsan delivers all of this performance, flexibility, and scalability without the complexity—or the cost—of competitive SAN solutions.

Integrated Lights-Out Remote Management



Remote management

Built-in remote management features in Xserve allow administrators to control and monitor information on hundreds of Xserve systems from any Internet-connected Mac OS X system.

Xserve includes built-in remote monitoring capabilities that enable network administrators to stay in touch with their Xserve systems from anywhere on the network or over the Internet. Enabled by hardware built into every Xserve system, the remote management system stays running as long as the system is plugged into power—even if the system is powered off or in a hung state. Xserve monitoring and management tools run securely over TCP/IP, using robust password authentication based on an enhanced version of the Intelligent Platform Management Interface (IPMI). And everything needed—hardware and software—is included with every Xserve, with no further purchase required.

Anywhere, Anytime Monitoring and Control

Forget about ever again having to trek to the server rack to control your server. Built-in lights-out management (LOM) capabilities allow remote control of an Xserve system from anywhere on the network or over the Internet. Easy-to-use Server Monitor software provides complete remote access to Xserve, including reboot, power on, and power off. Remote Server Admin tools let you configure and monitor all key services of Mac OS X Server from near or far. If you prefer using a terminal window, Server Admin provides extensive command-line tools to configure, monitor, and manage your systems remotely using the preinstalled secure shell (SSH).

Built on industry standards, Xserve lights-out management conforms to version 2.0 of the IPMI specification, which will continue to improve server management and help reduce costs—by enabling customers to save time, maximize IT resources, and potentially manage multivendor environments in the same way. It also provides a highly secure environment for protecting management data and server deployments from unauthorized access.

Dedicated Monitoring Hardware

Embedded in the I/O controller of every Xserve main logic board is a dedicated microcontroller. This independently powered, fully out-of-band LOM processor can communicate directly to the host system or through the Ethernet channels in the I/O controller—allowing administrators to talk to Xserve even if it's powered off or has crashed. The system need only be connected to power and the Ethernet network.

For data centers with a serial terminal server infrastructure, Xserve also provides console access over built-in serial (DB-9) or Ethernet ports. And if network services are down, UNIX-savvy administrators can access the system through a serial console session.

More than 100 embedded hardware sensors in the Xserve enclosure integrate with Apple's sophisticated Server Monitor software to check the condition of critical subsystems, such as memory, fans, power supplies, and Ethernet links. Temperature measurements for hard drives, processors, memory, PCI, power supply, and incoming ambient temperature are processed using a microcontroller and dedicated communications buses on the logic board.

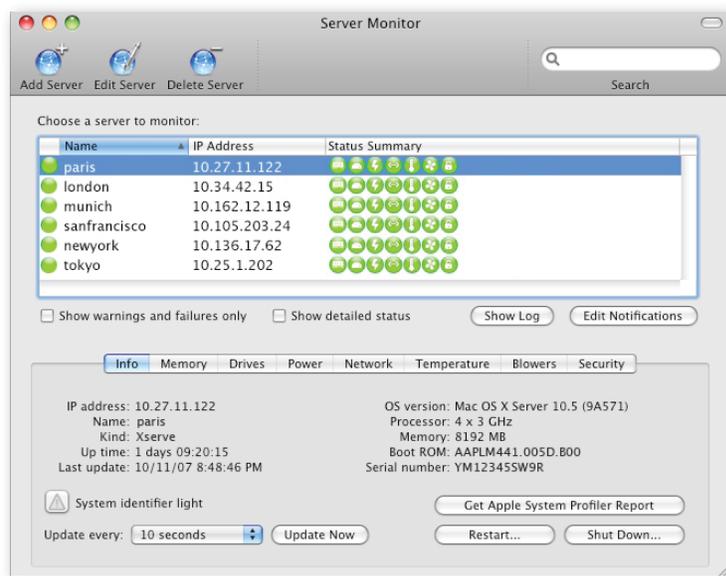


Automatic notifications

Server Monitor can send an email to alert specified individuals when operating conditions exceed predefined thresholds. Short text messages can be sent to email-capable pagers, cell phones, or PDAs; full-text details can be sent to email clients or full-function PDAs.

Server Monitor Software

To maximize server uptime, Server Monitor software aids in the early identification and easy diagnosis of system problems. This powerful application uses data from the hardware sensors and the LOM processor to continuously report on the status of all Xserve subsystems, for all servers on the network. If operating conditions for any component exceed predefined thresholds, Server Monitor can instantly send notification via email or email-capable pager, so network administrators can respond quickly to prevent or repair the problem.



Server Monitor can monitor hundreds of servers using a single, intuitive interface. Each server is identified by name and IP address (or DNS host name), and at-a-glance summary information indicates the status of individual components (green indicates OK, yellow means warning, red alerts of an error). A click on any icon displays detailed status and performance information, including these individual server attributes, subsystems, and system variables:

- **Info.** Lists key attributes of the server: name, IP address, device kind, operating system version, processor type, amount of memory, firmware version, uptime, last monitoring update, and hardware serial number.
- **Memory.** Displays the size, speed, and type of memory installed in each system, as well as ECC error counts.
- **Drives.** Provides the status of each of the server's hard drives, including SMART data for predictive failure notification. Hardware or software RAID information is also available.
- **Power.** Shows the current, voltage, and processor power, as well as a historical line graph for each supply rail. Also provides uninterruptible power supply (UPS) information and status when available.



Apple Xserve diagnostics

Xserve includes a server-class diagnostic tool that supports advanced hardware diagnostics. This powerful tool provides an easy-to-use GUI that can be run locally or remotely.

- **Network.** Indicates the status of active network links, the network stack, and link settings and provides a historical line graph for each link.
- **Temperature.** Provides the values of the 10 enclosure and processor temperature sensors, as well as a historical line graph for each sensor reading.
- **Blowers.** Shows the revolutions per minute and status of the seven double-blade fans, including a historical line graph for each one. In the case of a single blower failure, the other fans speed up to compensate, allowing the server to continue to run, while also notifying the system administrator.
- **Security.** Displays the security status of the Xserve enclosure. Xserve features a hardware enclosure lock that prevents drives from being removed, as well as software-based I/O port security that allows administrators to disable optical mounting, removal of hard drives, or use of USB and FireWire devices.

In addition, Server Monitor records a log of activities and messages for each monitored Xserve. The log provides the times when Server Monitor attempted to contact the server and whether a connection was successful. It also shows changes in server status. For asset tracking or support logging, a System Profiler report can be saved for a selected server or multiple servers.

Innovative Remote Management

Mac OS X Server comes with intuitive remote management tools that provide a consistent, unified interface for setting up and managing the built-in services. The Server Admin application enables network administrators to securely manage services on multiple servers at the same time. Administrators can use Server Admin on any Internet-connected Mac OS X computer to install software updates (including system software), set preferences, and configure workgroup and Internet services—such as Samba 3, Apache 2, DHCP, Postfix, and QuickTime Streaming Server.

Mac OS X Server also makes it easy to monitor services remotely. Server Admin displays the current status of services running on Xserve systems. Administrators can read access and error logs, view charts of traffic patterns, and graph the performance of individual network services and file throughput—providing valuable information for planning and allocating network resources.

For administrators who prefer to manage from a terminal, Mac OS X Server includes Secure Shell (SSH2) technology for encrypted and authenticated login. Xserve is equipped with a DB-9 (9-pin) serial port, giving UNIX-savvy administrators a way to access the system through a serial console session, even when network services are down. Command-line tools allow administrators to remotely install software, run Software Update, or set system and network preferences. In addition, Mac OS X Server supports industry-standard Simple Network Management Protocol (SNMP) for integrating with third-party products such as HP OpenView.



Apple Remote Desktop 3

Apple Remote Desktop complements the workgroup management features in Mac OS X Server, enhancing the remote administrative capabilities needed to support a population of Mac OS X clients. Running detailed hardware or software configuration reports becomes an easy task, whether clients are on a local LAN or distributed across a multi-site WAN. The same is true for upgrading software across a large user population or for providing remote assistance.

Apple Remote Desktop

A suite of integrated remote management tools available as a separate and complementary product to Xserve, Apple Remote Desktop facilitates a wide range of IT tasks and simplifies the administrative process without compromising power and flexibility. Administrators can manage one or hundreds of Xserve systems remotely with ease—distributing software, creating asset reports on hardware configurations or software versions, providing remote graphical screen control, and automating routine management tasks.

Administrators can use Apple Remote Desktop to control Xserve systems—whether they're "headless" or in a remote location—from anywhere on the network, even from a virtual private network at home. For extra convenience, Apple has enabled the Apple Remote Desktop agent on the Mac OS X Server installer DVD, including a one-click option to install and configure the Apple Remote Desktop client. Also available is a command-line utility for configuring software on the server.

Apple Remote Desktop also supports the lights-out management (LOM) capabilities of the Intel-based Xserve. Administrators can power on/off and restart the Xserve remotely, as well as obtain information on how the LOM is configured.

Mac OS X Server v10.5 Leopard



Mac OS X Server v10.5 key features

- Fully compliant UNIX certified foundation
- Optimized for multicore Intel processors
- Support for simultaneous 64-bit and 32-bit applications and network services
- Simple setup and administration
- Advanced networking architecture including multithreaded network stack, IPv6, IPSec, multilink multihoming, and link aggregation
- Support for Mac, Windows, and Linux clients
- Advanced services including Spotlight Server, iCal Server, Wiki Server, iChat Server, and Podcast Producer
- Client management and system imaging tools including Workgroup Manager, NetBoot, NetInstall, and Software Update Server
- Open Directory services for delivering standards-based enterprise directory and network authentication services
- Xcode 3 development environment including Dtrace, Instruments, and Shark tools
- No additional client licenses, per-user fees, or per-connection fees

Xserve ships with Mac OS X Server version 10.5, the sixth major release of Apple's award-winning server operating system. Optimized for 64-bit multicore processors, and with all services running 100 percent natively on Intel processors, Mac OS X Server provides open source, standards-based workgroup and Internet services without the complexity inherent in Linux and other UNIX-based solutions. An unlimited-client license means there are no additional per-seat fees for connecting more users. Hardware and software work together—all with a uniquely Apple ease of use—to deliver powerful, scalable solutions for supporting Mac, Windows, and Linux workgroups; for deploying powerful Internet services; and for hosting enterprise applications.

UNIX Certified Foundation

Mac OS X Server v10.5 Leopard is built on a fully compliant UNIX foundation. This rock-solid core provides the stability, performance, and security that organizations require—and full UNIX conformance ensures compatibility with existing compliant server and application software. An Open Brand UNIX 03 Registered Product—conforming to the SUSv3 and POSIX 1003.1 specifications for the C API, Shell Utilities, and Threads—Mac OS X Server can compile and run all your existing UNIX 03-compliant code. So you can deploy it in environments that demand full conformance, complete with hooks to maintain compatibility with existing software.

Optimized for Multicore Intel Processors

Leopard Server builds on the SMP and multitasking legacy of Mac OS X with numerous optimizations specifically for multicore processors:

- **Fine-grained multithreading.** The kernel in Mac OS X Server provides superior thread management and affinity algorithms for efficient handling of multithreaded applications on the latest generation of multicore Intel processors. It also provides precise control of real-time processing requirements, allowing a user-level thread—even an unprivileged one—to precisely specify its requirements for time-sensitive operations. Mac OS X Server implements the complete POSIX threading model (from POSIX 1003.1c standard), ensuring that each thread can be scheduled independently for maximum efficiency.
- **Symmetric multiprocessing (SMP).** Mac OS X Server harnesses all the available processing power in multiprocessor systems, enabling applications to benefit immediately from the exceptional performance of multiple processors. Complex tasks—such as numerical calculations, database queries, and compression and encoding operations—can take a long time to complete when they are done consecutively. With multiple

processors working in parallel, multiple tasks can execute in little more than the time required to complete each task on a single processor. Because Mac OS X Server is multithreaded, services benefit from multiple processors, even with applications that do not take advantage of the multiple threads.

64-Bit Computing

Leveraging the 64-bit-enabled hardware on the Quad-Core Intel Xeon processor, Mac OS X Server brings the power of 64-bit computing and optimized file services to mainstream servers. Mac OS X Server features kernel and system software libraries updated specifically for 64-bit Intel processors; many of the core services—such as Apache 2, MySQL 5, Postfix, Podcast Producer, QuickTime Streaming Server, and Java VM—are now 64-bit.

With full 64-bit memory addressing, applications can now break through the 4GB physical memory barrier, allowing them to deal with large data sets commonly found in scientific computing, databases, and multimedia solutions. The math and vector libraries have been tuned to take maximum advantage of new and faster math functions supported by 64-bit processors. And because Mac OS X Server supports both 32-bit and 64-bit applications simultaneously, without negative performance impacts or compatibility mode limitations, you can continue to run existing applications in parallel with new 64-bit services and applications.



Full UNIX conformance

Mac OS X Server is now an Open Brand UNIX 03 Registered Product. This means it conforms to the SUSv3 and POSIX 1003.1 specifications for the C API, Shell Utilities, and Threads. Since version 10.5 can compile and run all existing UNIX 03-compliant code, it can be deployed in environments that demand full conformance.

Advanced Networking Architecture

Mac OS X Server is built on open, industry-standard protocols and the latest in network security standards to increase the performance and security of server deployments. Using the time-tested BSD sockets and TCP/IP stack, this advanced networking architecture helps ensure compatibility and integration with IP-based networks.

- **Multithreaded TCP stack.** Mac OS X Server uses a fully multithreaded TCP stack with dedicated write and read threads for each network interface. To improve performance and to avoid lock contention with multicore, multi-NIC, and 10-Gbps Ethernet networks, the TCP stack maintains a dedicated pool of memory buffers for each processor.
- **Multilink multihoming.** Multilink multihoming enables Mac OS X Server to host multiple IP addresses on the same or multiple network interfaces. This is ideal for connecting your server simultaneously to multiple networks, such as a public and a private network, or hosting multiple websites, each with its own IP address.
- **Ethernet link aggregation with network interface failover.** Also known as IEEE 802.3ad, link aggregation allows you to configure multiple network interfaces to appear as a single interface—with the same MAC address, the same IP address, and the same server host name. This provides two significant benefits: It multiplies the potential I/O performance by the number of interfaces; for example, two 1-gigabit interfaces bonded together can provide up to 2 gigabits of aggregate network bandwidth, and four 1-gigabit interfaces can provide up to 4 gigabits. Link aggregation also eliminates a potential single point of failure—if one interface fails, the remaining interface maintains the network connection.
- **VLAN.** Mac OS X Server supports virtual local area networks (VLANs). This feature allows you to configure computers on different network sections to behave as if they were on the same section. For example, with a VLAN, people in a workgroup who are located on different floors or in different buildings can appear as if they are on the same local network.

- **Jumbo frames.** Mac OS X Server supports jumbo frames, or packets larger than 1518 bytes. By packing more data in fewer packets, jumbo frames can increase network efficiency and throughput, while reducing demands on the server processor. Jumbo frames require compatible hardware and clients that can accept jumbo frames.

Exclusive no-CAL model

With Mac OS X Server, customers never pay anything extra for client access licenses (CALs). In addition, other services, such as email and streaming media, do not require client licenses.

High-availability services

To minimize downtime and maximize data protection, Mac OS X Server includes high-availability features such as software RAID, directory replication, file system journaling, a two-node IP failover service, and “watchdog” features such as automatic restart of the server and individual services.

Comprehensive Built-in Services

Mac OS X Server includes a complete suite of robust solutions for file and print, Internet and web, networking, workgroup management, and directory services. Apple has integrated and tested the latest open source technologies—such as OpenLDAP, Kerberos, Postfix, and Apache 2—making them easy to deploy right out of the box.

Built on open standards, Mac OS X Server is compatible with existing network and computing infrastructures. Samba 3, the latest version of the popular open source SMB/CIFS server, provides reliable file and printer sharing for Windows clients, as well as support for NT Domain services. The built-in directory services architecture is based on LDAPv3, allowing Mac OS X Server systems to host LDAP directory services or integrate with any network that uses LDAP directory services. In addition, Mac OS X Server includes compatibility with legacy directory service solutions such as NIS, as well as proprietary solutions such as Active Directory. What’s more, the open source UNIX-based foundation makes it easy to port and deploy existing tools to Mac OS X Server.

Powerful Workgroup Management Services

Mac OS X Server provides services to Mac OS X clients that no other server platform can. Workgroups of any size can benefit from the management, system imaging, security capabilities, and collaboration features that integrate seamlessly with the desktop user experience.

Mac OS X Server includes Workgroup Manager, a suite of powerful tools for directory-based management of users, computers, and groups. Easy-to-use desktop management administration tools let you manage Mac systems from anywhere on the network. You can create standardized desktop configurations; set system preferences; establish password policies; automount home directories and group folders; and control access to hardware, software, and network resources.

By using Xserve to power your Mac OS X workgroup, you can streamline the support of Macintosh clients and reduce system administration costs through system imaging tools. Use NetBoot to host a standard operating system and application configuration on all of the desktop systems. For security-conscious organizations, NetBoot permits Mac computers to boot “disklessly”—without needing to read from or write to the computer’s local drive. NetInstall is an ideal solution for installing software on the Mac OS X desktop and portable systems on your network.

The Software Update Server gives you extended flexibility in managing software updates. This streamlined process allows you to cache Apple software updates locally and lets you decide how and when users should view and download the software—reducing bandwidth consumption and saving the costs of multiple downloads.

Members of your workgroup can access their own personalized desktop, application, and files from any computer on the network, thanks to network-based home directories. Powerful file and print services, with features like quotas and access control lists (ACLs), provide fine-grained management while delivering outstanding network performance. This centralized storage enables workgroup members to back up their work to a single location and allows mobile users to synchronize versions of home directory folders locally and on the network. It’s a fast, easy, and reliable way to protect your data.



Shared information with Directory

Mac OS X Server unlocks the capabilities of the new Directory application in Leopard by allowing shared access to organizational information. Users can change their own account information, share it with others, and create and manage groups, locations, and resources—there's no need for administrator support. And since Directory works in conjunction with iCal Server, users can easily schedule conference rooms, reserve shared resources, and set up meetings with individuals or groups.



Quartz Composer

With Apple's Quartz Composer technology, you can add stunning filters, transitions, and effects to your podcasts. This visual programming environment for graphics processing and rendering takes full advantage of the graphics hardware in Xserve systems.

Innovative Collaborative Services

With the introduction of Mac OS X Server v10.5 Leopard, Apple offers intuitive new solutions that help workgroups collaborate and communicate in powerful ways.

- **Wiki Server** makes it easy for groups to work together on their own wiki-powered intranet website—complete with group calendar, blog, and mailing list. Group members can create and edit wiki pages, tag and cross-reference material, upload files and images, add comments, and search content with point-and-click ease.
- **iCal Server** is a full-featured calendaring solution built on the open CalDAV standard. Using iCal Server, colleagues can quickly coordinate events within a workgroup, small business, or large enterprise. This makes it easy to share calendars, set up meetings, book conference rooms, and more. iCal Server integrates with leading CalDAV programs and, unlike other calendaring solutions, doesn't impose a per-user license—so you don't have to pay for additional licenses as your organization grows.
- **iChat Server** delivers the collaborative power of instant messaging by enabling workgroups to communicate among themselves or with others outside the group in a secure fashion. iChat Server provides secure instant messaging for users on the network and can integrate with your organization's directory service for user account information. Based on Jabber, the industry-standard IM protocol also known as XMPP, iChat Server enables support for Mac computers using iChat, as well as for other Jabber clients running on Windows and Linux systems, PDAs, and even cell phones. Since all text messages and file transfers are encrypted, information sent through your server is kept secure and confidential.
- **Podcast Producer** is a complete, end-to-end solution for capturing, encoding, and publishing podcasts—perfect for employee training, university lectures, presentations, or other audio or video productions. This powerful workflow-based solution automates the details, such as encoding into specific file formats or adding standard title frames and opening videos. Podcast Producer includes a dozen built-in workflows to automate publishing of podcasts to blogs, iTunes, iTunes U, or even multimedia-enabled cell phones over high-speed wireless networks using QuickTime Streaming Server. For high-volume production or for production of long or high-definition video content, Podcast Producer leverages Xgrid technology to distribute encoding tasks across multiple Mac or Xserve systems.

Software Development with Xcode 3

The Apple Xcode 3 development toolset makes it easy to build high-performance applications for the multiple execution cores of the Intel Xeon processor. Based on version 4 of the GCC (GNU Compiler Collection) development toolchain, Xcode is optimized for the latest Intel processors, taking full advantage of the Core micro-architecture features and capabilities, including the SSE2/3/4 extensions and the extra processor registers available in EM64T 64-bit modes.

Xcode and GCC are multicore-aware themselves, automatically running in parallel for superfast compilation times. By recompiling with Xcode and the GCC 4 compiler, developers get improved code generation that keeps the processor's integer and floating-point units constantly fed with instructions.

In addition, GCC 4 includes auto-vectorization capabilities. Previously, developers had to create code for the vector processing unit by hand. Now the compiler can generate vector-based code automatically, delivering superior application performance while easing the developer's work.



Instruments

New to Xcode 3, Instruments provides a graphical time-based view of your application, enabling debugging through visualization of related events.

Intel compilers for Mac OS X

Intel provides C/C++ and Fortran compilers (icc, ifort), Math Kernel Library (MKL), Integrated Performance Primitives (IPP), and the new Intel Threading Building Blocks library for Mac OS X. Delivering outstanding performance for multicore Intel processors, these compilers and tools can be run from the command line or as plug-ins to Xcode. See www.intel.com/software for more information.

Xcode 3 includes a new developer application called Instruments. Built on the DTrace systemwide analysis tool in Leopard, Instruments enables visual analysis of your application in a time-based manner. Information such as CPU load, network and file activity, and memory allocations is displayed as separate “tracks” of data that are synchronized over time, allowing you to quickly identify application events—like what was happening with the disk just before the CPU usage spiked. Instruments gives you a complete picture of your application, so you can better understand cause-and-effect relationships and make changes to improve performance.

For advanced performance optimization, Xcode includes Shark, a key component of the Computer Hardware Understanding Development (CHUD) tools. These powerful tools measure and evaluate performance, identifying specific areas of an application that can benefit significantly from the capabilities of the Quad-Core Intel Xeon processor. Shark enables you to very quickly identify where your application’s performance problems lie, down to the specific functions on which you should concentrate your optimization efforts. You can then focus on the fixes that can yield maximum benefit.

Shark supports performance analysis locally on the same system, remotely from another system over the network, and through a command-line interface—making it ideal both for local performance tuning on a single machine and for use on clusters. The Windowed Time facility allows Shark to analyze performance events that just happened by recording the past few seconds of the system execution. Since Shark and the gdb debugger can utilize symbol files in the DWARF format, you can optimize and debug production binary code without needing to recompile a specific debug version.

For more information about development resources for the Quad-Core Intel Xeon processor, visit developer.apple.com.

Service, Support, and Training Options

Every Xserve comes with a one-year limited warranty and 90 days of up-and-running telephone support. In addition, the AppleCare website publishes in-depth product information, training on hardware and software installation and configuration, and technical resources, including the AppleCare Knowledge Base, discussions, and downloadable software on Apple's Featured Software site.

For critical server deployments, Apple also offers a comprehensive range of service and support options for Xserve hardware and Mac OS X Server software. For more information about these AppleCare products, visit www.apple.com/server/support.

AppleCare Premium Service and Support Plan

This server-class support product provides up to three years of up-and-running telephone and email support and onsite hardware service. Apple technical support experts are available 24 hours a day to help you determine whether you're experiencing a hardware failure or a Mac OS X Server configuration issue. In either case, Apple will work to get systems up and running quickly. And because Apple hardware and software are uniquely integrated, there's only one vendor to call.

The AppleCare Premium Service and Support Plan delivers up-and-running telephone and email support within 30 minutes—24 hours a day, 7 days a week. The hardware repair coverage provides global onsite response within 4 hours during business hours and next-day onsite response when you contact Apple after business hours (terms apply).⁵ For added peace of mind, you'll have the assurance that Apple-authorized technicians will perform repairs using genuine Apple parts.

The AppleCare Premium Service and Support Plan can be purchased at any time while Xserve is still under its original one-year warranty. However, since coverage ends three years after the hardware purchase date, you'll get maximum advantage when you make both purchases at the same time.



Convenient replacement modules

Problem resolution is fast with AppleCare Service Parts Kits for Xserve (sold separately).

AppleCare Service Parts Kit

Xserve is designed for quick serviceability of crucial parts; no special tools, training, or certifications are needed. AppleCare Service Parts Kits let system administrators keep key components handy to address the most common hardware failures. Each kit has a logic board, a power supply, and a fan array. When the AppleCare Premium Service and Support Plan is combined with an AppleCare Service Parts Kit, technical support experts can often help troubleshoot and fix systems right over the phone—day or night—eliminating the need for an onsite technician.

Apple Maintenance Program

This optional program for Mac OS X Server makes it easy to manage software expenditures while benefiting from the latest technologies and improvements. With one payment, you automatically receive major Mac OS X Server software upgrades for three years. For more information, including program terms and conditions, visit www.apple.com/server/maintenance.

Mac OS X Server Software Support

Apple offers support programs for Mac OS X Server that extend beyond the up-and-running support provided by the AppleCare Premium Service and Support Plan. Apple technical support experts can provide consultative phone and email support for Mac OS X Server integration and migration issues, as well as help with command-line configuration.

Three levels of Mac OS X Server Software Support are available, depending on the number of incidents supported and desired response time. Each plan provides one year of coverage.

- **Select** covers up to 10 incidents with 4-hour response⁶ for priority 1 issues (server down), 12 hours a day, 7 days a week. Support for additional incidents can be purchased as needed.
- **Preferred** covers an unlimited number of incidents with 2-hour response⁶ for priority 1 issues, 12 hours a day, 7 days a week, and assigns a technical account manager to the organization.
- **Alliance** covers an unlimited number of incidents at multiple locations with 1-hour response⁶ for priority 1 issues, 24 hours a day, 7 days a week. This plan includes an onsite review by an Apple technical support engineer.

Training and Certification Programs

Apple offers comprehensive training programs on Mac OS X and Mac OS X Server applications and technologies. A combination of lecture, demonstration, and hands-on exercises, classes are taught by Apple Certified Trainers with real-world experience and dynamic presentation skills. Customers can choose to attend classes at an Apple Authorized Training Center or have the training delivered onsite at their business or institution.

Once IT professionals have acquired the requisite skills, Apple certification programs provide tangible evidence of their technical expertise. Three certification levels—Apple Certified Support Specialist, Apple Certified Technical Coordinator, and Apple Certified System Administrator—are based on corresponding training course content. For more information about Mac OS X Server training and certification programs, visit www.apple.com/server/training.

Product Details

Related Products

- Xsan
- Apple Remote Desktop 3
- AppleCare Premium Service and Support Plan
- AppleCare Service Parts Kit
- Mac OS X Server Maintenance Program
- Third-party products, including racks, switches, and UPS devices

For up-to-date information on these and other products that enhance Xserve deployments, visit www.apple.com/store or call 800-MY-APPLE.

The new Xserve is the ultimate in configurability. Starting with a base configuration, you can choose from many options to build an Xserve that fits your application environment, your server workloads, and your budget.

Base Configuration

Order number	MA882LL/A
Processors	One 2.8GHz Quad-Core Intel Xeon 5400 series processor
Frontside bus	1600MHz frontside bus per processor
L2 cache	12MB shared L2 cache (2x6MB) per processor
Memory	2GB of 800MHz DDR2 ECC FB-DIMM memory (two 1GB modules)
Hot-plug storage	Three drive bays with one 80GB 7200-rpm SATA drive installed
Optical drive	8x double-layer SuperDrive (DVD+R DL/DVD±RW/CD-RW)
I/O connectivity	Two built-in Gigabit Ethernet interfaces (10/100/1000BASE-T); two FireWire 800, two USB 2.0, and one DB-9 serial port on back; one USB 2.0 port on front
Graphics	Built-in ATI Radeon X1300 PCI Express graphics with 64MB of GDDR3 SDRAM and mini-DVI output; mini-DVI to VGA adapter included
Expansion slots	Two open PCI Express 2.0 expansion slots: one 9.25-inch x16 PCI Express 2.0 slot and one half-length (6.6-inch) configurable slot (x8 PCI Express 2.0 or 133MHz PCI-X)
Power	Single 750W power supply
Software	Mac OS X Server version 10.5 unlimited-client edition

Configuration Options

Processors	Two 2.8GHz or 3.0GHz Quad-Core Intel Xeon 5400 series processors
Memory	Up to 32GB of 800MHz DDR2 ECC memory using 1GB, 2GB, or 4GB FB-DIMMs
Hot-plug storage	SATA or SAS Apple Drive Modules: up to 3TB using three 1TB SATA drive modules or up to 900GB using three 300GB SAS drive modules <ul style="list-style-type: none"> • 80GB 7200-rpm SATA Apple Drive Module with 8MB cache • 1TB 7200-rpm SATA Apple Drive Module with 32MB cache • 73GB 15,000-rpm SAS Apple Drive Module with 16MB cache • 300GB 15,000-rpm SAS Apple Drive Module with 16MB cache
Expansion cards	<ul style="list-style-type: none"> • Apple Dual-Channel 4Gb Fibre Channel PCI Express Card • Apple Quad-Channel 4Gb Fibre Channel PCI Express Card • Apple Dual-Channel Gigabit Ethernet PCI Express Card • Apple Dual-Channel Ultra320 SCSI PCI-X Card
Power	Optional second load-sharing 750W power supply for redundancy

Technical Specifications

Hardware

Processing

- One 2.8GHz or two 2.8GHz or 3.0GHz Quad-Core Intel Xeon 5400 series processors featuring:
 - Enhanced Intel Core microarchitecture
 - 80W per socket maximum power
 - 12MB on-die L2 cache per processor
 - Enhanced 128-bit SSE4 SIMD unit
- Independent 1600MHz frontside bus per processor

Memory

- Advanced 256-bit-wide memory architecture with four fully buffered DIMM (FB-DIMM) channels featuring:
 - ECC (Error Correction Code) logic with on-demand error scrubbing
 - CRC (cyclic redundancy check) protection for commands and data
 - SDDC (Single Device Data Correction) algorithm
- Eight DIMM slots supporting up to 32GB of 800MHz DDR2 ECC memory using the following (pairs required; four or eight identical DIMMs recommended for best performance):
 - 1GB FB-DIMMs
 - 2GB FB-DIMMs
 - 4GB FB-DIMMs

I/O connections

- Two open PCI Express 2.0 expansion slots: one 9.25-inch x16 PCI Express 2.0 slot and one half-length (6.6-inch) configurable slot (x8 PCI Express 2.0 or 133MHz PCI-X)
- PCI Express and PCI-X cards available from Apple:
 - Apple Dual-Channel 4Gb Fibre Channel PCI Express Card
 - Apple Quad-Channel 4Gb Fibre Channel PCI Express Card
 - Apple Dual-Channel Gigabit Ethernet PCI Express Card
 - Apple Dual-Channel Ultra320 SCSI PCI-X Card
- Two independent 10/100/1000BASE-T (Gigabit) RJ-45 Ethernet interfaces on main logic board
- Built-in ATI Radeon X1300 PCI Express graphics board with 64MB of GDDR3 memory and single-link mini-DVI port; mini-DVI to VGA adapter included
- Two FireWire 800 ports on back panel; 15W total power
- Two USB 2.0 ports (480Mb/s each) on back panel; and one USB 2.0 port on front panel
- One DB-9 serial port (RS-232)

Storage

- Three internal drive bays with independent SATA and SAS channels, up to 3Gb/s each
- Up to 3TB of hot-plug internal storage using SATA Apple Drive Modules or up to 900GB using SAS Apple Drive Modules¹; Apple Drive Modules are server-class rated for 24/7 operation and are available in the following capacities:
 - 80GB 7200-rpm SATA with 8MB disk cache
 - 1TB 7200-rpm SATA with 32MB disk cache
 - 73GB 15,000-rpm SAS with 16MB disk cache
 - 300GB 15,000-rpm SAS with 16MB disk cache
- Optional Xserve RAID card with 256MB cache and 72-hour cache battery backup; support for RAID 0, 1, and 5
- Support for reading SMART data from Apple Drive Modules for prefailure notification
- 8x double-layer SuperDrive (DVD+R DL/DVD±RW/CD-RW)

Rack support

- Fits EIA-310-D-compliant, industry-standard four-post racks and cabinets: 19 inches wide, 24 to 36 inches deep
- Front-to-back cooling for rack enclosure
- Support for square-hole racks or threaded racks based on mounting kit selection

Electrical

- Output power: 750W
- Optional second load-sharing 750W power supply for redundancy
- Line voltage: universal input (100V to 240V AC), power factor corrected
- Maximum input current: 8.0A (100V to 120V) or 4.0A (200V to 240V); current is shared when system is configured with two power supplies
- Frequency: 50Hz to 60Hz, single phase

Environmental

- Operating temperature: 50° to 95° F (10° to 35° C)
- Storage temperature: –40° to 116° F (–40° to 47° C)
- Relative humidity: 5% to 95% noncondensing
- Maximum altitude: 10,000 feet
- FCC Class A approved

Size and weight

- Height: 1.73 inches (4.4 cm)
- Width: 17.6 inches (44.7 cm) for mounting in standard 19-inch rack
- Depth: 30 inches (76.2 cm)
- Weight: 31.7 pounds (14.4 kg) for base configuration; 38.3 pounds (17.4 kg) for 8-core system with eight FB-DIMMs, three 300GB SAS Apple Drive Modules, and two power supplies⁷

Software

Mac OS X Server v10.5

- Unlimited-client edition

Included services

- File and printer sharing: Mac (AFP, AppleTalk PAP, IPP), Windows (SMB/CIFS, IPP), UNIX and Linux (NFS, LPR/LPD), Internet (FTP, WebDAV)
- Directory services: Open Directory (OpenLDAP, Kerberos, SASL), NT Domain Controller (Samba 3), Backup Domain Controller (BDC), LDAP directory connector, Active Directory connector, BSD configuration files (/etc), RADIUS

- Mail services: SMTP (Postfix), POP and IMAP (Cyrus), SSL/TLS encryption (OpenSSL), mailing lists (Mailman), WebMail (SquirrelMail), junk mail filtering (SpamAssassin), virus detection and quarantine (ClamAV)
- Calendaring: iCal Server (CalDAV, iTIP, iMIP)
- Distributed computing: Xgrid 2
- File systems: HFS+ (journaled, case sensitive), read-only UFS and ZFS
- Web hosting: Apache web server (2.2 and 1.3), SSL/TLS (OpenSSL), WebDAV, PHP (5.2), Perl (5.8.8), Ruby (1.8.6), Rails (1.2.3), MySQL 5, Capistrano, Mongrel
- Collaboration services: Wiki Server (RSS), iChat Server 2 (Jabber/XMPP)
- Application services: Apache Tomcat (6), Java Virtual Machine (J2SE), Apache Axis (SOAP), WebObjects 5.4 Deployment
- Client management: Managed Preferences, NetBoot, NetInstall, Software Update Server, Portable home directories
- Networking and VPN: DNS server (BIND 9), DHCP server, NTP server, Firewall (IPFW), WINS, VPN server (L2TP, PPTP)
- Management features: Server Assistant, Server Admin, Server Preferences, Server Status widget, Workgroup Manager, System Image Utility, Secure Shell (SSH2), Server Monitor, RAID Utility, SNMPv3 (Net-SNMP)
- High-availability features: automatic recovery, file system journaling, IP failover, software RAID, disk space monitor
- Media streaming: QuickTime Streaming Server 6, QuickTime Broadcaster 1.5

For More Information

For more information about Xserve, Mac OS X Server, Xsan, and other Apple server solutions, visit www.apple.com/server.

For more information on AppleCare service and support products, visit www.apple.com/support/products.

Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve.

¹For hard drive capacity measurements, 1GB = 1 billion bytes and 1TB = 1 trillion bytes; actual formatted capacity less. Maximum capacity of 3TB achieved through use of three 1TB Apple Drive Modules. ²Based on industry-standard SPECjbb2005 benchmark testing conducted by Apple in December 2007 using a preproduction 3.0GHz 8-core Xserve (2 chips, 8 cores, 4 cores per chip, 3.0GHz; SPECjbb2005 bops = 103,886, SPECjbb2005 bops/JVM = 25,972) and a shipping 3.0GHz quad-core Xserve (2 chips, 4 cores, 2 cores per chip, 3.0GHz; SPECjbb2005 bops = 47,195, SPECjbb2005 bops/JVM = 23,598). SPEC® and SPECjbb® are registered trademarks of the Standard Performance Evaluation Corporation (SPEC); see www.spec.org for more information. Competitive benchmark results reflect internal Apple testing and have been submitted to SPEC in December 2007. For the latest SPECjbb2005 benchmark results, visit <http://www.spec.org/osg/jbb2005>. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve. ³Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xserve units and shipping 3.0GHz quad-core Xserve units. All systems were configured with 8GB of RAM. Results are based on the STREAM v. 5.6 benchmark (www.cs.virginia.edu/stream/ref.html) using OMP support for multiprocessor-compiled builds. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve. ⁴Testing conducted by Apple in December 2007 using preproduction 3.0GHz 8-core Xeon-based Xserve units configured with Xserve RAID card. Testing conducted using Iometer 2006.07.27 with a 30-second ramp-up, 5-minute run duration, 512KB request size, 4 outstanding IOs, and using non-OS-cached reads and writes. System configured with the operating system and test volume on a single RAID volume. Performance tests are conducted using specific computer systems and reflect the approximate performance of Xserve RAID card. ⁵A separate AppleCare Premium Service and Support Plan must be purchased for each Xserve system to be covered. To qualify, systems must be within the one-year hardware warranty. Coverage ends three years after date of Xserve purchase. Actual onsite response time and availability of onsite service depend on location; see www.apple.com/support/products premium for details. Local telephone fees may apply; telephone numbers and hours of operation may vary and are subject to change. ⁶Response times are not guaranteed. ⁷Weight varies by configuration and manufacturing process.

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