Xserve

Technology Overview
February 2003

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Introduction

Xserve is designed from the ground up for performance, serviceability, and easy integration into a wide range of computing environments. Introduced in May 2002, this rack-optimized 1U server has been applauded for its value and versatility. The new Xserve builds on the success of its predecessor with performance enhancements, more storage, and flexible new build-to-order options.

Xserve is fully equipped for demanding server deployments in businesses and institutions everywhere. In addition to robust hardware features, it comes complete with an unlimited-client license for Mac OS X Server software, a host of powerful network services, and integrated management and monitoring tools that make Xserve easy to set up and maintain. For added peace of mind, Apple offers server-class service and support products that cover both Xserve hardware and Mac OS X Server, with only one number to call.

This uniquely Apple integration results in superior performance, increased uptime, and unparalleled ease of use. Xserve with Mac OS X Server dramatically reduces the complexity of system administration and the total cost of ownership—enabling businesses and institutions to minimize maintenance costs, resolve problems quickly, and reduce the pressure on network administrators.

Xserve is perfect for traditional server applications, including cross-platform file and print, managing desktops in workgroups or classrooms, web serving, and media streaming. It also has the horsepower for compute-intensive applications, such as RIP, OPI, and rendering farms and computational clusters. And for high-end audio and video production environments, Xserve can be custom-configured as a rackmount workstation. With all this flexibility, Xserve delivers the solution customers need—whether in small and medium-size businesses, higher education or K–12 schools, creative departments, or science and technology research centers.

Product Overview

The new Xserve is even faster and more affordable—and now holds up to 720GB of internal storage.

Xserve RAID

Connect Xserve to Apple's new Xserve RAID storage solution for enormous capacity and superior data protection in a rack-optimized 3U enclosure. This powerful, cost-effective system includes:

• Up to 14 hot-swap Apple Drive Modules for 2.5TB of storage[1]
• Dual independent 2Gb Fibre Channel interface
• Support for RAID levels 0, 1, 3, 5, and 0+1; and for hybrid levels 10, 30, and 50 when used in conjunction with software RAID
• Redundant power and cooling modules
• Built-in tools for remote management and monitoring

Key Features

Xserve combines the power and flexibility of UNIX with server-optimized hardware and Apple's legendary ease of use. In addition, Xserve boasts numerous build-to-order options, making it easy to create a system to suit your needs and your budget.

High-density processing power. Xserve packs single or dual 1.33GHz PowerPC G4 processors, 2MB of dedicated L3 cache memory per processor, an advanced 167MHz system bus, and up to 2GB of 333MHz DDR memory in a 1U enclosure.

Server-optimized I/O. Two full-length 64-bit, 66MHz PCI slots with up to 533MB/s throughput and one half-length combination PCI/AGP slot allow easy expansion. Dual Gigabit Ethernet and FireWire 800 interfaces offer high-performance connectivity and deployment flexibility.

Flexible, scalable storage. Four independent drive bays hold up to 720GB of hot-plug internal storage[1] on quad independent ATA/133 channels for fast data access. Superfast PCI slots and optional cards allow you to connect external SCSI and Fibre Channel storage devices, including Apple's new Xserve RAID with dual independent 2Gb Fibre Channel interface.

UNIX-based operating system. An unlimited-client license for Mac OS X Server, complete with powerful cross-platform services and open source Internet applications, is included at no additional cost. Built on open standards, Mac OS X Server integrates seamlessly into enterprise infrastructures.

Built-in management tools. Easy-to-use software enables administrators to set up and manage services over a secure, remote connection. Industry-leading Server Monitor allows remote monitoring of multiple Xserve systems and sends automatic notifications via email or pager.

Server-class support products. Problem resolution is fast with the AppleCare Premium Service and Support Plan, offering four-hour response for onsite hardware repair service and up-and-running Mac OS X Server support (terms apply).[2] In addition, AppleCare Service Parts Kits enable immediate self-service replacements.

High-Density Rackmount Design

Xserve packs enormous processing power and flexible storage capacity into an ultra-dense 19-inch-wide enclosure. All the necessary rackmounting hardware is in the box, including rack rails with sliders, mounting brackets for industry-standard four-post racks and telco center-post racks, and complete setup instructions.

A Closer Look

Front view

Back view
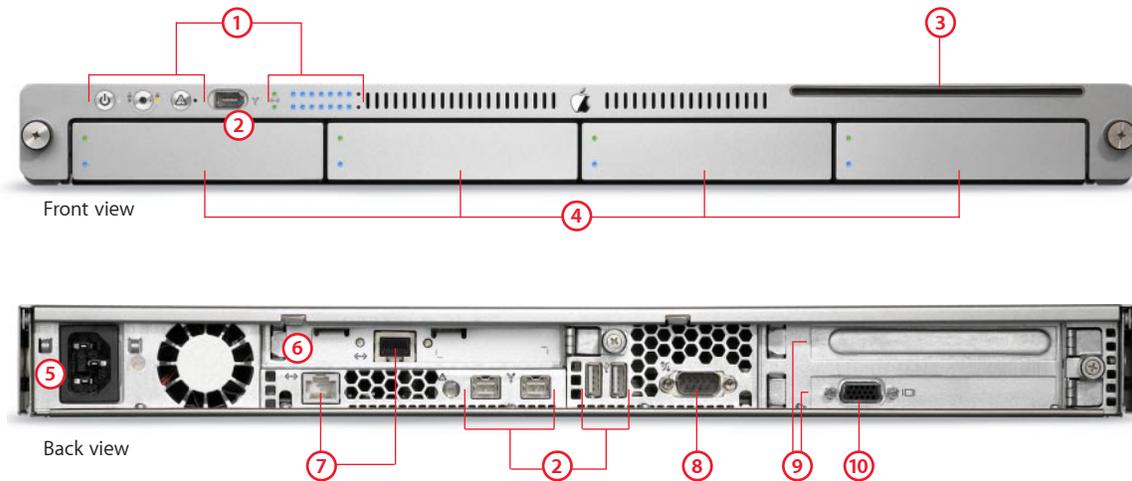
1. **Indicator lights.** Xserve gives you instant feedback on power, enclosure lock, drives, Ethernet links, and processor activity. The system identifier allows you to identify a specific server in a rack and diagnose problems remotely using Server Monitor.

2. **FireWire and USB ports.** Xserve has two FireWire 800 ports on the back and one FireWire 400 port on the front for high-speed connectivity to storage, backup devices, and other servers. Two USB ports on the back connect to industry-standard peripherals.

3. **Optical drive.** The slot-loading 24x-speed CD-ROM drive is convenient for software installation and recovery. Or choose the optional Combo drive for reading DVD data and backing up files on CDs.

4. **Drive bays.** Four bays support up to 720GB of hot-plug ATA internal storage on four independent channels.[1] Hot-plug support allows you to add storage without bringing down the server. Apple Drive Modules have LEDs indicating drive status and health using Self-Monitoring, Analysis, and Reporting Technology (SMART) data.

5. **Cable management.** The power cord connection has a cable-locking clip to avoid accidental unplugging, and a cable management arm keeps cables with the system when you slide it out of a four-post rack.

6. **PCI/AGP slot.** A half-length 32-bit, 66MHz combination PCI/AGP slot comes with a Gigabit Ethernet card preinstalled. Or replace it with a high-performance AGP 4X video card with a DVI connector for graphics and video applications.

7. **Gigabit Ethernet interfaces.** Xserve comes with Gigabit Ethernet on the main logic board and a Gigabit Ethernet card in the half-length PCI/AGP slot.

8. **Serial port.** The DB-9 port allows for system access through a serial console session, even when the network is down.

9. **PCI slots.** Two full-length 64-bit, 66MHz PCI slots offer through-put of up to 533MB/s for I/O-hungry applications and high-performance networking and storage systems. The top slot is open for user configuration.

10. **Graphics card.** A server-class VGA graphics card in the lower 64-bit, 66MHz PCI slot makes it easy to connect to cross-platform VGA KVM switches or industry-standard VGA displays. Xserve also supports headless booting and hot plugging of display devices.

Xserve Applications and Performance

Xserve features high-density processing power and massive storage in a convenient 1U rackmount enclosure that fits easily into data centers and numerical cluster environments.

Xserve is a versatile server solution that fits easily in a variety of deployment scenarios. Since its introduction in May 2002, customers have appreciated how Xserve integrates into their organizations, enhances their workflow, and reduces overall deployment costs. System administrators in small and medium-size businesses, creative departments, universities, and K–12 education use Xserve to provide cross-platform file and print services, manage computers in workgroups or classrooms, deliver web services, and stream rich media over the Internet.

In fact, all of these capabilities are built into Xserve and the included Mac OS X Server software. What's more, numerous third-party products are available to equip your Xserve for advanced applications such as enterprise-class databases, computational clustering, and digital audio and video production.

Cross-Platform File and Print Server

Xserve provides fast, affordable internal storage that scales up to 720GB—and beyond, with an additional 2.5TB using Apple's new Xserve RAID system. Mac OS X Server supports Mac, Windows, UNIX, and Linux clients right out of the box, making Xserve the easiest way to deliver file and print services in multiplatform environments. Since native support for UNIX and Windows is built into Mac OS X Server, all users on your network can have their own folder on the server. Mac OS X Server also provides printer sharing and queuing services for Mac, Windows, and UNIX clients, as well as per-user print quotas. And since Xserve comes with an unlimited-client license for Mac OS X Server, there are no additional CALs when you add users to your network. With low-cost storage, built-in services, and no per-seat licensing fees, Xserve and Xserve RAID offer an affordable alternative to Network Attached Storage (NAS) systems, without compromising on performance or capacity.

Sample configurations

Basic services:
• Single-processor Xserve with 1GB of memory
• Up to four 180GB Apple Drive Modules for internal file storage
• SCSI card for connecting to tape backup system
• Mac OS X Server Unlimited-Client Edition with built-in cross-platform file and print services (included)

Advanced services:
• Dual processor Xserve with 2GB of memory for better file system cache performance
• Two 60GB Apple Drive Modules for mirroring the boot volume for higher availability
• 2.5TB Xserve RAID and Apple Fibre Channel PCI Card for high-performance, high-availability file storage
• SCSI card for connecting to tape backup system
• Mac OS X Server Unlimited-Client Edition with built-in cross-platform file and print services (included)

Test systems

Apple Xserve
Dual 1.33GHz PowerPC G4
1GB RAM

Dell PowerEdge 1650
Dual 1.4GHz Pentium III
1GB RAM

IBM eServer xSeries 335
Dual 2.4GHz Xeon
1GB RAM for Bonnie
2GB RAM for WebBench and BLAST

**Sun LX50 Server**
Dual 1.4GHz Pentium III
1GB RAM

Optional:
- Dantz Retrospect backup software
- Exabyte VXA-2 tape backup loader

Performance

Storage performance was tested using Bonnie, an open source benchmark, ported to Mac OS X by Apple. Xserve was tested against the Dell PowerEdge 1650 and the IBM eServer xSeries 335 running Red Hat Linux. Bonnie measures the throughput of drive systems by reading and writing to the disks using standard UNIX system calls. The test was conducted with a file-size setting of 2GB, ensuring that data is written to the disks and not to the drive cache or the RAID controller buffer.

Storage Capacity and Throughput

Four independent drive channels for faster data access—up to 150MB/s

Apple Xserve
Four 180GB drives
720GB
150MB/s

Dell PowerEdge 1650
Three 146GB drives
438GB
43MB/s

IBM eServer xSeries 335
Two 146GB drives
292GB
78MB/s

Testing performed by Apple in February 2003.
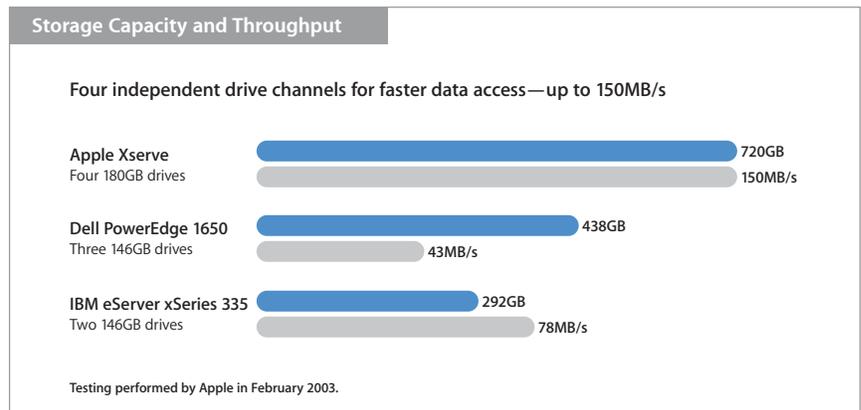
Xserve offers more storage capacity and faster throughput than any of its competitors in the 1U server market—64 percent more storage than the Dell PowerEdge 1650 and 146 percent more than the IBM xSeries 335. Xserve storage is faster as well—over three times faster than the Dell system and nearly twice as fast as the IBM system.

Storage Scalability

Xserve is even faster than before

New Xserve (Read)
New Xserve (Write)
2002 Xserve (Read)
2002 Xserve (Write)

Megabytes per second

Number of drives

Testing performed by Apple in February 2003.
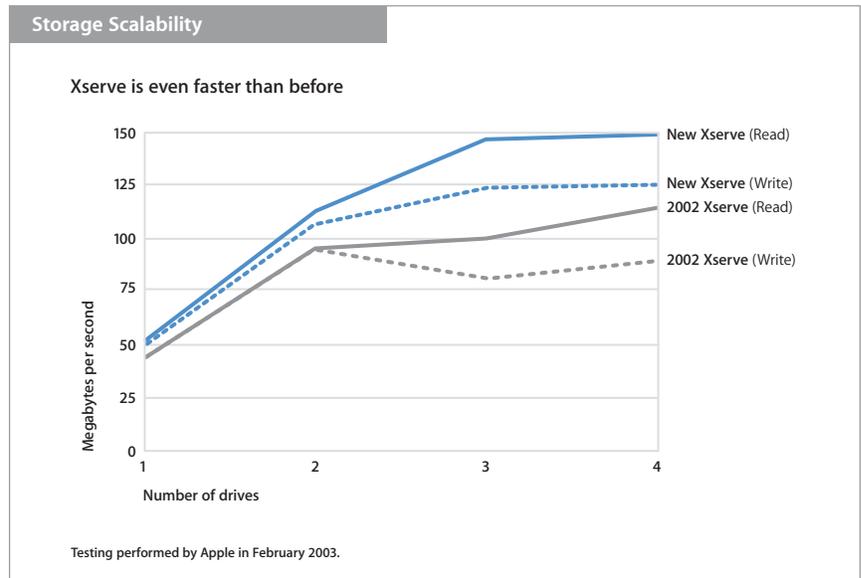
A scalable storage architecture, with four independent ATA/133 drive channels, allows Xserve storage throughput to increase as you add more drives. On Xserve with a single drive, Bonnie reports a read speed of 52MB/s, versus the 46MB/s on the original Xserve. As the number of drives increases, the performance of Xserve improves linearly up to a peak of 150MB/s—a throughput that's 30 percent higher than the original Xserve.

Desktop Management and Directory Server

Xserve with Mac OS X Server includes a suite of powerful tools that save resources and simplify system administration. Apple's Open Directory architecture uses the LDAP standard, enabling you to consolidate directory information from Mac, Windows, and UNIX platforms and deliver services using a single name space. If you already have an LDAPv3 directory server, Open Directory integrates seamlessly—protecting your investment in standards-based network resources. In addition, innovative work-group management tools allow you to manage Mac OS X and Mac OS 9 computers 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.[3] Managed preferences and policies are stored in any central LDAPv3 directory server using Open Directory.

Sample configurations

Basic services:
- Dual processor Xserve with 1GB of memory
- Up to four 180GB Apple Drive Modules for internal storage
- SCSI card for connecting to tape backup system
- Mac OS X Server Unlimited-Client Edition with Open Directory Server, Workgroup Manager, NetBoot, Network Install, Macintosh Manager, and AFP over TCP/IP (included)

Advanced services:
- Dual processor Xserve with 2GB of memory
- Two 60GB Apple Drive Modules for mirroring the boot volume for high availability
- 2.5TB Xserve RAID and Apple Fibre Channel PCI Card for high-performance, high-availability storage
- SCSI card for connecting to tape backup system
- Mac OS X Server Unlimited-Client Edition with Open Directory Server, Workgroup Manager, NetBoot, Network Install, Macintosh Manager, and AFP over TCP/IP (included)

Optional:
- Apple Remote Desktop
- Dantz Retrospect backup software
- ADIC tape library
- Asanté Gigabit Ethernet switches

Web Server

Xserve ships with Mac OS X Server and everything you need to deliver robust, standards-based Internet services. An optimized Apache web server enables you to host secure, high-performance websites. Also included are a server-optimized implementation of Java 2 and support for the latest in web security and networking protocols, including SSL, WebDAV, XML-RPC, and SOAP. Best of all, you can set up these leading-edge services quickly and easily using intuitive management tools. Integrated preconfigured tools make Xserve ideal for serving dynamic web content, with support for PHP, Ruby, and MySQL, as well as WebObjects 5.2 Deployment soft-ware for hosting websites that connect to databases.

Sample configurations

Basic services:
- Single-processor Xserve with 512MB of memory
- One 60GB Apple Drive Module for booting
- Two 60GB Apple Drive Modules for data mirroring for high availability
- Mac OS X Server Unlimited-Client Edition with built-in Apache, MySQL, and dynamic publishing tools (included)

Advanced services:
- Dual processor Xserve with 1GB of memory
- One 60GB Apple Drive Module for booting
- Two 180GB Apple Drive Modules for data mirroring for high availability
- Mac OS X Server Unlimited-Client Edition with built-in Apache, MySQL, and dynamic publishing tools (included)

Optional:
- WebObjects Development software

Performance

WebBench from eTesting Labs measures the performance of a web server by having client systems repeatedly request random web pages. It then determines the number of connections per second that each web server can support. WebBench uses 32 desktop computers to test performance of each server. Each desktop computer simulates five clients, providing a total of 160 simulated clients.

In measuring web server performance, Xserve was tested against the Dell PowerEdge 1650 and the IBM eServer xSeries 335, both running Red Hat Linux; and the Sun LX50 Server running Sun Linux. All tests were run using Apache software, the leading web server on the market.

Apache Web Serving

Xserve sweeps other 1U servers in WebBench testing

Testing performed by Apple in February 2003.
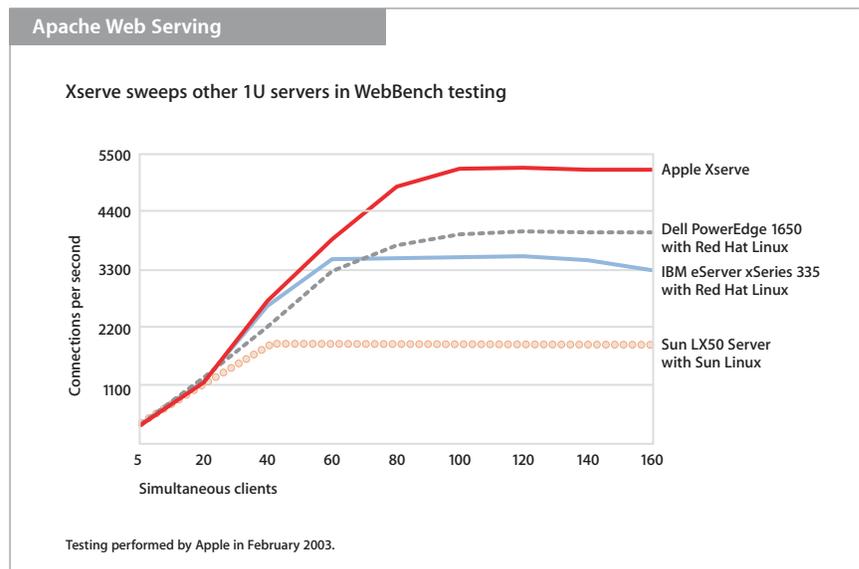
Xserve running Apache on Mac OS X Server outperforms all three other 1U servers running Apache on Linux operating systems. Xserve is 29 percent faster than the Dell PowerEdge 1650, 47 percent faster than the IBM eServer xSeries 335, and nearly three times as fast as the Sun LX50 Server. These results demonstrate the benefit of the high-throughput Xserve architecture, optimized for demanding server tasks.

eTesting Labs WebBench version 4.1 was used with the standard test suite STATIC_WB41.TST. This test mixes up to 32 clients. Each client system had 5 threads running to simulate 5 discrete clients. The WebBench test was performed without the supervision or verification of eTesting Labs, which makes no representation or warranty of the results.

Streaming performance

Xserve running QuickTime Streaming Server can deliver more than 3000 independent low-bit-rate streams simultaneously—and there's no per-stream license fee.

Media Streaming Server

Xserve and Mac OS X Server combine with Apple QuickTime, the industry-standard platform for digital media, to provide the most integrated cross-platform streaming media server available. With QuickTime Streaming Server enabled, Mac OS X Server can stream digital video—for news, entertainment, or educational content—over the Internet using RTP/RTSP. A natural companion to QuickTime Streaming Server, QuickTime Broadcaster captures and encodes QuickTime content in the latest media formats, including MP3, MPEG-4, and AAC audio. Together they provide an inexpensive, end-to-end solution for delivering live events over the Internet.

Sample configurations

Basic services:
- Single-processor Xserve with 512MB of memory
- One 60GB Apple Drive Module for booting
- Up to three 180GB Apple Drive Modules for striping data for high performance
- Mac OS X Server Unlimited-Client Edition with QuickTime Streaming Server and QuickTime Broadcaster (included)

Advanced services:
- Dual processor Xserve with 1GB of memory for added power for video encoding
- One 60GB Apple Drive Module for booting
- Up to three 180GB Apple Drive Modules for striping data for high performance
- Mac OS X Server Unlimited-Client Edition with QuickTime Streaming Server and QuickTime Broadcaster (included)

Optional:
- iBOT FireWire web cam
- Canon DV camera

Compute Cluster

With dual 1.33GHz G4 processors, Xserve delivers the processing power required for computational clustering in science and technology research centers—and its high-density rack-optimized design makes it easy to deploy in space-constrained data centers. Xserve packs up to 19 gigaflops in a single 1U system, for almost 800 gigaflops in a standard 42U rack. This level of performance is made possible by the Velocity Engine, a 128-bit vector processing unit on each PowerPC G4 chip. Since many popular science and technology applications have been written to take advantage of Velocity Engine, Xserve users can experience superfast high-bandwidth computing for data processing and algorithm-intensive tasks. Many of these are readily available as shareware or open source utilities.

NetBoot, included in Mac OS X Server, makes it easy to manage multiple servers or cluster nodes as if they were a single system. Administrators can create a centralized disk image and deploy it across all the nodes in the compute cluster. What's more, the new front-panel mode makes it possible to boot an Xserve from the network— or perform other system functions—without a keyboard.

With Mac OS X Server, Xserve gives scientists and researchers a UNIX foundation for implementing open source and third-party clustering solutions and for using familiar UNIX utilities, shells, scripting languages, and compilers to build specialized software for their work. A full suite of developer tools comes with Mac OS X Server, including the gcc command-line compiler and a development tool called Project Builder, for writing Mac OS X applications, tools, frameworks, libraries, plug-in bundles, kernel extensions, and device drivers in C, C++, Objective-C, or Java. Project Builder can be used to port command-line applications to Mac OS X and Mac OS X Server or to enhance them with a Mac OS X user interface.

Sample configurations

Head node:
- Dual processor Xserve with 2GB of memory
- One 60GB Apple Drive Module for booting
- Up to three 180GB Apple Drive Modules for striping data for enhanced performance and sharing via NFS
- Mac OS X Server Unlimited-Client Edition with NFS file sharing, NetBoot, and developer tools (included)

Compute node:
- Dual processor Xserve with 1GB of memory
- One 60GB Apple Drive Module for booting
- Mac OS X Server Unlimited-Client Edition (included)

Optional:
- Asanté Gigabit Ethernet switch

Performance

Industry experts believe that nearly 70 percent of all compute time in the biotechnology industry is spent on BLAST searches. A BLAST search matches the genetic sequence of DNA fragments against a database of mapped genomes. The length of the DNA fragment is referred to as word length. BLAST searches demand both proc–essing power and memory bandwidth, because the processor must read data from the genome database and compare it against the target DNA fragment. The longer the word length, the more computational power is required.

Xserve was tested using A/G BLAST, the PowerPC G4–optimized version of NCBI-BLAST that was developed by Apple in collaboration with Genentech. The IBM eServer xSeries 335 and Sun LX50 Server ran NCBI-BLAST on Linux, the platform of choice for computational biology on Intel processor–based systems.

Compute Performance

Xserve running BLAST matches DNA sequences more than four times faster

Millions of nucleotides per second (y-axis: 2.6, 2.1, 1.6, 1.0, .5)
Word length (x-axis: 8, 11, 15, 20, 25, 30, 35, 40)

Apple Xserve

IBM eServer xSeries 335
Sun LX50 Server

Testing performed by Apple in February 2003.
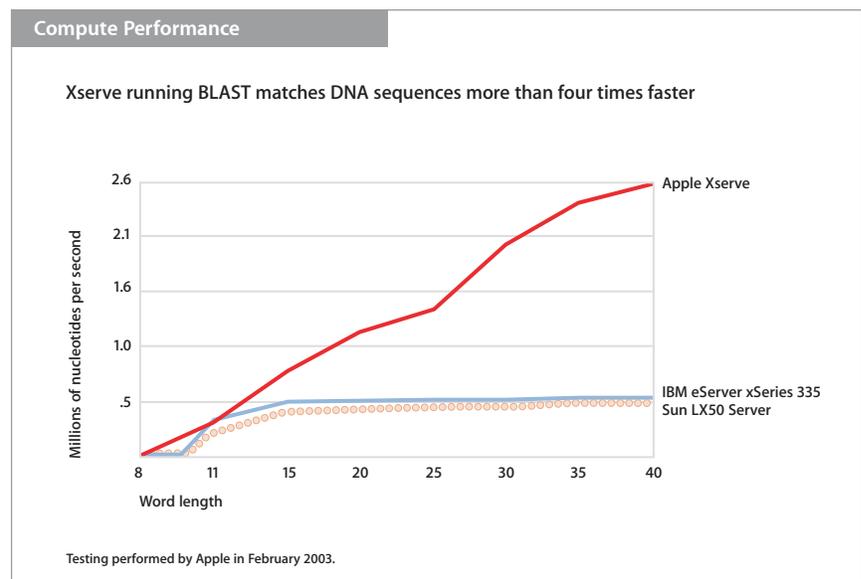
When performing large computations, the vector processing capabilities of the PowerPC G4 provide a major advantage over competitive systems. At the long word length of 40, Xserve is nearly five times faster than both the IBM xSeries 335 and the Sun LX50 Server. Xserve completes this search in approximately 13 seconds, while the IBM system with dual 2.4GHz Xeon processors takes 63 seconds and the Sun system with dual 1.4GHz Pentium III processors takes 66 seconds. This dramatic performance advantage enables researchers to use Xserve for computing more specific and more accurate comparisons at longer word length searches—operations that are prohibitively slow on other 1U server systems. In fact, only at a word length of 11—for which NCBI-BLAST has been extensively optimized—do the IBM and Sun systems perform comparably to Xserve.

Audio and Video Workstation

Xserve is the perfect rackmount workstation for audio and video professionals. With four drive bays supporting up to 720GB of internal storage, it offers flexible storage capacity that can scale as digital media files grow. In addition, 64-bit, 66MHz PCI slots allow superfast connections to external SCSI and Fibre Channel storage and backup systems, including Apple's new Xserve RAID with dual independent Fibre Channel interface and up to 2.5TB of storage. The same high-throughput slots allow customers to add digital audio cards and video capture cards for real-time editing and enhancement. Two built-in FireWire 800 ports connect to high-performance FireWire hard drives, tape backup systems, professional digital audio recorders, and DV camcorders— allowing Xserve to be used for audio and video applications without special cards or adapters. Xserve also has two USB ports for connecting to keyboards, speakers, microphones, and other devices.

With Apple Final Cut Pro and Mac OS X, Xserve becomes the ultimate video workstation. Users can configure Xserve as a video editing and production system by adding a high-performance ATI Radeon 8500 AGP 4X graphics card and connecting one of Apple's world-class displays, such as the 23-inch Apple Cinema HD Display.[4] Since the Radeon 8500 supports dual displays, video professionals can also add a VGA or S-video monitor for more screen real estate or for previewing their work. Optional DVI cable extenders allow producers to work at a monitor in one room and keep their AV rack and Xserve system in another room or in an equipment closet, up to 330 feet away.

Sample configurations

Basic workstation:
- Dual processor Xserve with 1GB of memory
- Up to four 180GB Apple Drive Modules for striping audio and video data for enhanced performance
- ATI Radeon 8500 AGP 4X graphics card

Advanced workstation:
- Dual processor Xserve with 2GB of memory for maximum performance
- Up to four 180GB Apple Drive Modules for striping audio and video data for enhanced performance
- 2.5TB Xserve RAID and Apple Fibre Channel PCI Card for high-performance, high-availability media storage
- ATI Radeon 8500 AGP 4X graphics card

Optional:
- Apple flat-panel display and Apple DVI to ADC Adapter
- Apple Final Cut Pro software
- XtremeMac Xrack
- Pinnacle Systems CineWave capture card
- AJA Kona video capture card
- Gefen DVI-Repeater and cables
- USB extension cable

System Architecture

Xserve features a high-performance system architecture for delivering powerful network services.

Xserve features an advanced architecture that combines ultra-efficient PowerPC G4 processors, a superfast memory architecture, and a high-bandwidth I/O system—providing the power and throughput for demanding Internet applications, robust network infrastructure solutions, and high-performance computational clustering environments.

Superior Processing Power

Xserve is equipped with one or two 1.33GHz PowerPC G4 processors on a 167MHz system bus. Intelligently designed for maximum efficiency and performance, the G4 processor includes a powerful floating-point unit, the Velocity Engine vector processing unit, and impressive parallel processing capabilities. In fact, one dual processor system can execute up to 19 billion floating-point operations per second, or 19 gigaflops. That means a 42U rack filled with Xserve systems can offer almost 800 gigaflops of processing power.

PowerPC G4 processor
The PowerPC G4 chip set was designed by Apple, Motorola, and IBM for superior processing performance. It features a short seven-stage pipeline, full 128-bit memory paths between L1 and L2 cache, and a floating-point unit capable of executing double-precision mathematical calculations in a single processor cycle. The PowerPC G4 also supports prefetching operations with up to four simultaneous 32-bit data streams. Prefetching improves processor performance by retrieving and caching data before it's actually demanded by the processor, ensuring optimal utilization of each processor cycle.

Velocity Engine vector processing unit
The G4 processor improves efficiency further with a powerful 128-bit vector parallel processing unit called the Velocity Engine. In applications written to take advantage of vector processing, the Velocity Engine accelerates processing by executing an oper-ation on multiple pieces of data at the same time. It processes data in large, 128-bit chunks, instead of the smaller 32-bit or 64-bit chunks used in traditional processors. The Velocity Engine operates concurrently with the integer and floating-point units in the PowerPC G4 chip set. This allows highly parallel operations—for simultaneous execution of up to sixteen 8-bit or four 32-bit floating-point calculations in a single cycle. Support for the Velocity Engine is built into Mac OS X Server to dramatically speed up high-bandwidth data processing and algorithm-intensive tasks, such as data encryption, audio and video compression, multimedia processing, and networking.

Dual processing

Dual 1.33GHz PowerPC G4 processors provide the high-density power required by applications such as research and computational clustering environments; rendering, encoding, and compression farms; audio and video editing; and high-bandwidth networking. Symmetric multiprocessing in Mac OS X Server dynamically manages multiple processing tasks across both processors, allowing the dual processor Xserve to accomplish up to twice as much as a single-processor system in the same amount of time—without requiring any special optimization of the application.

Applications and tasks that have been written for multithreading can take further advantage of dual processing. A thread is a self-contained task; when tasks are broken into multiple threads, the threads can be assigned to separate processors. By utilizing both processors at the same time, a multithreaded application can achieve up to twice the performance on a dual processor system as on a single-processor system running at the same clock speed. In fact, since Mac OS X Server is also multithreaded, server applications that use network file services, access databases, or encrypt and authenticate communications will experience a dramatic performance boost on the dual processor Xserve.

Server-Optimized Architecture
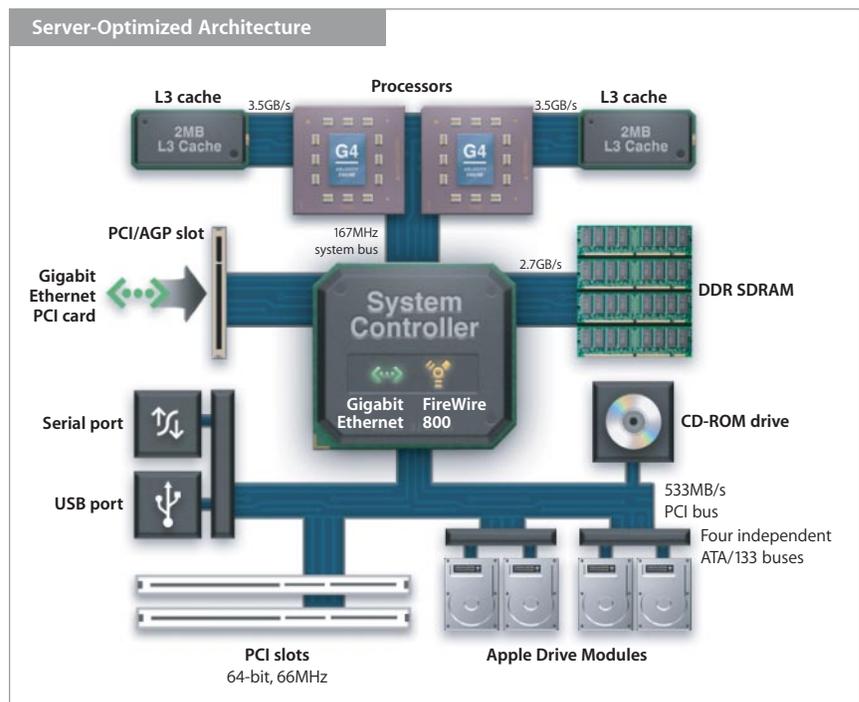
Advanced Memory Architecture

Xserve maximizes the efficiency of its computing power with an advanced memory architecture. Featuring an enhanced 167MHz system bus, dedicated L3 cache memory, and Double Data Rate (DDR) main memory, it's ready to process the massive data sets used in science and technology research centers, higher education, or audio and video production environments.

L3 cache

In addition to an on-chip L2 cache, Xserve processors each have 2MB of DDR L3 cache, providing fast access to data and application code. For increased effectiveness, this cache features a dedicated 64-bit data path to the processor, with 3.5GB per second of throughput and no interference from other data transfers. In fact, the processor can

receive data from the L3 cache up to five times faster than from main memory. This low-latency memory keeps feeding the processor data—so it doesn't sit idle, waiting for the next task to arrive. In dual processor Xserve systems, each processor has its own L3 cache and dedicated high-throughput bus, enabling the two processors to share data with each other seamlessly, without pausing to update main memory.

The L3 cache is ample enough to store large portions of active application code and data. When Xserve is rendering 3D graphics or serving a web application, most of the active code for the program can be stored in the L3 cache. This keeps the most important information close to the processor and quickly accessible. In contrast, standard Pentium III– or Pentium 4–based systems must access main memory more often—causing congestion among data streams and hampering server performance.

Double Data Rate (DDR) memory
Xserve features four DIMM slots that use ultrafast PC2700 DDR SDRAM. This high-performance memory handles two memory operations per clock cycle for a 333MHz data rate—a throughput of 2.7GB per second. Xserve comes standard with 256MB or 512MB of DDR SDRAM, and memory is scalable up to 2GB—allowing customers to increase server memory as their application requirements increase. More main memory enables the server to run demanding programs simultaneously and to accommodate spikes in demand.

For added system efficiency, the Xserve I/O subsystems have direct access to the high-speed DDR memory. Direct memory access (DMA) in the system architecture enables attached devices, such as PCI cards and hard drives, to bypass the processor and communicate directly with the server's main memory. This direct access allows the attached components to work faster and frees the processor from involvement with the data transfer.

Server-Optimized I/O

I/O throughput is essential to server performance, and Xserve features Apple's fastest-ever I/O system to meet the demands of high-bandwidth networking and storage deployments.

High-performance PCI slots
Xserve features two full-length 64-bit, 66MHz PCI slots with throughput of up to 533MB per second—providing the bandwidth for demanding I/O applications such as asset databases; video editing; computational clusters; and connectivity to high-performance networking, storage, and backup devices using optional SCSI and Fibre Channel cards. Standard single- and dual processor Xserve configurations ship with one PCI slot open for user configuration and one with a VGA graphics card preinstalled.

In addition, a half-length combination PCI/AGP slot on an independent bus can be used as a 32-bit, 66MHz PCI slot or as an AGP 4X graphics card slot. On standard models, it is configured as a PCI slot with a Gigabit Ethernet card preinstalled. Users who demand powerful graphics capabilities can order Xserve with an ATI Radeon 8500 graphics card installed in the AGP 4X slot. This graphics option leaves both full-length PCI slots open for specialized processing cards or connectivity to external audio, video, or storage devices.

Dual independent Gigabit Ethernet ports
Xserve features two independent 10/100/1000BASE-T Ethernet ports—one on the main logic board and one on a card in the half-length PCI/AGP slot—to provide tremendous networking bandwidth and deployment flexibility. Separate PCI buses ensure maximum throughput—up to 1000Mb per second per port—to alleviate bottlenecks even with very large files. Together with the multihoming function in

Mac OS X Server, dual ports enable Xserve to serve more client systems, to provide redundant links, or to support an isolated management network that is independent from a client services network. Dual Gigabit Ethernet also enables the high-speed network interconnect needed by many compute farm deployments.

Dual FireWire 800 ports
Two FireWire 800 ports on the back panel and one FireWire 400 port on the front panel connect to high-bandwidth FireWire (IEEE 1394) devices, such as storage devices and audio and video input devices. FireWire 800 is the next generation of FireWire technology. Using the same highly efficient coding scheme pioneered in Gigabit Ethernet and Fibre Channel, it doubles the throughput of the original FireWire 400, advancing from 400Mb to 800Mb per second.[5] In addition, FireWire 800 works over distances of up to 100 meters, making it ideal for operation in larger facilities.

Additional connectivity
Xserve offers a number of easy-to-access ports for connecting industry-standard I/O devices.

· **VGA graphics port.** The preinstalled graphics card features a VGA port for easy connection to industry-standard VGA displays and KVM (keyboard-video-mouse) switches. It supports headless booting by defaulting to a known safe resolution (1024 by 768 pixels at 60Hz) and allows hot plugging of a display device to the server.

· **DB-9 serial port.** An industry-standard 9-pin serial port allows for system access through a serial console session.

· **Two USB ports.** Two ports on the back panel connect to keyboards, mice, speakers, and other industry-standard peripheral devices.

· **Optical drive.** A slot-loading 24x-speed CD-ROM drive comes standard for software installation and recovery on server configurations. A Combo drive (DVD-ROM/CD-RW) is available as an option for customers who need to read DVD data and back up data on CDs.

Storage

The growth of digital content creation and distribution in business and education is driving the need for high-capacity data storage. Digital video footage, large databases, media-rich student documents, immense scientific data sets, and uncompressed audio all place enormous demands on server storage resources. Xserve addresses this growing need by providing up to 720GB of internal storage capacity.[1]

High-throughput I/O lets users connect to external devices for even greater storage capacity or to share storage among multiple servers. Optional PCI-based Fibre Channel or SCSI cards connect to rackmount storage and backup systems such as Apple's new Xserve RAID with up to 2.5TB of storage.

Affordable, High-Capacity Internal Storage

Xserve breaks new ground in the 1U server category. Using 180GB Apple Drive Modules, it can scale up to 720GB of internal storage. In addition, a unique storage architecture delivers the best balance of performance, reliability, capacity, and price.

Four drive bays with hot-plug Apple Drive Modules

Internal storage competitive comparison

Server	Apple Xserve	Dell PowerEdge 1650	IBM eServer xSeries 335	Sun LX50 Server
Maximum internal storage capacity	720GB (four 180GB drives)	438GB (three 146GB drives)	292GB (two 146GB drives)	146GB (two 73GB drives)
Onboard disk controller for internal drives	Quad independent Ultra ATA/133	Dual Ultra160 SCSI	Single Ultra320 SCSI	Dual Ultra160 SCSI
Hot-plug drives	Yes	Yes	Yes	No
Cost of additional drives*	$499 (180GB)	$899 (146GB)	$1279 (146GB)	$930 (73GB)
Cost per GB	$2.77	$6.16	$8.76	$12.74

Xserve offers affordable internal storage that scales to nearly twice the capacity of most other 1U servers on the market.

* Based on suggested retail prices published on manufacturers' websites as of January 28, 2003.

Four independent drive channels

To boost drive performance and overall system reliability, Apple took a new approach in designing the Xserve storage subsystem. Instead of relying on expensive SCSI technology, Apple developed a high-performance ATA-based system that delivers superior throughput at a much lower cost. Xserve features multithreaded system operation using four independent drive controllers, each with a dedicated ATA bus to a single Apple Drive Module. This unique quad independent architecture eliminates the single-threaded operation of the typical ATA master/slave configuration. Multithreading enables the system to send commands to multiple drives at once, resulting in maximum throughput with no additional load on the processor. An independent drive architecture also provides drive isolation, preventing a single drive failure from causing unavailability or performance degradation of the surviving drives—a common problem with multidrive SCSI implementations.

ATA/133 drive controllers

The new Xserve architecture features sophisticated ATA/133 drive controllers that work with both ATA/100 and ATA/133 hard drives. Apple's implementation of 48-bit Large Block Addressing (LBA) translation supports high-capacity hard drives such as the 180GB Apple Drive Modules, while increasing efficiency and performance on smaller drives such as the 60GB Apple Drive Modules. Because each drive operates on an independent ATA/133 bus and connects to a high-speed I/O system, the Xserve storage subsystem scales without compromising performance.

Superfast I/O

The Xserve drive subsystem is backed by a fast, high-bandwidth 64-bit, 66MHz PCI bus that minimizes bottlenecks, even when all four drives are active at once. Combined with its quad independent drive channels, Xserve delivers faster throughput than competitors in the 1U server market. Using the Bonnie benchmark, Xserve is over three times faster than the Dell PowerEdge 1650 and nearly twice as fast as the IBM eServer xSeries 335.

Both Xserve and Apple's new Xserve RAID use reliable, high-performance Apple Drive Modules to provide cost-effective, high-capacity system storage.

Hot-plug Apple Drive Modules

The four Xserve drive bays provide affordable storage expansion using 60GB ATA/133 or 180GB ATA/100 Apple Drive Modules.[1] Apple Drive Modules feature sophisticated hot-plug connectors called SCA II, or Single Connector Attachment II, that 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. Tight integration between the system hardware and software makes this possible. The four independent Xserve drive controllers detect when a drive is unplugged, so removing the drive doesn't mean risking data loss or a system crash. When the drive is plugged back in, its controller instantly recognizes that it's back online—without requiring cycles or "resets" to reinitiate communication between the drive and the controller, as in other storage architectures.

Apple Drive Modules feature a unique handle design for fast, easy installation and a positive locking mechanism to hold them tightly in place after insertion. Carefully tested and qualified to ensure maximum performance and reliability, Apple Drive Modules work seamlessly with the sophisticated Xserve remote hardware monitoring system.

Software RAID

Using software RAID built into Mac OS X Server, the four Apple Drive Modules can be striped or mirrored for improved performance or data redundancy. RAID 0, or striping, increases disk performance dramatically by taking full advantage of the Xserve quad independent ATA architecture and utilizing 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. The quad independent architecture and software RAID combine to provide this protection with no performance penalty. If a mirrored drive fails, the system doesn't go down; Server Monitor sends a notification, enabling the administrator to swap in a new drive module and rebuild the mirror.

For additional protection or higher performance, Mac OS X Server on Xserve can boot from a mirror or a stripe.

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 the operating system 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 (green—OK, yellow—warning, red—fail).

Scalable External Storage

Affordable and easy-to-install hard drive modules make it simple to expand Xserve systems to meet growing storage needs over time. Superfast PCI slots and optional cards allow you to add external storage systems, including SCSI devices and Apple's new Xserve RAID.

Xserve RAID
Xserve connects to the Xserve RAID storage system for massive capacity and superior data protection. Xserve RAID holds up to 14 hot-swap Apple Drive Modules—a phenomenal 2.5TB of storage—in a rack-optimized 3U enclosure. The innovative Apple-designed architecture combines affordable, high-capacity ATA drive technology with a dual independent 2Gb Fibre Channel interface for fast, reliable data access. With easy-to-use tools for remote setup and management, this powerful RAID system provides a cost-effective answer to the growing storage requirements of businesses and institutions.

Xserve RAID connects to a host Xserve system using the dual-port 2Gb Apple Fibre Channel PCI Card (sold separately). This high-speed storage interface provides 400MB/s throughput with guaranteed bandwidth. The PCI card comes with two 2.9-meter copper cables. For connecting over longer distances—up to 500 meters—Apple's card accepts SFP (Small Formfactor Pluggable) optical transceivers for use with fiber-optic cables.

Xserve RAID packs up to 2.5TB into a 3U enclosure. It uses the same Apple Drive Modules as Xserve, providing investment protection as storage needs grow.

Mac OS X Server

Xserve server configurations ship with an unlimited-client license for Mac OS X Server,
Apple's UNIX-based server operating system. Hardware and software work together
to deliver powerful, scalable solutions for workgroup and Internet services—all with
Apple's legendary ease of use. Industry-leading configuration and management tools
make the system easy to deploy, and all-new monitoring capabilities make it possible
to monitor network services and critical hardware subsystems remotely. Reliability
and availability features are also built into Mac OS X Server: If an essential service fails,
the operating system automatically restarts it, with minimal downtime. Xserve running
Mac OS X Server dramatically reduces the complexity of system administration—
enabling businesses and institutions to minimize maintenance costs and lower their
total cost of ownership.

Open Source UNIX-Based Operating System

Mac OS X Server is based on the Mach 3.0 microkernel and BSD 4.4 commands and
libraries, network stack, and file systems. This robust foundation provides all you'd
expect of a UNIX operating system, such as preemptive multitasking, symmetric multi-
processing, and support for IPv6 and IPSec. Designed from the ground up for stability,
performance, and interoperability with industry-standard technologies, Mac OS X
Server unleashes the power of Xserve. Together they provide a superior architecture
for sharing files and printers, hosting dynamic websites, streaming real-time digital
media, exchanging email, providing network services, and deploying flexible network
applications.

Open standards
Because it's built on open standards, Mac OS X Server is a model citizen in a multiplat-
form world. It uses native protocols to enable Mac, Windows, and UNIX clients to share
files and printers. Apple's Open Directory architecture offers centralized management
of network resources using any LDAPv3 directory server and supports authentication
using Kerberos. Mac OS X Server also supports NFS resharing over AFP, giving Mac
clients easy access to enterprise storage with improved security. A server-optimized
version of Java 2 and the latest in security standards enable fast and secure delivery
of web services.

For UNIX and Linux users who are at home in a command-line environment, Mac OS X
Server offers a full BSD UNIX command set accessible from the Terminal application.
Also included is an extensive suite of developer tools for compiling UNIX open source
utilities and building custom server applications. For more information, see
www.apple.com/downloads/macosx.

Network security
To protect network assets from unauthorized access, Mac OS X Server takes maximum advantage of its secure operating system design. In addition to a UNIX file system permissions architecture, Mac OS X Server supports the latest in data and protocol security. Integrated SSL support enables encrypted and authenticated client/server communications, and Secure Shell (SSH2) provides encrypted and authenticated login and secure remote administration from a command line.

Built-in Networking Services

Mac OS X Server includes a comprehensive set of open source, standards-based solutions for file and print, Internet and web, networking, workgroup management, and directory services. This kind of power has never been easier to put to work—or easier to integrate into your organization. What's more, the unlimited-client license means there are no additional per-seat fees for connecting more users.

Software licensing fees

Number of client licenses	Xserve with Mac OS X Server	Intel-based server with Windows 2000 server software*
5	Included	$799
25	Included	$1379
50	Included	$2104
75	Included	$2829
100	Included	$3554

Xserve reduces deployment costs with no per-user licensing fees.

* Based on costs published on Microsoft website as of January 2003.

Mac OS X Server features an intuitive interface and powerful tools for configuring file and print services, managing workgroups, monitoring traffic and usage patterns, and more.

Cross-platform file and print services
Highly scalable file sharing services enable Mac, Windows, and UNIX clients to access data from anywhere on the Internet. Using Samba, Mac OS X Server provides native file and print services to Windows users: They see available Mac OS X Server systems in their Network Neighborhood, just as they would see a Windows server. NFS file services are built in for sharing files with other UNIX desktop computers and servers. In addition, with NFS resharing over AFP, Mac users can discover services and securely share data on UNIX-based storage systems. Mac OS X Server also provides printer sharing and queuing services for Mac, Windows, and UNIX clients, as well as per-user print quotas.

Directory services and authentication
Mac OS X Server uses open standards to deliver directory services and authentication for users, groups, and computers. The Open Directory architecture works with any LDAPv3 server, providing full read/write capabilities, SSL security, password policy management, and support for Kerberos authentication of AFP, FTP, and mail services. It can even authenticate against Microsoft's Active Directory. For organizations that

don't already have a directory service, Mac OS X Server provides Open Directory Server for hosting and storing directory information and Password Server for SASL-based management and enforcement of password policies.

Workgroup management
Mac OS X Server features Workgroup Manager, an innovative tool for standardizing desktop environments, controlling user and system preferences, and managing access to applications, printers, and network file servers. Preferences are stored in a central LDAPv3 directory, allowing users to access their personal settings from any Mac OS X system on the network.[3] And because they're also cached on the local hard drive, managed settings are maintained on notebook computers even when they're offline.

NetBoot
NetBoot makes it easy to standardize Mac desktop configurations and administer multiple systems, including servers, as if they were a single system. Administrators can create a single server-based disk image and deploy the same operating system and applications across an entire workgroup—or multiple servers in a clustered deployment. Updating the NetBoot image on the server updates all of these systems automatically. NetBoot is also a powerful tool for deploying network-based diagnostic and repair utilities.

Network Install
For operating system and application upgrades, Network Install enables automated software installation over the network.[3] Perfect for handling operating system upgrades, restoring computers in classrooms and labs, or configuring a cluster of servers, Network Install streamlines administration and reduces support costs. Administrators can install, restore, or upgrade the operating system and applications on any Mac OS X system in their organization, as well as on other servers running Mac OS X Server.

Internet services
Mac OS X Server adds an intuitive interface to Apache, making it easy to build dynamic websites. SSL support enables secure encryption and authentication for e-commerce and confidential information, while WebDAV brings drag-and-drop simplicity to web publishing and content management. Mac OS X Server also comes with Webmail and an easy-to-use, standards-based mail server that supports cross-platform clients using SMTP, POP, and IMAP protocols.
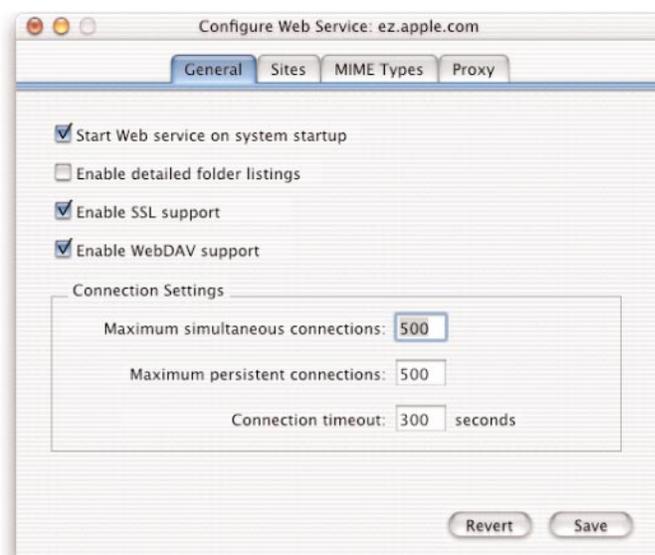
Apple has added an intuitive interface to Apache, making the world's most popular web server easy to set up and manage.

Media streaming
QuickTime Broadcaster and QuickTime Streaming Server provide an end-to-end solution for live encoding and streaming of digital media. QuickTime now supports MPEG-4, the new industry standard for delivering broadcast-quality audio and video over the Internet.

Web applications
With a robust Java 2 implementation optimized for server use and full support for JSPs, Java Servlets, SOAP, and XML-RPC, Mac OS X Server is the fastest way to deploy standards-based web applications. For hosting high-performance websites that connect to databases, administrators can use WebObjects 5.2 Deployment software, PHP, Ruby, and MySQL. Enterprise-class J2EE and database solutions are also available for Mac OS X Server.

Networking and security
Robust TCP/IP network services allow administrators to implement an IP firewall system and protect their network from intruders. They can also assign IP addresses dynamically using DHCP and locate Internet resources with DNS.

Mac OS X Server integrates key network administration tools in a single application called Server Settings and makes them accessible in an easy-to-use interface.

Remote Administration of Network Services

Network administrators can securely manage multiple servers at the same time, making it easy to set up and manage IP-based file and print services, web publishing systems, and networking services. In addition, 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.

Mac OS X Server includes new tools for setting up and managing servers remotely, without requiring a display to be attached to each server. Administrators can use these tools on any networked Mac OS X computer to install software (including system software), set preferences, set up directory services, create print queues, and view real-time logs of server usage—from anywhere on the Internet.

For administrators who prefer to manage from a terminal, Mac OS X Server includes Secure Shell (SSH2) technology for encrypted and authenticated log-on. New command-line tools are also available with Xserve, allowing administrators to remotely install software, run Software Update, or set system and network preferences.

Reliability and Availability

To ensure maximum uptime for your Xserve systems, Mac OS X Server has built-in tools that continuously monitor activity and recover services in the event of an application, system, or power failure.

File system journaling
A robust new journaling feature enhances server availability and fault resilience by protecting file system integrity in the event of an unplanned shutdown or power failure. It also helps to maximize server and storage uptime by dramatically expediting repairs to the volumes when the system restarts.

IP failover
When Mac OS X Server is used with a second server, a new IP failover service further increases availability: If one server fails, the second server can take over the IP address and deliver services for the failed server.

Remote Monitoring

Mac OS X Server integrates easy-to-use remote monitoring capabilities—including Server Monitor for monitoring hardware and Server Status for monitoring services—into its suite of network services for Xserve. These valuable tools make it possible for network administrators to stay in touch with their Xserve systems whether they're on the other side of campus or away on vacation. To protect management data and server deployments, Mac OS X Server monitoring tools run over an authenticated TCP/IP connection that encrypts the entire data stream.

Administrators can securely monitor both hardware and software from anywhere on the network or over the Internet. Embedded hardware sensors and sophisticated Server Monitor software combine in a complete, user-friendly solution for checking the status of key hardware subsystems. In addition, Simple Network Management Protocol (SNMP) support allows integration of Xserve systems with third-party monitoring tools. For monitoring network services, Server Status displays detailed information on network services, including charts and graphs of use patterns, network throughput, and the health of services.

Hardware Monitoring Using Server Monitor

Xserve expands on the power of Mac OS X Server with Server Monitor, an advanced software tool that monitors server hardware and displays information on all key subsystems. To maximize server uptime—and peace of mind—Server Monitor aids in the early identification and easy diagnosis of system problems.

Built-in sensors in Xserve perform continuous checks and report on system temperature, blower operation, hard drive health, Ethernet links, and power supply condition. Server Monitor uses this data to provide a detailed, continuously updated report on the status of all Xserve systems. If operating conditions for any subsystem exceed predefined thresholds, Server Monitor can instantly notify administrators via email or email-capable pager or cell phone, allowing them to respond quickly to prevent or repair the problem.

Server Monitor is easy to set up and can manage dozens of servers using a single interface. Red, yellow, and green lights indicate the health of each server, identified by name and IP address (or DNS host name). Next to the server name is at-a-glance summary information; the tabs below provide detailed status and performance information.
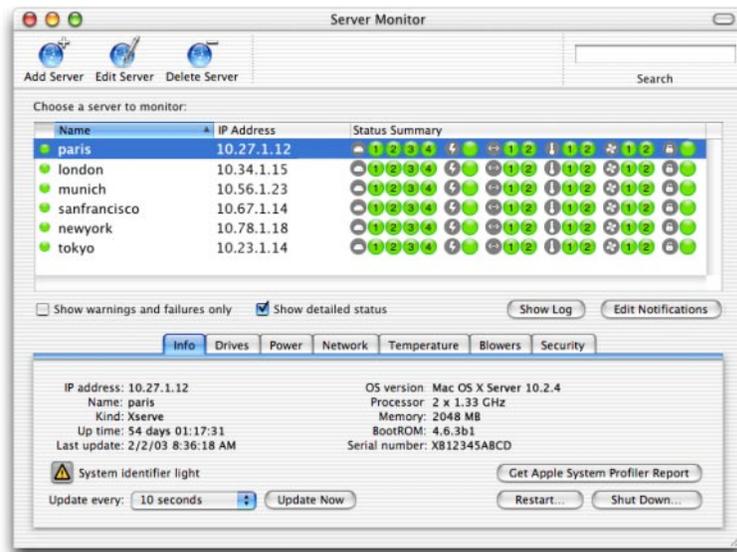
Status Summary. Reports the status of each subsystem. The status line for each server displays gray icons for the server subsystems and colored icons indicating the status of the individual components: hard drives, power supply, Ethernet links, temperature sensors, blowers, and system security (green—OK, yellow—warning, red—fail). A click on any gray icon opens the corresponding tab for instant retrieval of subsystem details.
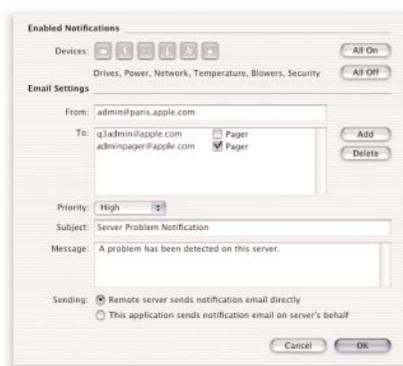
Notifications settings

Show Log. Opens a log of activities and messages for each monitored Xserve. For example, the log may show the times Server Monitor attempted to contact the server and whether a connection was successful. The log also shows changes in server status.

Edit Notifications. Sends a customized 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.

Info. Lists key attributes of the server: name, IP address, device kind, operating system version, processor type, amount of memory, uptime, last update, and hardware serial number.

Get Apple System Profiler Report. Opens the Apple System Profiler report for the selected server or for multiple servers. This file can be saved for asset tracking or support logging.

Drives. Shows the status of each of the server's hard drives (in this case, drive 1), as well as SMART data for predictive failure notification.
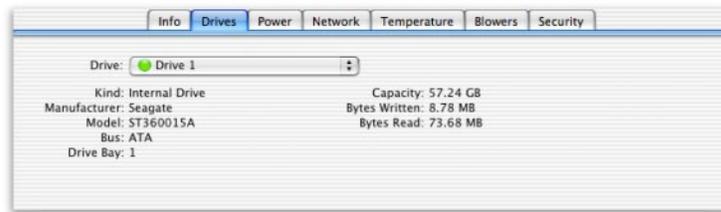
Power. Shows the status of the power supply, including a historical line graph for each supply rail and Uninterruptible Power Supply (UPS) information and status.

Network. Shows the status of the two Ethernet links and a historical line graph for each link.
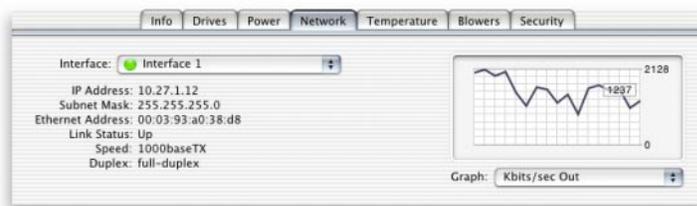
Temperature. Shows the values of the two thermal sensors, one for the processor card and one for the enclosure itself, as well as a historical line graph for each sensor reading. Users can set a preference for Celsius or Fahrenheit temperature values.

Blowers. Shows the revolutions per minute and status of the two blowers, including a historical line graph for each blower. In this case, Server Monitor displays a warning about the second blower.

Security. Shows the security status of the Xserve enclosure. Xserve features a hardware enclosure lock that prevents drives from being removed and software-based I/O port security that allows administrators to disable CD mounting, removal of hard drives, or use of the mouse and keyboard.

Additional Monitoring Tools

In addition to Server Monitor, Xserve comes with a suite of innovative network management and security tools from Neon Software.[6] NetMinder Ethernet captures and decodes packet data, quickly pinpointing and alerting you to security issues, conflicts, and traffic bottlenecks. LANsurveyor can map, troubleshoot, and manage your entire network remotely. And CyberGauge monitors network and device utilization with real-time graphs, so you get early warning of security risks and bandwidth limitations via email or pager. For more information, see www.neon.com/xserve.
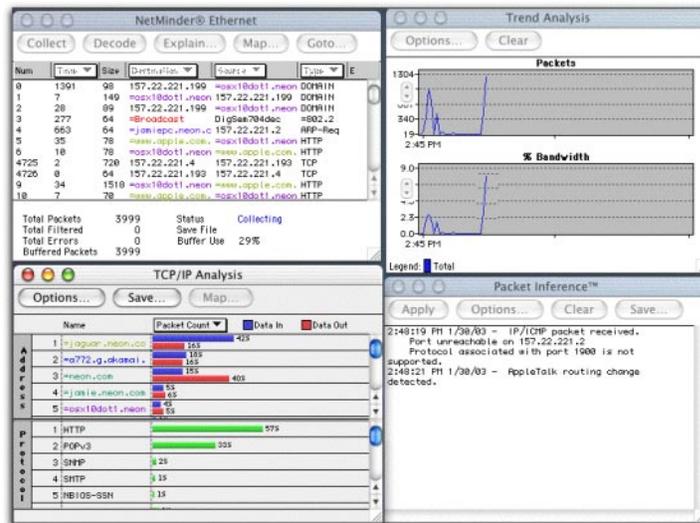
Manage and secure your network with a special suite of tools from Neon Software.

Industry-standard SNMP

Xserve also supports industry-standard SNMP for monitoring and managing multiplatform networks. Mac OS X Server provides useful system and network statistics via its default Net-SNMP management information bases (MIBs). Administrators can use both open source and commercial tools, such as HP OpenView, for remote monitoring of processor and bandwidth use, disk space levels, and other key network statistics. For more information about Net-SNMP, visit www.net-snmp.com.

Monitoring Network Services with Server Status

Mac OS X Server makes it easy to monitor services remotely from any networked Mac OS X system. The built-in Server Status utility displays the current status of all services running on Xserve systems, enabling administrators to read access and error logs, view charts of traffic patterns, and graph the performance of individual network services and file throughput.

Server Status helps administrators understand the needs of network users, plan server resources, and set quotas.

Service and Support

Easy-to-access parts
Xserve is designed for instant access to drives, PCI cards, and blowers, and all key components can be replaced without tools. Each server unit slides out of the rack like a drawer, and the cable management arm allows the cables to travel with the system.

When your operation hinges on server reliability, you can't afford downtime. To ensure rapid issue resolution for Xserve systems, Apple offers a comprehensive range of service and support options. And since both Xserve and Mac OS X Server come from Apple, customers don't need to figure out where the problem lies: Apple's service and support products are as integrated as Apple's hardware and software.

In addition to the included 90 days of support and one-year limited warranty, Xserve customers can purchase the AppleCare Premium Service and Support Plan, which delivers up to three years of onsite hardware service and expert telephone and email support.[2] For deployments with aggressive uptime requirements, AppleCare Service Parts Kits facilitate rapid onsite repairs. And the three-year Mac OS X Server Maintenance Program makes it easy to stay current with new software versions, while saving upgrade and distribution costs. These and other service and support products are designed to keep your critical server installations running smoothly.

AppleCare Premium Service and Support Plan

A powerful server solution like Xserve calls for world-class service and support to match. The AppleCare Premium Service and Support Plan provides up to three years of coverage for both Xserve hardware and setting up Mac OS X Server software. Apple technical support experts are available 24 hours a day to help customers determine whether they're experiencing a hardware failure or a Mac OS X Server configuration issue. In either case, Apple support staff will work to get systems up and running as quickly as possible. And because Apple hardware and software are uniquely integrated, there's only one number to call.

The AppleCare Premium Service and Support Plan covers hardware repairs with four-hour onsite response during business hours and next-day onsite response after business hours (terms apply). For added peace of mind, Apple-authorized technicians perform repairs using genuine Apple parts. Up-and-running Mac OS X Server support and basic troubleshooting are available over the phone and email with 30-minute response time—24 hours a day, seven days a week.

Training and support resources available on the AppleCare support website can also help keep Xserve systems running smoothly. This easy-to-use site 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.

Xserve customers can purchase the AppleCare Premium Service and Support Plan at any time while the hardware is still under its original one-year warranty. However, since coverage ends three years after the hardware purchase date, customers will get

maximum advantage when they make both purchases at the same time. For more information, visit www.apple.com/support/products or call 800-275-2273 in the United States and Canada.

AppleCare Service Parts Kits for Xserve

Customers can also purchase AppleCare Service Parts Kits, which include a logic board, a power supply, a blower, and an Apple Drive Module (60GB or 180GB). Xserve is designed for quick and easy swapping of crucial parts; no tools or training certifications are needed. AppleCare Service Parts Kits let system administrators keep key components handy to address the most common hardware failures. When customers combine the AppleCare Premium Service and Support Plan with an AppleCare Service Parts Kit, Apple experts can often help them troubleshoot and fix their systems right over the phone—day or night—without having to wait for a technician.

Mac OS X Server Maintenance Program

The three-year subscription to the Mac OS X Server Maintenance Program covers major software upgrades, which are shipped to you automatically at a reduced price. This is an ideal way to manage your software investment and expenditures while benefiting from the latest technologies and improvements. With one easy payment, you can simplify budget management and reduce administration overhead. Fees are based on the number of servers in your organization. For more information or to enroll, call 800-747-7483.

Additional Service and Support Products

Complex applications and network installations may require expert long-term technical support. Apple offers additional support options to keep your Xserve up and running.

Mac OS X Server Software Support. This cost-effective, flexible support product delivers comprehensive phone and email consulting. Apple technical experts help with advanced networking issues, including integrating Mac OS X Server into heterogenous environments, configuring and managing network services, and developing open source components for Mac OS X Server. Pricing is based on the number of incidents and the level of support required. For more information, visit www.apple.com/support/products or call 800-275-2273 in the United States and Canada.

Apple Professional Services. Designed for medium-size and large organizations looking to integrate Xserve and Mac OS X Server with other enterprise systems—such as Windows, UNIX, and LDAP—Apple Professional Services offers customized consulting beyond the scope of traditional technical support. Services include project planning, platform migration, and development of custom applications.

Mac OS X Server Training and Certification. Apple also offers comprehensive training and certification programs for system administrators and developers using Mac OS X Server. These classes offer the fastest and most cost-effective path to understanding Mac OS X and Mac OS X Server in depth. Training classes are taught in Apple Authorized Training Centers or onsite at customer locations by a team of veteran instructors with real-world experience. These programs are a great way to develop technical skills and also to market those skills to IT management. Certification testing centers are available in most major U.S. metropolitan areas.

For more information about Apple Professional Services or Mac OS X Server Training and Certification, visit www.apple.com/services.

AppleCare Service Parts Kits for Xserve include a power supply, blower, logic board, and Apple Drive Module.

Technical Specifications

Hardware

Processor
- Single or dual 1.33GHz PowerPC G4 processors
- Velocity Engine vector processing unit
- Full 128-bit internal memory data paths
- Powerful floating-point unit supporting single-cycle, double-precision calculations
- Data stream prefetching operations supporting four simultaneous 32-bit data streams
- 256K on-chip L2 cache running at processor speed
- 2MB DDR SRAM L3 cache per processor with up to 3.5GB/s throughput
- 167MHz system bus

Memory
- 256MB or 512MB of PC2700 DDR SDRAM (at 333MHz) with up to 2.7GB/s throughput
- Four DIMM slots supporting up to 2GB of DDR SDRAM using the following:
  – 128MB or 256MB DIMMs (64-bit-wide, 128Mb technology)
  – 512MB DIMMs (64-bit-wide, 256Mb technology)

I/O connections
- Two full-length 64-bit, 66MHz PCI slots; support for 32-bit or 64-bit 3.3V PCI cards running at 33MHz or 66MHz, respectively
- One half-length 32-bit, 66MHz combination PCI/AGP slot
- Two 10/100/1000BASE-T (Gigabit) RJ-45 Ethernet connectors, one on logic board and one on PCI card
- Two FireWire 800 ports on back panel and one FireWire 400 port on front panel; 15W total power
- Two USB 1.1 ports (12Mb/s each)
- One DB-9 serial port (RS-232)

Storage
- Four internal drive bays with independent 133MB/s buses for up to 720GB of internal storage[1] using hot-plug Apple Drive Modules, available in the following capacities:
  – 60GB 7200-rpm ATA/133 with 2MB disk cache
  – 180GB 7200-rpm ATA/100 with 8MB disk cache
- One bay filled with 60GB 7200-rpm Apple Drive Module (standard configurations); empty drive bays contain blank modules
- Support for reading SMART data from Apple Drive Modules for prefailure notification
- Slot-loading 24x-speed CD-ROM drive with front-panel eject button or optional Combo drive (DVD-ROM/CD-RW)

Graphics support
- ATI PCI graphics card with 32MB of DDR SDRAM graphics and VGA connector; support for 33MHz or 66MHz operation
- Optional ATI Radeon 8500 AGP 4X graphics card with 64MB of DDR SDRAM and DVI, VGA, and S-video connectors; dual display support; support for digital and analog resolutions up to 2048 by 1536 pixels

Rack support
- Fits EIA-310-D–compliant, industry-standard 19-inch-wide racks, including:
  - Four-post racks—24 inches, 26 inches, and from 29 to 36 inches deep
  - Two-post telco racks (center-mount brackets included)
- Front-to-back cooling for rack enclosure

Electrical requirements
- Line voltage: universal input (90V to 264V AC), power factor corrected
- Maximum input current: 3.6A (90V to 132V) or 1.8A (180V to 264V)
- Frequency: 47Hz to 63Hz, single phase
- Output current: 345W

Environmental requirements and approvals
- 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: 28 inches (71.1 cm)
- Weight: 26 pounds (11.8 kg); 31 pounds (14.1 kg) with four Apple Drive Modules[7]

Software

Mac OS X Server
- Unlimited-Client Edition

Included services
- File sharing: Macintosh (AFP over TCP/IP), Windows (SMB/CIFS), Internet (FTP), UNIX and Linux (NFS)
- Printer sharing: Macintosh and UNIX (LPR/LPD), Windows (SMB/CIFS), AppleTalk PAP
- Directory services: Open Directory (LDAPv3, NetInfo), Password Server (SASL), BSD configuration files (/etc), Kerberos v5 authentication (AFP, FTP, mail)
- Internet and web: Apache web server, SSL, WebDAV, mail server (SMTP, POP, IMAP), Webmail, Java virtual machine (J2SE), JavaServer Pages, Java Servlets, WebObjects 5.2 Deployment, PHP, Ruby, MySQL, SOAP, XML-RPC, QuickTime Streaming Server, QuickTime Broadcaster (MPEG-4)
- Workgroup management: Workgroup Manager, NetBoot, Network Install, Macintosh Manager
- Networking and security: BSD networking, SSH2, IP firewall, DHCP server, DNS server
- Remote management: Server Monitor, Server Settings, Server Status, SNMPv3, Neon Software bundle, command-line tools

Purchasing Information

Standard Configurations

Xserve is available in two standard configurations to meet the needs of server and cluster deployments in education and business.

Order number	Single-processor server M8888LL/A	Dual processor server M8889LL/A
Processor	1.33GHz PowerPC G4	Dual 1.33GHz PowerPC G4
On-chip L2 cache	256K at 1.33GHz	256K at 1.33GHz per processor
L3 cache (DDR SRAM)	2MB	2MB per processor
Memory (PC2700 DDR SDRAM)	256MB	512MB
Storage[1]	Hot-plug 60GB Apple Drive Module	
Storage expansion	Four drive bays supporting up to 720GB, using 60GB and/or 180GB drives	
Optical drive	Slot-loading CD-ROM or optional Combo drive (DVD-ROM/CD-RW)	
Gigabit Ethernet interfaces (10/100/1000BASE-T)	Two, one on logic board and one on card in PCI/AGP slot	
PCI slots	Two full-length 64-bit, 66MHz PCI slots and one half-length 32-bit, 66MHz combination PCI/AGP slot	
Ports	Back panel—two FireWire 800, two USB 1.1, one DB-9; front panel—one FireWire 400	
Graphics	One ATI card in lower PCI slot; optional AGP 4X card in PCI/AGP slot	
Service and support	90 days of free telephone support and one-year limited warranty; optional extended service and support products	
Also included	Mounting screws with M5 and 10/32-inch threads; caged nuts; cable management arm for four-post racks; agency-approved 12-foot power cable	

Build-to-Order Options

Customers can order a custom-configured Xserve from the Apple Store or an author-ized Apple reseller. Build-to-order options can include the following. For up-to-date information on these options and other products that enhance Xserve deployments, visit www.apple.com/store or call 800-MY-APPLE.

- Memory: 512MB, 1GB, 1.5GB, 2GB
- Internal storage: 60GB and 180GB Apple Drive Modules
- Optical drive: Combo drive (DVD-ROM/CD-RW)
- Graphics: ATI Radeon 8500 AGP 4X graphics card (includes AGP riser)
- Other: Ultra160 SCSI PCI card, Apple Fibre Channel PCI Card

Other Products

These products are available to enhance your Xserve system.
- 180GB Apple Drive Module, order number M8939G/A
- Xserve RAID (720GB), order number M8668LL/A
- Xserve RAID (1.26TB), order number M8669LL/A
- Xserve RAID (2.52TB), order number M8670LL/A
- Apple Fibre Channel PCI Card, order number M8940G/A

Service and Support Details

Xserve includes 90 days of free telephone support and a one-year limited warranty. With the AppleCare Premium Service and Support Plan, customers receive up to three full years of onsite hardware repair and up-and-running telephone and email support (terms apply).[2] Order number M8830LL/B.

Additional services and programs include the following:

AppleCare Service Parts Kits for Xserve. Include crucial parts for rapid onsite replacement.
- Kit with 60GB Apple Drive Module, order number M9113G/A
- Kit with 180GB Apple Drive Module, order number M9114G/A

Mac OS X Server Maintenance Program. Offers a three-year subscription for major Mac OS X Server upgrades.

Mac OS X Server Software Support. Provides consultative phone and email support for advanced Mac OS X Server issues.

Apple Professional Services. Delivers expert long-term system support and consulting.

Mac OS X Server Training and Certification. Offers instruction and certification programs for technical coordinators and administrators.

Visit www.apple.com/support/products or call 800-275-2273 in the United States or Canada for more information or to order AppleCare service and support products.

For More Information

For more information about Xserve technologies, including Xserve RAID, and Mac OS X Server, visit www.apple.com/xserve.

Product contains electronic documentation. Backup copy of software is included. [1]For hard drive capacity measurements, 1GB = 1 billion bytes and 1TB = 1 trillion bytes; actual formatted capacity less. Maximum capacity of 720GB achieved through use of four 180GB Apple Drive Modules. Empty drive bays contain blank modules. [2]A separate AppleCare Premium Service and Support Plan must be purchased for each Xserve system to be covered. To qualify, your Xserve system must be within its 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 may vary and are subject to change. [3]Requires Mac OS X v10.2 (or later) licensed clients. [4]Requires Apple DVI to ADC Adapter. [5]Actual rates will vary. [6]The included suite of Neon Software tools is designed to work specifically with Xserve and differs from the generally available releases of the products. [7]Weight varies by configuration and manufacturing process.