Mac OS X Server

Version 10.4

Technology Overview
April 2005

Contents

Introduction

Mac OS X Server version 10.4 "Tiger" gives you everything you need to manage servers in a mixed-platform environment and to configure, deploy, and manage powerful network services. Featuring the renowned Mac OS X interface, Mac OS X Server streamlines your management tasks with applications and utilities that are robust yet easy to use.

The latest release of Apple's award-winning server software brings people and data together as never before. Whether you want to empower users with instant messaging and blogging, gain greater control over email, reduce the cost and hassle of updating software, or build your own distributed supercomputer, Mac OS X Server v10.4 has the tools you need.

The power and simplicity of Mac OS X Server are a reflection of Apple's operating system strategy—one that favors open industry standards over proprietary technologies. It begins with a UNIX-based foundation built around the Mach microkernel and the latest advances from the open source BSD community. This foundation provides Mac OS X Server with a stable, high-performance, 64-bit computing platform for deploying server-based applications and services.

Open source made easy
Tiger Server is the fifth major release of Mac OS X Server, providing standards-based workgroup and Internet services without the complexity of Linux or the cost inherent in other UNIX-based solutions. Instead of developing proprietary server technologies, Apple has built on the best open source projects: Samba 3, OpenLDAP, Kerberos, Postfix, Apache, Jabber, SpamAssassin, and more. Mac OS X Server integrates these robust technologies and enhances them with a unified, consistent management interface. Powerful administrative tools permit novices to configure and maintain core network services, while providing the advanced features and functionality required by experienced IT professionals.

Because it is built on open standards, Mac OS X Server is compatible with existing network and computing infrastructures. It uses native protocols to deliver directory services, file and printer sharing, and secure network access to Mac, Windows, and Linux clients. A standards-based directory services architecture offers centralized management of network resources using any LDAP server—even proprietary servers such as Microsoft Active Directory. The open source UNIX-based foundation makes it easy to port and deploy existing tools to Mac OS X Server.

Best of all, Mac OS X Server fits easily into IT budgets everywhere. A complete suite of workgroup and Internet services is included in the box, so network administrators can get started right away. Mac OS X Server is available in 10-client and unlimited-client editions. The unlimited-client edition does not require additional per-seat fees for connecting more users, making it an affordable solution for organizations of any size.

Mac OS X Server: for supporting Mac and Windows workgroups, deploying powerful Internet services, and hosting enterprise applications—all with an ease of use that is uniquely Mac.

New in Version 10.4

Xserve and Xserve RAID
Mac OS X Server unleashes the power of
Xserve G5, Apple's rack-optimized server
hardware. With phenomenal performance,
massive storage capacity, high-bandwidth
I/O, and integrated remote management
tools, Xserve G5 running Mac OS X Server
is an unparalleled server solution for busi-
nesses, schools, and research centers. For
even more storage, Xserve RAID offers a
high-availability, high-performance storage
solution in a 3U enclosure.

Mac OS X Server v10.4 continues the Mac OS X tradition by delivering a world-class
UNIX-based server solution that's easy to deploy and easy to manage. This latest
release incorporates more than 100 open source projects and offers more than 200
new features. The key new features include:

64-bit applications. Mac OS X Server v10.4 brings the power of 64-bit computing
to mainstream servers. Its 64-bit addressing offers access to massive amounts of
memory, and its 64-bit optimized math libraries provide high-performance, extremely
accurate mathematical calculations. These capabilities make Mac OS X Server the ideal
platform for the most demanding databases and scientific, technical, and creative
computing tasks.

Access control lists. To provide greater file sharing flexibility in mixed-platform work-
flows, Apple has added support for access control lists (ACLs). With file system ACLs,
any file object can be assigned multiple users and groups, including groups within
groups. Each file object can also be assigned both allow and deny permissions, as
well as a granular set of permissions for administrative control, read, write, and delete
operations. For added security, Mac OS X Server v10.4 supports a file permission
inheritance model, ensuring that user permissions are inherited when files are moved
to the server and rewritten when files are copied to the server.

Software Update Server. Now you can decide whether the users in your organization
are notified of new Apple software updates. This gives administrators control over
which updates and patches users install. By hosting your own Apple software update
proxy/cache server, you will also save on network costs. Instead of each client com-
puter having to download an update from Apple, all your clients can obtain updates
from a single copy cached on your software update server.

iChat Server. Mac OS X Server v10.4 includes a new iChat Server for secure instant
messaging—designed for organizations that need to keep internal communication
private. Your organization can define its own namespace and use SSL encryption to
ensure privacy. iChat Server works with Apple's popular iChat conferencing in Mac
OS X client software, and is compatible with open source Jabber clients available for
Windows and Linux systems and popular PDAs.

Weblog Server. With the emergence of weblogs, organizations now have a quick
and easy way to share information. Weblog Server, included in Mac OS X Server v10.4,
makes it simple to publish and syndicate these online journals. The predefined blog
themes and calendar navigation provide an intuitive interface for managing blogs.
Individual users and groups can publish and access weblogs using only their normal
browsers; no additional tools or technical expertise is required. That simplicity makes
Weblog Server the perfect collaboration tool.

Xgrid. Mac OS X Server v10.4 includes Xgrid, the first distributed computing architecture to be built into a desktop or server operating system. Xgrid makes it easy to turn an ad hoc group of Mac systems into a low-cost supercomputer by streamlining the process of assembling nodes, submitting jobs, and retrieving results. Scientists, animators, and digital content creators now have the opportunity to easily run a single job across multiple computers at once, dramatically improving performance and responsiveness.

Ethernet link aggregation and network interface failover. Also known as IEEE 802.3ad, link aggregation allows you to configure multiple network interfaces to appear as a single interface, which can increase throughput and availability. First, link aggregation 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. Second, link aggregation eliminates a potential single point of failure. If one interface fails, the remaining interface maintains the network connection.

Gateway Setup Assistant. The new Gateway Setup Assistant helps you quickly and easily set up Mac OS X Server v10.4 to share a single Internet connection across a local network. The assistant eliminates the complexity of setting up network services by automating the process. All you have to do is make a few configuration choices when prompted.

Adaptive junk mail filtering and virus detection. To protect your organization from unwanted mail and destructive viruses, Mac OS X Server v10.4 integrates two popular open source projects: SpamAssassin for adaptive junk mail filtering, and ClamAV for virus detection and quarantine.

Operating System Fundamentals

Mac OS X Server has an open source, UNIX-based foundation that provides a stable, high-performance platform for deploying business-critical enterprise applications, services, and technologies. The core operating system at the heart of Mac OS X Server is known as Darwin.

UNIX-Based Foundation

Darwin provides Mac OS X Server with the stability, performance, and compatibility associated with UNIX. It's built around the Mach 3.0 microkernel, which is based on the OSF/mk project from the Open Software Foundation. The Mach kernel in Darwin provides services for memory management, thread control, hardware abstraction, and interprocess communication. It also brings advanced features critical to the operation of a server, including fine-grained multithreading, symmetric multiprocessing (SMP), protected memory, a unified buffer cache, 64-bit kernel services, and system notifications.

Darwin also includes the latest technological advances from the open source BSD community. Originally developed at the University of California, Berkeley, BSD has become the foundation of most UNIX implementations today. Darwin is based in large part on FreeBSD and includes the latest innovations from that development community.

64-Bit Computing

64-bit computing is the next big step in providing greater computing power to solve even the most challenging tasks. It gives scientists, engineers, and other power users the tools to address problems that are billions of times larger than the ones that can be solved with 32-bit systems.

Mac OS X Server v10.4 brings the power of 64-bit computing to mainstream servers. Its 64-bit addressing offers access to massive amounts of memory, transcending the 4GB memory limitation of 32-bit systems. And its 64-bit optimized math libraries provide high-performance, extremely accurate mathematical calculations. These capabilities make Mac OS X Server the ideal platform for the most demanding databases and scientific, technical, and creative computing tasks.

Advanced BSD Networking Architecture

Mac OS X Server incorporates industry-standard protocols and the latest in 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 ensures compatibility and integration with IP-based networks.

The networking architecture in Mac OS X Server v10.4 includes advanced features critical to high-performance server operation and deployments. These include:

· Multilink multihoming for hosting multiple IP addresses on one or more network interfaces

· IPv6 to support the next generation of Internet addressing

· IPSec for general-purpose protection of IP communications

· IP over FireWire for ad hoc network deployments and system administration

· Ethernet link aggregation and network interface failover (IEEE 802.3ad) for higher aggregated throughput and increased server availability

· Virtual local area network (VLAN) tags that let you treat specified systems on different physical LANs as though they were all on the same LAN

· 802.1X network authentication for improved access security

· Ethernet jumbo frames to increase network efficiency and throughput

Robust Security

Mac OS X Server is built on a robust UNIX foundation that contains many security features in its core architecture. State-of-the-art, standards-based technologies protect your server, network, and data. These technologies include a built-in firewall with stateful packet analysis, strong encryption and authentication services, data security architectures, and support for access control lists (ACLs). Simple interfaces and configuration tools allow you to configure systems easily and securely. In fact, when you take an Apple server out of the box, it's already configured with secure settings—no security expertise is required.

Directory Integration

Integration with directory services
Workgroup Manager works with Open Directory or any other LDAP solution to access and store user, group, and computer information. Based on open standards, Apple's Open Directory architecture features built-in directory access modules that simplify integration with third-party directory services, including IBM Directory Server, Microsoft Active Directory, Novell eDirectory, OpenLDAP, Sun ONE, NIS, and NetInfo.

By using open standards and publishing the schema extensions specific to the Mac, Apple has made it easy to integrate Mac OS X and Mac OS X Server systems into virtually any directory-based network, including ones that use Open Directory, Microsoft's Active Directory, or open standard LDAP-based solutions.[1]

Open Directory, Apple's standards-based directory and network authentication services architecture, is a robust, scalable directory server that's perfect for organizations that haven't yet deployed centralized directory services—as well as for businesses and institutions migrating from expensive proprietary solutions. Based on the LDAPv3 standard, the Open Directory architecture allows Mac OS X systems to use any LDAP directory, leveraging the directory services in existing network infrastructures.

The Open Directory architecture comes with directory access modules for various popular directory services solutions. It adheres to the RFC 2307 schema and also allows for customized schema mappings. So attributes in an LDAP-based directory can be mapped to settings on the Mac, eliminating the need to configure each client system. Apple has published these extensions as part of a comprehensive open source project that includes all interoperability components.

High Availability

Computer problems such as unplanned shutdowns can severely impair an organization's operations. High availability of your computing resources is essential to guarantee service levels, comply with industry regulations, and provide access to business-critical information. Apple has built into Mac OS X Server powerful high-availability features that maximize server uptime and reduce the risks of shutdowns. These features include:

- Watchdog processes that continuously monitor activity and recover services in the event of an application, system, or power failure
- IP failover to further increase service availability in the event of a failure on one server
- File system journaling to dramatically expedite file system repairs on system restarts
- Software RAID with disk mirroring to eliminate drive failures bringing down a server
- Disk space monitoring to access available drive space and, if necessary, proactively free up space by deleting or backing up noncritical logs and utilities

Integrated Management Tools

Server Admin displays service activity in real time, as well as graphs of network traffic, throughput, and performance history.[2]

Mac OS X Server comes with industry-leading management tools that simplify the configuration and deployment of network services for Mac, Windows, and Linux clients. Everything required to deliver powerful network solutions within a depart-ment, across an enterprise, or over the Internet is built in and ready to use. With the unlimited-client edition of Mac OS X Server, your organization can add clients as your needs grow—without draining the IT budget.

Server Admin

Server Admin provides a graphical user interface that makes it easy to set up, manage, and monitor services from any Internet-connected Mac OS X system.[2] Mac OS X Server also supports SSH for secure remote administration from the command line, as well as the open standard SNMPv3 protocol for integration with third-party monitoring and management software.

Managing Services with Server Admin

1. **Encrypted, authenticated access.** Use Server Admin to securely access servers from any Internet-connected Mac OS X system. Manage and monitor multiple servers from a single interface.

2. **List of services.** Select a service to manage settings and monitor activity. Indicator lights display at-a-glance information about the status of individual services.

3. **Activation button.** Turn services on or off with a single click.

4. **Admin tools.** Choose from a selec-tion of logs and graphs to view real-time and historical information. Or choose Settings for detailed con-figuration and management options.

5. **Functions.** Configure services and change settings using context-sensitive functions.

Workgroup Manager

Mac OS X Server features the innovative Workgroup Manager application for defining
and managing directory information. This powerful tool makes it easy for adminis-
trators to set up user accounts, define group relationships, and manage computing
resources in a directory-based network environment. Workgroup Manager scales from
managing local accounts on a single server to managing an entire organization using
an enterprise directory server.

By taking full advantage of the robust manageability features built into the Mac OS X
client operating system, Workgroup Manager provides greater control over organi-
zational resources. At the same time, it optimizes the user's computing experience
with consistent settings, network-based home directories, and easy access to network
resources, such as printers and group folders.

Defining users, groups, and computers
Workgroup Manager features an intuitive interface for directory-based management
of user, group, and computer account information. Administrators can control
passwords, print quotas, email quotas, and group membership, as well as set up
share points, for Mac, Windows, and Linux clients—all from a single interface. The
information defined in Workgroup Manager can be stored on the local server or
in a central LDAP directory server.

Managing Users, Groups, and Computers with Workgroup Manager
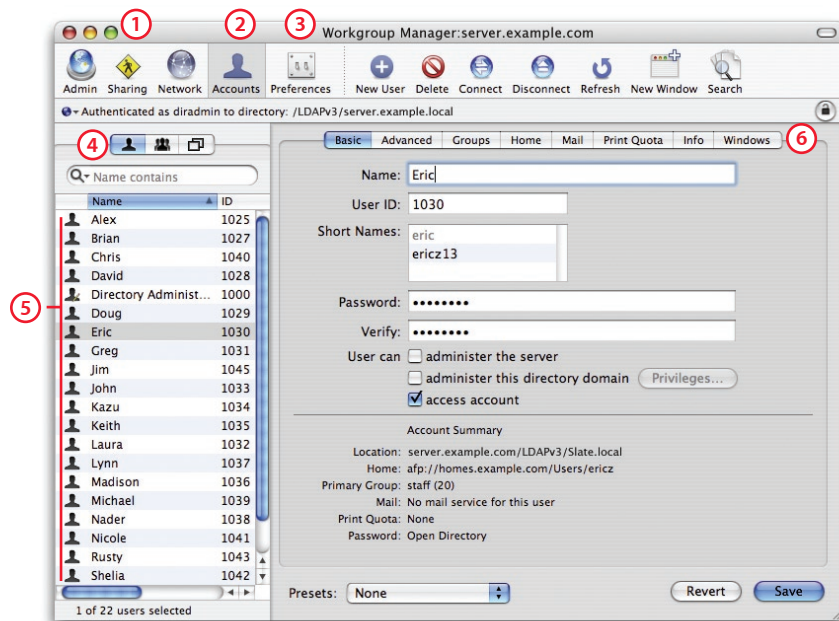
① **Share points.** Designate folders
or volumes to share among Mac,
Windows, and Linux clients on
the network.

② **Account settings.** Set up user and
group accounts and lists of computers
in the directory.

③ **Preferences.** Set preferences and
policies for Mac OS X systems on
the network.

④ **Users, groups, and computers.**
Choose to define settings on a
per-user, per-group, or per-computer
basis. Depending on the selection,
Workgroup Manager displays a list
of users, groups, or computers
currently defined in the directory.

⑤ **List of users.** Select a name to set
up accounts or change settings.

⑥ **Network resources.** Manage
network resources and settings
for individual users.

Defining preferences for Mac OS X clients

Administrators can use Workgroup Manager to set preferences and define privileges by user, group, computer, or any combination of the three, providing an appropriate balance between organizational control and user access.[3]

The flexibility offered by Workgroup Manager makes it easy to create custom computing environments for different workgroups or classrooms. When users log in, predefined group applications launch automatically, and shared network resources are mounted on the desktop. The same functionality can be used to restrict operations. For example, administrators can disable media burning, limit which applications can be used, or require authentication for access to specific devices or printers.
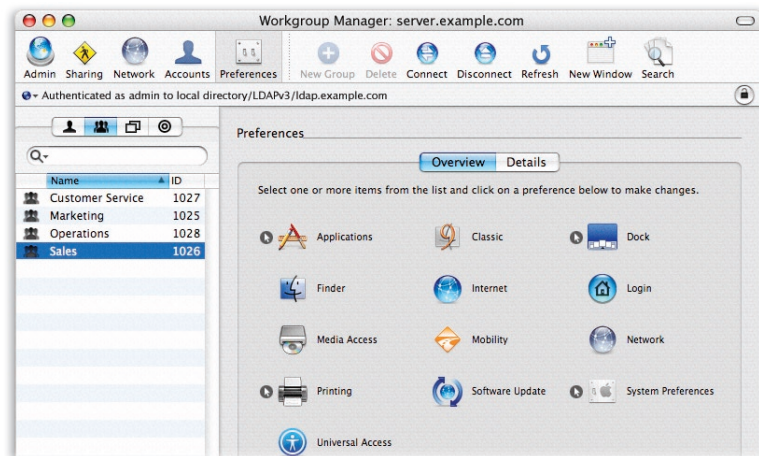
The available settings vary for users, groups, and computers, but they include the following:

Applications. Specify available applications, preventing users from running unauthorized applications. Set authorized applications to open automatically when a user or a group member logs in.

Classic. Designate the location of the Classic startup system. Control Classic utilities. Set the system to launch Classic automatically at startup, if required.

Dock. Manage Dock attributes such as display, size, magnification, and position onscreen. Ensure that personal and group applications, documents, and URLs are always in the Dock.

Energy Saver. Set a computer to make optimal use of power, depending on performance requirements. (This setting is especially useful for lab environments.)

Finder. Define Finder behavior, desktop appearance, availability of Finder menu commands, and the desktop display of hard disks, removable media, and connected servers. Configure Simple Finder for environments such as a kindergarten classroom or a visitor area.

Internet. Set preferences for default email and web applications, such as defining a default home page and download location, controlling email account types, and restricting outgoing email traffic.

Login. Define the Mac OS X login experience. Set the login window to display a list of users local to the computer and on the network. For greater security, require users to enter their user names manually at login.

Media Access. Set authenticated access to, or disable the use of, internal and external disks, including hard drives, CD-ROMs, DVDs, and USB and FireWire devices.

Mobility. Set a portable system to cache the LDAP user, group, and computer account information, including authentication token, on its hard drive. (This enables managed settings to remain in effect when the computer is disconnected from the network.) Synchronize folders on users' portable computers with their network home directories.

Network. Set preferences to configure network proxies such as FTP, Web, and Secure Web.

Printing. Define a set of printers and a default printer for any user, group, or computer. For example, associate a computer with a nearby printer, or associate individual users with a particular printer regardless of the computer they are using.

Software Update. Define a Software Update Server for Mac OS X systems.

Service Deployment and Administration

Mac OS X Server v10.4 comes with a wide range of Internet and workgroup services based on open standard technologies. Mac OS X Server integrates these robust technologies and enhances them with a unified, consistent management interface that takes full advantage of the renowned Mac ease of use. The result is simplified deployment and administration that permit novices to configure and maintain core network services, while providing the advanced features and functionality required by experienced IT professionals.

Open Directory Server

Mac OS X Server includes a robust LDAP directory server and a secure Kerberos password server to provide directory and authentication services to Mac, Windows, and Linux clients.

Apple has built the Open Directory server around OpenLDAP, the most widely deployed open source LDAP server, so that it can deliver directory services for both Mac-only and mixed-platform environments. LDAP provides a common language for directory access, enabling administrators to consolidate information from different platforms and define one namespace for all network resources. This means a single directory for all Mac, Windows, and Linux systems on the network; there's no need to maintain a separate server or separate user records for each platform. It also results in a streamlined user experience: Users can authenticate to Mac OS X Server and access network resources from any platform using a single password.

To store directory information, the Open Directory server uses Berkeley DB, one of the world's most scalable databases, for high-performance indexing of hundreds of thousands of user records. In addition, a robust replication feature maximizes availability and scalability. The ability to replicate directory and authentication servers enables organizations to maintain failover servers for high availability, as well as remote servers for fast client interaction on distributed networks.

Open Directory

Why directory services?
A key component of any modern computing environment, directory services allow organizations to centralize information about users, groups, and computing resources. A network-based repository consolidates resources, simplifies system management, and reduces support and administration costs—all while providing strong authentication and password-protected access to network resources.
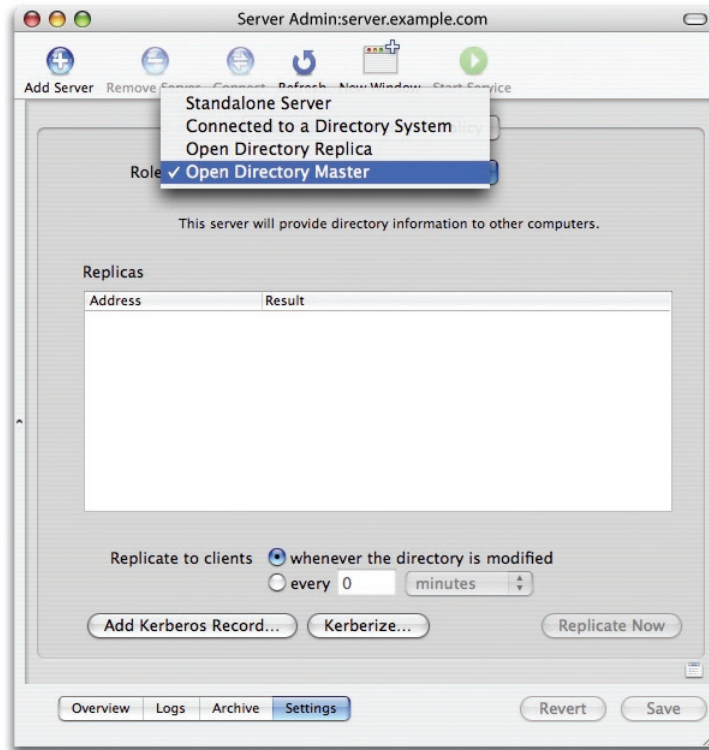
For example, when an employee leaves the company, the administrator can change that user's password, archive the user's network home directory, and delete the user's account quickly and easily, all from the administrator's own desk.

Server Admin makes it easy to set up replication services for Open Directory. Replica directories automatically synchronize with the master directory, so user accounts and authentication information remain consistent across distributed networks.

Single sign-on using Kerberos

Open Directory integrates an authentication authority based on MIT's Kerberos technology to provide users with single sign-on access to secure network resources. Using strong Kerberos authentication, single sign-on maximizes the security of network resources while providing users with easier access to a broad range of Kerberos-enabled network services. For services that have not yet been "Kerberized," the integrated SASL service automatically negotiates the strongest possible authentication protocol.

Directory support for Windows clients

In Mac OS X Server, Apple has integrated the NT Domain services of the popular open source Samba 3 project with Open Directory, making it possible to host NT Domain services. You can set up Mac OS X Server as a Primary Domain Controller (PDC) or Backup Domain Controller (BDC) for your network, allowing Windows users to authenticate against Mac OS X Server directly from their PC login windows.

NT Domain services also enable Mac OS X Server to host roaming profiles and network home directories for Windows clients. Now any user in your directory can securely log in and access the same user account, authentication, home directory, and network resources from either a Mac or a Windows system. These capabilities make Mac OS X Server ideal for replacing aging Windows NT or Windows 2000 servers, without requiring businesses to transition to an expensive Active Directory infrastructure.

Shared folders hosted on Mac OS X Server appear in the Network Neighborhood on Windows clients.

File and Print Services

Mac OS X Server is one of the easiest, most cost-effective ways for small businesses and departments to share network resources. Since native support for Mac, Windows, and Linux is built in, all users can have access to storage on the server and shared PostScript and raster (inkjet) printers. Apple's innovative tools for streamlined remote administration make it easy to configure services, manage user access privileges, enforce disk and print quotas, and view system traffic from virtually anywhere on the network or over the Internet.

Support for mixed-platform networks

Mac OS X Server v10.4 features enhanced support for heterogeneous networks, making it easy to set up central network storage that is accessible to clients throughout your organization. This versatile solution maximizes user productivity and makes your file services more secure and easier to manage.

Using native protocols, Mac OS X Server delivers file services to all the clients on your network: AFP for Mac, SMB/CIFS for Windows (via Samba 3), and NFS for UNIX and Linux. It also offers WebDAV and FTP for Internet clients.

The advanced capabilities for Windows clients include high-speed file and print services, and support for authenticated login, home directories, and roaming profiles. Mac OS X Server systems appear right in the network browser just like a Windows server, so Windows users can browse folders and share files without having to install additional software.

Mac OS X Server even works in organizations with an existing Active Directory deployment, allowing you to provide lower-cost file services while still integrating with Active Directory for user and group account information, permissions, and authentication.
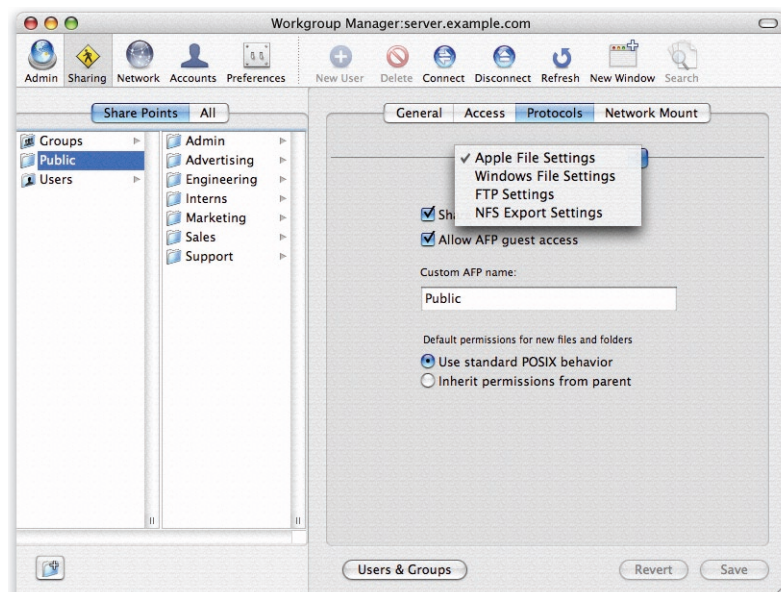
Any disk, volume, or folder hosted on Mac OS X Server can be shared using any combination of protocols, making it available to Mac, Windows, and Linux clients.

Compatibility in heterogeneous environments
Apple's ACL implementation is compatible with the POSIX 1003e draft. This enables full interoperability with the native permissions of Windows Server 2003 and Windows XP, while maintaining compatibility with traditional UNIX file permissions. Such versatility makes Mac OS X Server the ultimate platform for file sharing in mixed-platform workflows.

Mail services
• SMTP (Postfix)
• POP and IMAP (Cyrus)
• Berkeley DB for indexing
• SSL/TLS encryption (OpenSSL)
• Junk mail filtering (SpamAssassin)
• Virus detection (ClamAV)
• Mailing lists (Mailman)
• Webmail (SquirrelMail)

File system access controls
Mac OS X Server v10.4 supports both traditional UNIX file permissions and access control lists, offering administrators an exceptional level of control over file and folder permissions.

Most UNIX- and Linux-based operating systems are constrained by the UNIX file permissions model, also known as Portable Operating System Interface (POSIX) permissions. Standard UNIX file permissions allow you to assign one access privilege to the file's owner, one to a group, and one to everyone on the network. Access by multiple users or multiple groups is not allowed, nor is ownership by a group. The traditional UNIX model also lacks some other important file access features. It supports only three permissions (read, write, and execute) and does not support permission inheritance, which enables new or copied files to automatically inherit the access controls of the parent directory.

To provide greater flexibility in complex computing environments, Apple has added support for ACLs in Mac OS X Server v10.4. With file system ACLs, any file object can be assigned multiple users and groups, including groups within groups. Each file object can also be assigned both allow and deny permissions, as well as a granular set of permissions for administrative control, read, write, and delete operations. For added security, Mac OS X Server now supports a file permission inheritance model, ensuring that user permissions are inherited when files are moved to the server, and rewritten when files are copied to the server.

CUPS print services
At the heart of the print services in Mac OS X Server is the Common UNIX Printing System (CUPS), an open source printing architecture that supports standard cross-platform print protocols, including IPP, LPR, SMB/CIFS, and AppleTalk PAP.

Using Open Directory and Workgroup Manager, Mac OS X Server provides centralized, directory-based management of printer resources. Printers can be assigned to any combination of users, groups, and computers, and print quotas can be enforced on a per-user and per-queue basis. Flexible queue management and remote monitoring tools allow management of high-volume, cross-platform printing for Mac, Windows, and Linux clients from a single, intuitive interface. Settings and access policies are stored in any LDAP server using Open Directory.

Mail Services

Mac OS X Server combines several robust technologies from the open source community to deliver comprehensive, easy-to-use mail server solutions. Full support for Internet mail protocols—Internet Message Access Protocol (IMAP), Post Office Protocol (POP), and Simple Mail Transfer Protocol (SMTP)—ensures compatibility with standards-based mail clients on Mac, Windows, and Linux systems. With support for thousands of users per server and no per-user licensing fees, these high-performance mail services offer significant cost savings for small organizations and large enterprises alike.

Core mail services
Mac OS X Server uses the high-speed Postfix server for SMTP messaging, and the Cyrus mailbox server for scalable, enterprise-class POP and IMAP mail. Flexible mail storage makes it easy to scale the mail server to meet growing needs, and high-performance Berkeley DB indexing ensures continued responsiveness when clients access their mail, delete messages, and move files on the mail server. To protect your network mail services from unauthorized access or abuse, Mac OS X Server includes built-in SSL/TLS encryption, strong authentication, junk mail and virus filtering, and flexible mail quota handling capabilities.
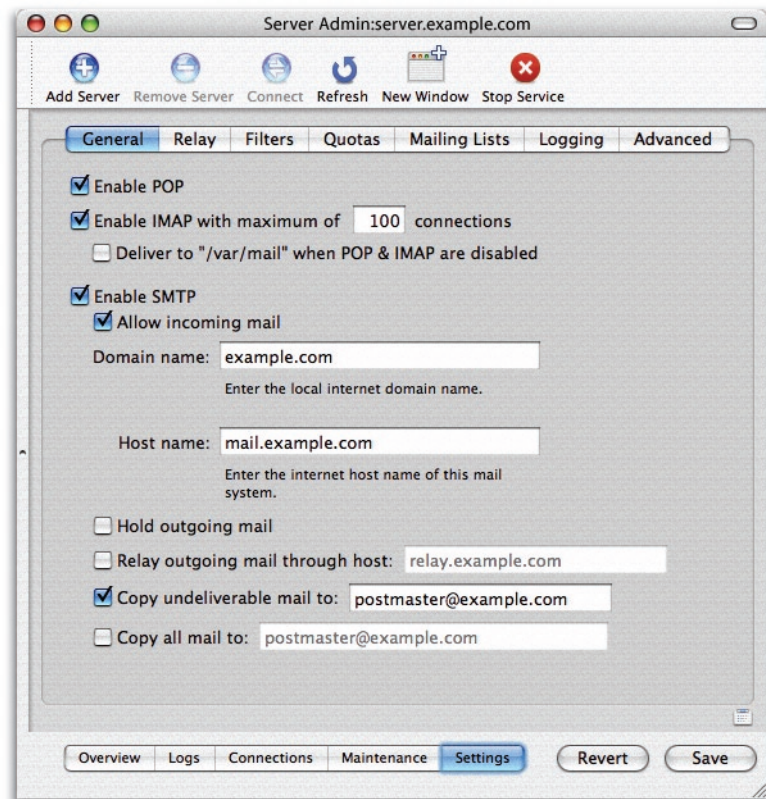
Postfix and Cyrus are easy to configure and manage using the Server Admin utility.

Protection against junk mail and viruses
To defend your servers and clients against unwanted mail and destructive viruses, Mac OS X Server v10.4 integrates two popular open source projects: SpamAssassin for adaptive junk mail filtering, and ClamAV for virus detection and quarantine.

SpamAssassin enables Mac OS X Server to analyze the content of each mail message. Using a wide variety of local and network tests, SpamAssassin assigns a probability rating that the mail is spam. If the probability is high, it classifies the mail as potential junk mail and allows the user to decide how to handle it. The SpamAssassin junk mail filter is adaptive, which means it can be trained to recognize which marginal mail messages are spam and which are not. Training can be done automatically: SpamAssassin analyzes the content of user inboxes every night and adapts its filters accordingly. Or, for greater control, postmasters and users may prefer to train SpamAssassin manually.

ClamAV scans mail messages and attachments for viruses. Administrators choose how ClamAV should handle a suspected virus. They can have the mail server bounce back the message to the sender, delete the message immediately, or quarantine it in a spec-ified directory for further analysis. The server can also automatically generate an email message notifying postmasters or senders that their message has been quarantined.
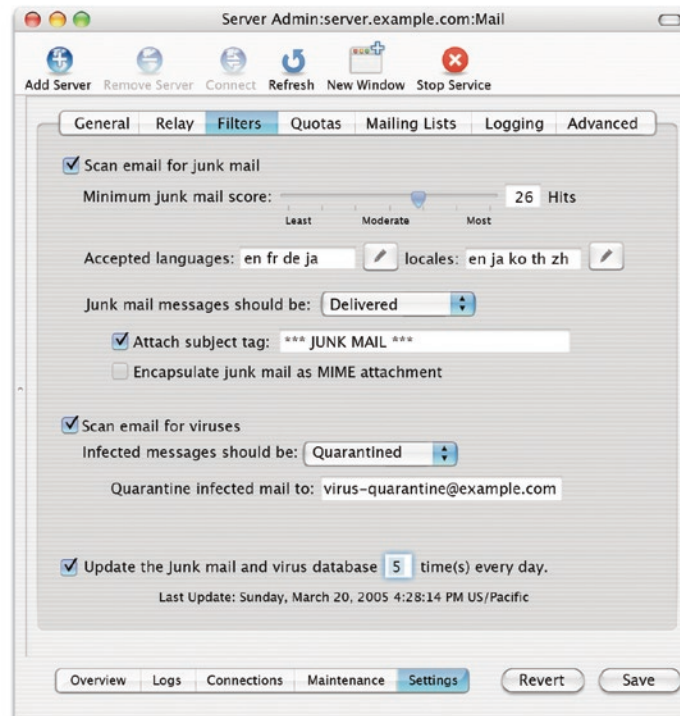
Junk mail and viruses can be easily avoided using the Server Admin utility.

In addition to these new capabilities, Mac OS X Server works with real-time blacklists. The mail server will refuse incoming traffic from hosts that are on any of the lists. Your organization can even add its own junk mail blacklists. It's also easy to prevent unauthorized outsiders from using your server to send email, and to refuse email messages that exceed a specified file size.

Additional standards-based mail solutions

Mac OS X Server provides a graphical user interface for Mailman, making it easy to deploy one of the most popular listserv solutions in the world. Mailman features list archiving, content filtering, and digest delivery options, as well as a web-based inter-face that enables individual users to create and maintain lists.

Completing its suite of industry-standard mail solutions, Mac OS X Server includes webmail services using the open source SquirrelMail project. SquirrelMail allows users to access their email from any standards-based browser, with full support for MIME, address books, and folders for organizing stored messages. PHP is fully integrated with the Apache web server, so webmail pages render in pure HTML 4.0—with no JavaScript required—for maximum compatibility across browsers. SquirrelMail is easy to configure and works with any IMAP server.

Web Hosting

Combining the latest open source and standards-based Internet services, Mac OS X Server makes it possible for organizations of any size to host websites and deploy powerful web applications—quickly and affordably. Mac OS X Server web technologies are based on the open source Apache web server, the most widely used HTTP server on the Internet.[4] With performance optimized for Mac OS X Server, Apache provides fast, reliable web hosting and an extensible architecture for delivering dynamic content and sophisticated web services.

Getting started with Apache
Apple's innovative administration tools take the complexity out of configuring, hosting, and managing websites. Apache is preconfigured with default settings, so novices can create a static website in a few simple steps and add features as their expertise grows. The web server supports aliases for greater website flexibility, making it possible to move web pages without breaking links and to create multiple URLs that refer to a single file. In addition, support for virtual hosting allows multiple sites to reside on a single server. Each of the websites can be configured with unique security options and separate log files for tracking and reporting.
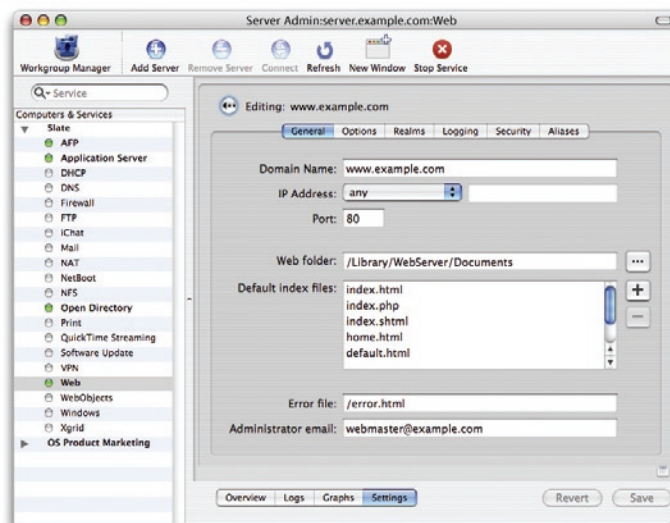

A graphical interface makes it easy to customize web server settings, as well as to implement advanced web hosting features.

Hosting dynamic content
Mac OS X Server includes everything professional webmasters need to deploy sophisticated web services: integrated tools for collaborative publishing, inline scripting, Apache modules, and custom CGIs, as well as support for JavaServer Pages and Java Servlets. Database-driven sites can be linked to the included MySQL database; ODBC and JDBC connectivity to other database solutions is also supported.

Weblog services
With the emergence of weblogs, organizations have a quick and easy way to share information. Weblog Server, included in Mac OS X Server v10.4, makes it simple to publish and syndicate these online journals. The predefined blog themes and calendar navigation provide an intuitive interface for managing blogs. Individual users and groups can publish and access weblogs using only their normal browsers; no additional tools or technical expertise is required. This simplicity makes Weblog Server the perfect collaboration tool.
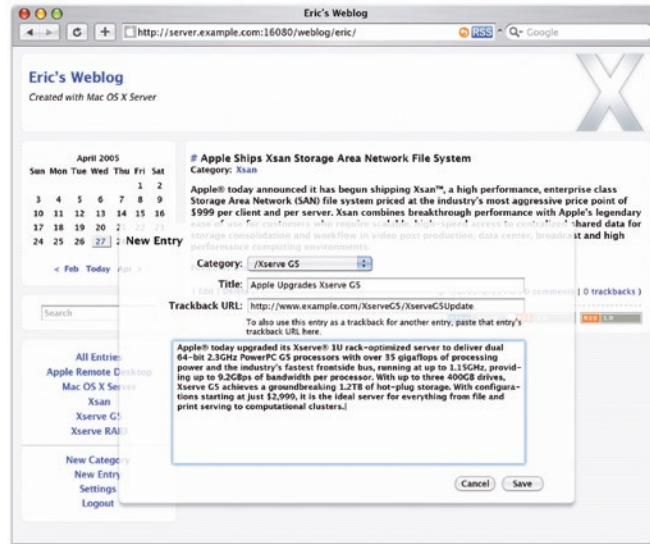
Weblogs can be easily published and syndicated using this intuitive interface.

Weblogs can be published and syndicated using HTML, RSS, RSS2, RDF, and Atom protocols, allowing users to receive content in their desired format automatically. With Open Directory authentication and access controls, Weblog Server fits into any environment.

Security and authentication
To protect credit card information and business data transmitted during web transactions, Mac OS X Server integrates OpenSSL with the Apache web server for strong 128-bit encryption. For intranet sites and collaborative publishing scenarios, it's also easy to set up realms to require user authentication, or to use Kerberos authentication for single sign-on.

Enterprise Applications

Application services
- JBoss application server (EJB)
- Apache Tomcat (JavaServer Pages, Java Servlets)
- Java virtual machine (J2SE)
- Apache Axis (SOAP, WSDL Web Services)
- WebObjects deployment

Mac OS X Server is one of the easiest ways to develop and deploy robust, reliable enterprise applications based on Sun's Java 2 Platform. It comes with all the components necessary to host J2EE applications, including JBoss, Apache Tomcat, and Apache Axis. Together, these components enable enterprise application services such as Enterprise JavaBeans (EJB), Java Message Services (JMS), XML-based web services, and Java Database Connectivity (JDBC).

Mac OS X Server also supports the SOAP and WSDL Web Services standards for exchanging data among distributed applications. Increasingly popular for business-to-business transactions, these transport protocols provide the integration essential in sophisticated, multitiered applications.

The J2EE architecture
The Java 2 Platform, Enterprise Edition (J2EE) standard defines a modular architecture for building secure and interoperable enterprise applications. Using a standards-based framework, these enterprise-grade Java server applications can deliver advanced features such as automatic data persistence, secure transactions, database connectivity, and dynamically generated web pages. Applications originating from another system (or even another application server) that adhere to the J2EE 1.3 or J2EE 1.4 standard can also usually be hosted on Mac OS X Server.

WebObjects

Apple WebObjects (sold separately) provides a rapid development environment for J2EE-compatible applications. With built-in assistants, it's easy to create web services or three-tier Java server applications—backed by robust relational databases—with rich HTML or Java client interfaces. WebObjects applications can be deployed, without reconfiguration, on virtually any J2EE-capable server—including the Mac OS X Server JBoss application server.

JBoss application server

Mac OS X Server makes it easy to manage and deploy J2EE-based applications, without having to edit numerous XML files by hand. A JBoss application server comes preinstalled and preintegrated for use with the built-in Apache web server, along with MySQL, the popular open source SQL database. And unlike expensive proprietary J2EE application servers, Mac OS X Server does not impose per-CPU license fees or high-priced maintenance fees.

Apple's JBoss application server features graphical management tools for validating, configuring, and monitoring J2EE applications. Deploying an enterprise application can be as easy as starting JBoss and copying the application resources to the deployment directory. Upgrading is instant—there's no need to restart the server. JBoss also features clustering, load-balancing, and failover capabilities that increase the reliability and scalability of J2EE deployments.
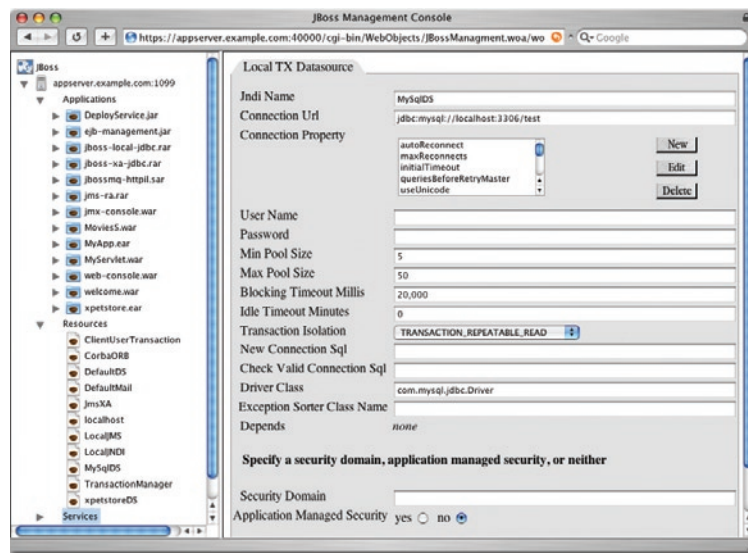
The JBoss Management Console allows administrators to monitor the activity of applications and services on the JBoss application server, as well as to configure new resources such as databases and message queues.

Media Streaming

Mac OS X Server v10.4 includes the latest version of the popular QuickTime Streaming Server. These powerful tools provide a complete, affordable, standards-based solution for delivering rich audio and video over the Internet and high-speed wireless networks.

Using the open standard Real-Time Transport Protocol/Real-Time Streaming Protocol (RTP/RTSP), QuickTime Streaming Server streams media—from modem to broadband rates and beyond—to users everywhere. Because QuickTime has no client-access license fees, it's one of the most cost-effective platforms for creating, playing, and streaming digital media over the Internet.

Standards-based streaming
• Delivers streams over RTP/RTSP via multicast or unicast transport
• Supports native MPEG-4 and 3GPP streaming
• Serves MP3 files via Icecast-compatible protocols over HTTP to MP3 clients
• Supports H.264 video streaming

Support for industry standards

QuickTime is one of the most versatile platforms for streaming live and on-demand media. It supports the latest global multimedia standards, including H.264, AAC, MP3, MPEG-4, and 3GPP, so your content can be played anywhere using standards-compliant media players—a Mac or Windows system, mobile phone, or set-top box.

Easy-to-use management tools

Setting up and administering QuickTime Streaming Server (QTSS) is a snap with the Server Admin application in Mac OS X Server. Server Admin provides secure remote management and monitoring of your server from anywhere on the Internet. Allowing you to do anything from setting passwords to binding QTSS to a specific IP address, Server Admin will have you up and streaming with just a few clicks.

In addition, QuickTime Streaming Server comes with a web-based administration tool that lets you monitor streaming activity from any computer that has a web browser.

Preparing content for streaming

Mac OS X Server v10.4 also includes the latest version of QTSS Publisher, Apple's QuickTime content management software. With an intuitive interface, QTSS Publisher allows individual users to publish media for streaming to the server quickly and easily from any Mac OS X system that has an Internet connection. Upload files to the server, create playlists of content, generate web pages, and much more, using this powerful application built into Mac OS X Server.
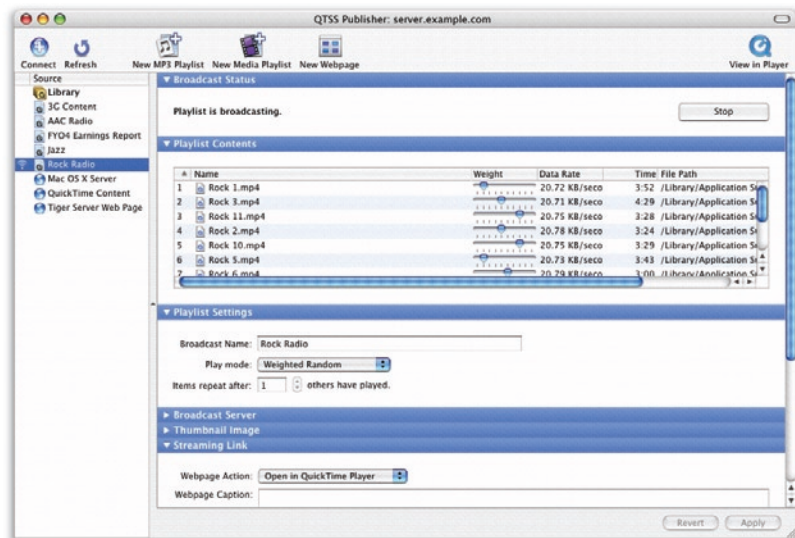
Broadcasting live events

Working seamlessly with QuickTime Streaming Server, QuickTime Broadcaster makes it easy to produce professional-quality live events for online delivery. This live encoding software has broad, extensible codec support that includes H.264 video, making it easy to reach large numbers of viewers for corporate meetings, online courses, key-note addresses, and other special events.

Based on standards, live broadcasts can be viewed in a variety of compliant devices in addition to QuickTime Player on Mac and Windows PCs. Live streaming begins with a Mac desktop or notebook computer connected to a video camera, microphone, or other media recording device. Using QuickTime Broadcaster, the system digitizes and compresses the media feed and sends the encoded signal to the server. The QuickTime Streaming Server software then reflects the signal, sending it out to audiences, who "tune in" with QuickTime Player or other compliant devices.

The intuitive QTSS Publisher interface makes it easy to upload prerecorded media to the streaming server and manage media playlists for simulated live broadcasts or on-demand viewing.

QuickTime

QuickTime is an extremely versatile, cost-effective platform for creating, playing, and streaming digital media over the Internet. It supports all the latest digital media standards, including MPEG-4, H.264, and 3GPP, so content can be played anywhere, using any standards-compliant media player.

iChat Server

With instant messaging quickly becoming a primary collaboration tool in organizations of all sizes, the importance of secure instant messaging has rapidly increased. By default, many instant messaging services are not encrypted, so any text messages and files exchanged by users can be compromised. That lack of security makes those instant message products risky for business communications. For example, when a user on a business trip chats with a colleague back at the office, the information they share can be intercepted as it goes over the Internet and through the office LAN.

iChat Server, new in Mac OS X Server v10.4, makes secure communications within the firewall possible. Designed from the ground up to be secure, iChat Server encrypts communications using SSL, ensuring that text messages and files are protected as they move between users.

Based on the popular Jabber open source instant messaging project, iChat Server works with Mac OS X Tiger iChat, as well as with Jabber clients available for Windows and Linux computers and popular PDAs.

Because iChat Server builds on the Jabber server, it supports namespace management and user authentication using Open Directory. By leveraging Open Directory, an organization can use existing user accounts stored in its Open Directory server, as well as Active Directory or other LDAP-based directory servers.

Software Update Server

Mac OS X Server v10.4 includes Software Update Server, which acts as a proxy for software updates for Mac OS X Tiger client systems. This caching server allows administrators to control when and how software updates become available for users' systems. It can also reduce network costs.

Your software update server automatically mirrors itself to Apple's software update servers, ensuring that you have the most current updates available. For security, all updates are digitally signed by Apple.
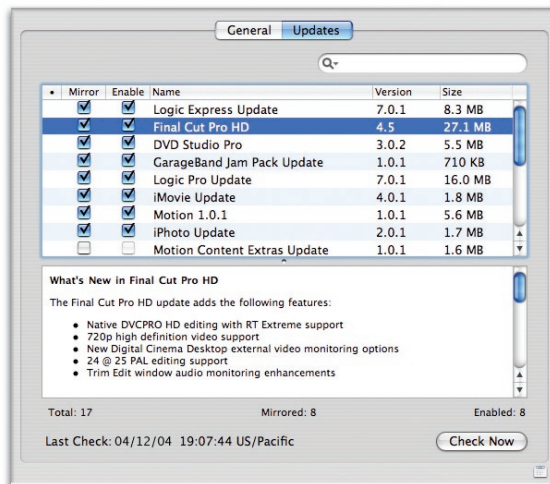
This easy-to-use interface offers the option to mirror or enable each update, while providing detailed information on each software program.

Managing client updates

In an uncontrolled environment, users may connect to Apple's software update servers at any time and update their computers with whatever software they want, even if it has not been approved by the IT group or system administrator. When you deploy local software update servers, users are restricted to downloading only approved software updates.

For example, IT administrators may not want to deploy every update on its day of publication. They may instead wish to go through a testing and evaluation phase before deploying the new software to users. By creating local update servers, you can control when and whether users get the new updates.

Using Workgroup Manager, you can assign various users, groups, and computers to specific local software update servers. You can also control which software update packages users can access by enabling and disabling individual packages at the local server.

Controlling costs

A local software update server caches software updates from Apple's software update servers, then shares them with local network clients. By eliminating the multiple Internet downloads required when each Mac OS X user individually accesses Apple's servers, the local server reduces the bandwidth demands on your Internet gateway—and therefore, your organization's costs for external network access. Having control over client updates also helps IT staff manage the support costs associated with help desk requests—the largest cost of ownership for personal computers.

NetBoot and Network Install

Included in Mac OS X Server are two powerful applications for standardizing and upgrading client systems. The NetBoot service allows multiple Mac clients to start up from a single server-based disk image. Network Install enables automated software installation from a master image. The new System Image Utility streamlines system deployment and reduces administration costs by providing a convenient single interface for both NetBoot and Network Install functions.[5]
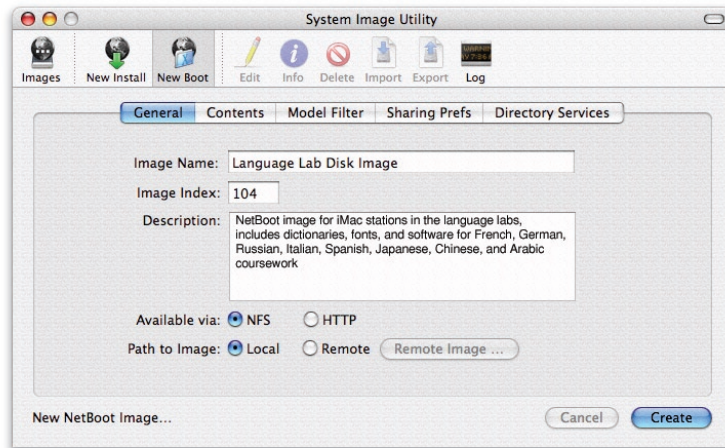
NetBoot

Use NetBoot to:
- Configure multiple desktop computers with the same operating system and applications
- Replicate server configurations for compute farms and data centers
- Deploy new systems and restore compromised systems instantly

The NetBoot service makes managing a group of computers as easy as managing a single Mac. Client systems can boot from a server-based disk image, which enables the same operating system and applications to be deployed across an entire workgroup. NetBoot can even be used to create server configurations and run multiple servers from one image. Updating the disk image on the server updates all of these systems automatically the next time they are restarted. NetBoot is also a powerful tool for deploying new systems, repurposing desktop or server systems, and deploying network-based diagnostics and repair utilities.

NetBoot is a proven technology that enables businesses and institutions to streamline the support of Mac clients and reduce system administration costs. The ability to deploy a standard desktop configuration across multiple systems and to protect them from alteration makes NetBoot ideal for computing environments such as classrooms, computer labs, kiosks, and computational clusters.

The new System Image Utility makes it easy to create a NetBoot disk image by cloning a local volume—no configuration required—or to build a new image from a Mac OS X Install CD.

Network Install

Network Install uses the same technology as NetBoot, but instead of starting up the client system from a server-based disk image, it installs the contents of the image on the client computer's hard drive. Once the installation process is complete, client systems no longer need to be connected to the network, making Network Install an excellent tool for managing mobile computers.

Designed for administrators who manage operating system installations and software updates for their organizations, Network Install performs automated software installations, whether it's a new version of the operating system, a specific suite of applications for a workgroup, or both. It saves time, and eliminates the expense of distributing software on CD or the need for administrators to configure each system in person. The block-copy installation capabilities in this powerful tool make configuring new systems or repurposing existing ones even faster and more reliable.

Use Network Install to:
- Install system software and packaged applications on desktop and mobile computers
- Standardize configurations and upgrade schedules
- Manage options for automated or semi-automated installations
- Configure new systems or repurpose existing systems

Apple Remote Desktop

The remote control capabilities of Apple Remote Desktop 2 (sold separately) enable administrators to specify the startup disk for multiple networked Mac computers and restart them remotely. This makes it easy to configure or update computers for an entire classroom, lab, or office at once.

Networking and VPN

Mac OS X Server includes everything needed to set up and secure a local area network. The Server Admin tool adds an intuitive interface to core network services (including DNS, NAT, NTP, DHCP, and Firewall), making it easier to set up an IP network infrastructure.
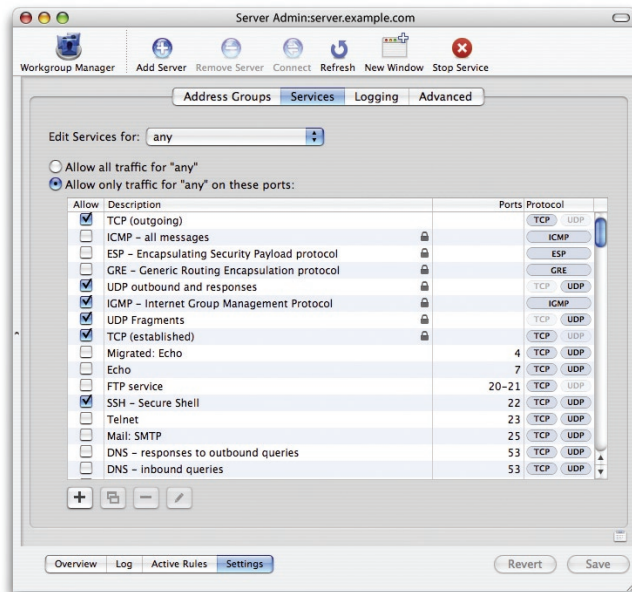
For maximum security, Mac OS X Server comes with all ports, except those used for remote administration and monitoring, locked by default. Any port can be opened by selecting the service using Server Admin.

Windows network infrastructure

Samba 3 provides network browsing and name-to-address translation services for Windows clients by integrating WINS (Windows Internet Naming Service) and NetBIOS (Network Basic Input/Output System) services. WINS allows Windows clients to use dynamic computer name registration and resolution to find each other on the same network or, when used with NetBIOS, to discover Windows clients and domains across subnets without requiring a local domain controller. DHCP can be configured to automatically assign WINS and NetBIOS information to Windows clients, simplifying system configuration and network administration.

VPN server

The built-in Virtual Private Network (VPN) server provides secure remote access to the LAN from any Internet-connected computer, or between LANs over the public Internet. Using L2TP and PPTP tunneling protocols, Apple's VPN server works with standards-based VPN clients to support encrypted IP connections for Mac, Windows, and Linux systems. Mac OS X Server VPN services use highly secure authentication methods, including MS-CHAP and network-layer IPSec.

Distributed Computing

Mac OS X Server v10.4 includes Xgrid, the first distributed computing architecture to be built into a desktop or server operating system. Xgrid makes it easy to turn an ad hoc group of Mac computers into a low-cost supercomputer by streamlining the process of assembling nodes, submitting jobs, and retrieving results. With Xgrid, scientists, animators, and digital content creators can easily run a single job across multiple computers at once, dramatically improving performance and responsiveness.
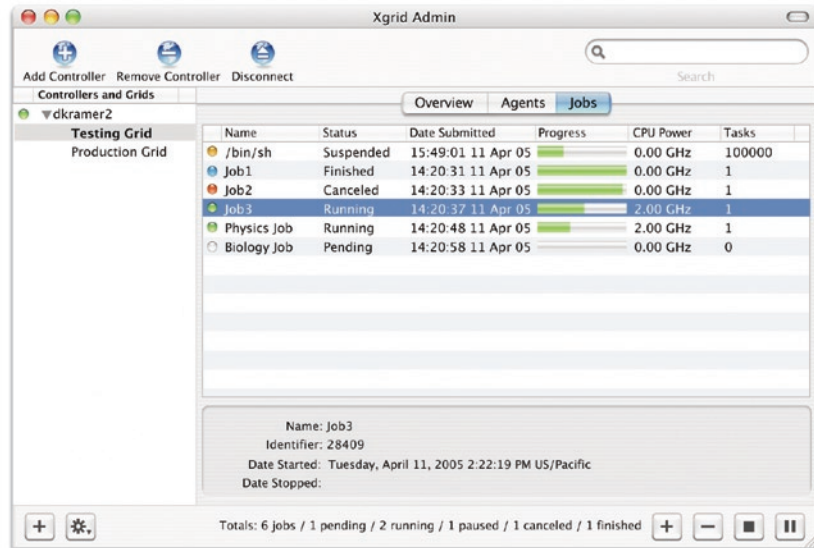
Xgrid Admin makes it easy to monitor and manage jobs and agents on multiple controllers.

Xgrid is integrated directly in Mac OS X Server v10.4. It works across portable computers, desktops, and servers to create a seamless distributed computing environment. Xgrid comes with administration tools for managing Xgrid clusters, monitoring job submissions and progress, and displaying the status of individual jobs.

Xgrid controllers mutually authenticate with both clients and agents, using either a password or the single sign-on facility in Mac OS X Server. Similarly, clients and agents can locate a controller using Bonjour, Open Directory, a host name, or DNS service lookups. This means Xgrid clusters can range from a single rack of Xserve systems, to a roomful of Power Mac G5 computers, to a diverse collection of Mac systems dispersed across the Internet.

Product Details

Mac OS X Server can be purchased in 10-client and unlimited-client editions to meet the needs of server deployments of any size. License restrictions apply only to simultaneous file sharing services for Mac and PC clients.

· **Mac OS X Server 10-client edition.** The easiest way to deploy powerful network services, the 10-client edition is designed for small workgroups and Internet hosting services that do not require simultaneous file sharing among more than 10 Mac and PC clients.

· **Mac OS X Server unlimited-client edition.** The most cost-effective way to support Mac and Windows workgroups, the unlimited-client edition is perfect for classroom labs, creative professionals, and medium-size to large workgroups with high volumes of file sharing activity.

Also available is an unlimited-client upgrade from the 10-client edition.

Package Contents

The Mac OS X Server package includes Mac OS X Server v10.4, Admin Tools, and Xcode 2 developer tools. Product documentation includes a getting started guide and the following electronic administration guides:

· Collaboration Services Administration
· File Services Administration
· High Availability Administration
· Mail Service Administration
· Migrating to Mac OS X Server from Windows NT
· Network Services Administration
· Open Directory Administration
· Print Services Administration
· QuickTime Streaming Server 5.5 Administration
· Server Glossary
· System Imaging and Software Update Administration
· Upgrading and Migrating
· User Management
· Web Technologies Administration
· Windows Services Administration
· Worksheet
· Xgrid Administration

System Requirements

Mac OS X Server requires an Xserve, Power Mac, iMac, eMac, or Mac mini computer; 256MB of RAM (at least 512MB for high-demand servers running multiple services); built-in FireWire; and 4GB of available disk space.

Apple Maintenance Program

This optional program for Mac OS X Server makes it easy for customers to manage software expenditures while benefiting from the latest technologies and improvements. With one payment, customers 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.

AppleCare Technical Support

Mac OS X Server comes with 90 days of toll-free telephone support for installation, launch, and recovery and lifetime access to Apple's online support resources, such as the AppleCare Knowledge Base and discussion forums.

In addition, Apple offers consultative phone and email support for advanced server migration and integration issues. Customers can choose from three levels of AppleCare technical support:

· **Select** covers up to 10 incidents with four-hour response for priority 1 issues (server down), 12 hours a day, 7 days a week.[6] Additional incidents can be purchased as needed.

· **Preferred** covers an unlimited number of incidents with two-hour response for priority 1 issues, 12 hours a day, 7 days a week,[6] and assigns a technical account manager to the organization.

· **Alliance** covers an unlimited number of incidents at multiple locations with one-hour response for priority 1 issues, 24 hours a day, 7 days a week.[6] This plan includes an onsite review by an Apple technical support engineer.

For more information about AppleCare support products, including terms and conditions, visit www.apple.com/server/support.

Training and Certification

Apple offers comprehensive instruction 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 Apple deliver training 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 Help Desk Specialist, Apple Certified Technical Coordinator, and Apple Certified System Administrator—are based on corresponding training course content. For more information about Apple training and certification programs, visit www.apple.com/training.

Open Source Projects

Mac OS X Server v10.4 Tiger integrates more than 100 open source projects.

AES encryption/Gladman: fp.gladman.plus.com/cryptography_technology
amavisd-new: www.ijs.si/software/amavisd
ant 1.5.3: ant.apache.org
Apache httpd 1.3.33: www.apache.org/httpd
Apache httpd 2: www.apache.org/httpd
apache_mod_dav: www.webdav.org
apache_mod_perl: perl.apache.org
apache_mod_php: www.php.net
apache_mod_ssl: www.modssl.org
autoconf 2.59: www.gnu.org/software/autoconf
automake 1.6.3: www.gnu.org/software/automake
awk 20040207: cm.bell-labs.com/cm/cs/awkbook
Axis 1.1: ws.apache.org/axis
bash 2.05b.0(1): www.gnu.org/software/bash
bc 1.06: www.gnu.org/software/bc
Berkeley DB4 4.2.52: www.sleepcat.com
BIND 9.2.2: www.isc.org/products/BIND
bison 1.28: www.gnu.org/software/bison
blojsom 2.17: blojsom.sf.net
Bonjour 58: developer.apple.com/darwin/projects/bonjour
bsdiff/bspatch: www.daemonology.net/bsdiff
bsdmake 5.2: www.freebsd.org
bzip2 1.0.2: sources.redhat.com/bzip2
CAST-128 & Blowfish encryption 0.9.7b: www.openssl.org/docs/crypto
CCE's (e)fax 0.9a-001114: www.cce.com/efax
CDSA (Common Data Security Architecture): developer.apple.com/darwin/projects/cdsa
checknr 2004-09-18: www.freebsd.org/cgi/cvsweb.cgi/src/usr.bin/checknr
ClamAntiVirus: www.clamav.net
CrackLib: www.crypticide.com/users/alecm
cron: www.freebsd.org/cgi/cvsweb.cgi/src/usr.sbin/cron
cscope 15.5: cscope.sourceforge.net
csplit: www.freebsd.org/cgi/cvsweb.cgi/src/usr.bin/csplit
CUPS (Common UNIX Printing System) 1.1.22: www.cups.org
curl 7.12.2: curl.haxx.se
cvs 1.1: www.cvshome.org
cxxfilt: directory.fsf.org/GNU/gcc.html
Cyrus IMAP Server 2.2.10: asg.web.cmu.edu/cyrus/imapd
CyrusSASL: asg.web.cmu.edu/sasl

Darwin 7: developer.apple.com/darwin
dcraw: www.cybercom.net/~dcoffin/dcraw
diffstat 1.3.4: dickey.his.com/diffstat/diffstat.html
diffutils 2.8.1: www.gnu.org/software/diffutils
distcc 2.0.1: distcc.samba.org
dom4j: www.dom4j.org
dscl: developer.apple.com/darwin
dummynet: info.iet.unipi.it/~luigi/ip_dummynet
EBlibrary: sra.co.jp/people/m-kasahr/eb
eFax: www.cce.com/efax
emacs 21.2.1: www.gnu.org/software/emacs
enscript 1.6.1: people.ssh.fi/mtr/genscript
Everson Unicode mapping tables: www.evertype.com/standards/mappings
expect 5.42.0: expect.nist.gov
fetchmail 6.1.2: catb.org/~esr/fetchmail
file 4.10: www.freebsd.org/cgi/cvsweb.cgi/src/usr.bin/file
fileupload: jakarta.apache.org/commons/fileupload
flex 2.5.4: www.gnu.org/software/flex
FreeBSD ~5.x: www.freebsd.org
gcc-GNU Compiler Collection 4: www.gnu.org/software/gcc
gdb-GNU Debugger 5.3: www.gnu.org/software/gdb
genscript: people.ssh.fi/mtr/genscript
giflib: sourceforge.net/projects/libungif
gimp-print drivers 4.2.5: gimp-print.sourceforge.net
glib: freshmeat.net/projects/glib
glibtool: www.gnu.org/software/libtool
gnuserv: www-uk.hpl.hp.com/people/ange/gnuserv
gnutar 1.13.25: www.gnu.org/software/tar
gperf 3.0.1: www.gnu.org/software/gperf
graphviz : www.graphviz.org
grep 2.5.1: www.gnu.org/software/grep
groff 1.19.1: www.gnu.org/software/groff
gzip (zlib) 1.2.4: www.gzip.org
HeaderDoc doc generator 7.2: developer.apple.com/darwin/projects/headerdoc
International Components for Unicode 3.2: www.ibm.com/software/globalization/icu
iodbc: www.iodbc.org
iODBC Driver Manager 3.52.1: www.iodbc.org
ipfw2: www.freebsd.org/cgi/cvsweb.cgi/src/sbin/ipfw
IPv6/IPsec 20010528: www.kame.net
iso-relax: iso-relax.sourceforge.net
jabberd 1.4.3: jabberd.jabberstudio.org/1.4
JBoss 3.2.3: sourceforge.net/projects/jboss
Kerberos for Macintosh 5.0 (krb5 1.3): web.mit.edu/macdev/www/kerberos.html
kern_lockf.c: svn.clkao.org/svnweb/freebsd/log/cvs/trunk/sys/kern/kern_lockf.c
KHTML (WebCore) 3.0.1+: developer.kde.org
KJS (JavaScriptCore): developer.kde.org
ksh 2004-02-29: www.research.att.com/sw/download
less 382: www.greenwoodsoftware.com/less
libedit 2.6.9: ftp://ftp.astron.com/pub/libedit
libiconv 1.9: www.gnu.org/software/libiconv
libJP2: www.ece.uvic.ca/~mdadams/jasper
libJPEG: freshmeat.net/redir/libjpeg/5665/url_homepage/www.ijg.org
libOpenEXR: www.openexr.com

libpng: www.libpng.org/pub/png/libpng.html
libtelnet: www.freebsd.org/cgi/cvsweb.cgi/src/crypto/telnet/libtelnet
libTIFF: www.remotesensing.org/libtiff
libuuid: e2fsprogs.sourceforge.net
libxml2 2.6.16: xmlsoft.org
libxslt 1.1.11: xmlsoft.org
LogKit: www.apache.org/dist/avalon/logkit
lookup2.c, match.h: burtleburtle.net/bob/c/lookup2.c
lsof: ftp://vic.cc.purdue.edu/pub/tools/unix/lsof
m4 1.4.2: www.gnu.org/software/m4
mailman: www.gnu.org/software/mailman
make (gnumake) 3.8: www.gnu.org/software/make
man 1.5o1: ftp://ftp.kernel.org/pub/linux/utils/man
mod_bandwidth: www.cohprog.com/mod_bandwidth.html
mod_encoding: webdav.todo.gr.jp
mod_spengo_apache: www.vintela.com/resources/topics/spnego
mu-conference: www.kdough.net/docs/wpjabber_muc
multischema: www.sun.com/software/xml/developers/multischema
MySQL 4.1.9: www.mysql.com
nano 1.2.4: www.nano-editor.org
ncurses: www.gnu.org/software/ncurses/ncurses.html
NetBSD: www.netbsd.org
netcat: netcat.sourceforge.net
net-snmp 5.2: net-snmp.sourceforge.net
newgrp: www.freebsd.org/cgi/cvsweb.cgi/src/usr.bin/newgrp
nl: www.freebsd.org/cgi/cvsweb.cgi/src/usr.bin/nl
ntp: www.ntp.org
OpenAL: www.openal.org
OpenEXR: radsite.lbl.gov
OpenLDAP 2.2.19: www.openldap.org
OpenSSH 3.8.1p1: openssh.org
OpenSSL 0.9.7b: www.openssl.org
PAM: Pluggable Authentication Modules 0.76+: www.kernel.org/pub/linux/libs/pam
passwordserver_sasl 2.1.18: asg.web.cmu.edu
patch 2.5.8: www.gnu.org/software/patch
PCRE: www.pcre.org
perl 5.8.6: www.perl.org
PHP (apache_mod_php) 4.3.10: www.php.net
postfix 2.1.5: www.postfix.org
procmail 3.21: www.procmail.org
proxy65: jabberstudio.org/projects/proxy65
pth: www.gnu.org/software/pth
Python 2.3.4: www.python.org
QuickLite: www.webbotech.com
QuickTime Streaming Server 0.0E+01: developer.apple.com/darwin/projects/streaming
RCS: www.gnu.org/software/rcs
rel2abs: tamacom.com/pathconvert.html
relax ng: www.relaxng.org
rsync 2.6.3: rsync.samba.org
ruby 1.8.2: www.ruby-lang.org
samba 3.0.10: www.samba.org
sandler: sourceforge.net/projects/sandler
screen 4.0.2: www.gnu.org/software/screen

SHA256 message digest/Gladman: fp.gladman.plus.com/cryptography_technology
sjeng (chess) 11.2: www.sjeng.org
smbfs: www.freebsd.org/cgi/cvsweb.cgi/src/contrib/smbfs
snowball: www.snowball.tartarus.org
SpamAssassin: spamassassin.apache.org
SQLite 3.0.8: www.sqlite.org
SquirrelMail 1.4.4: www.squirrelmail.org
srm: srm.sourceforge.net
stat: www.freebsd.org/cgi/cvsweb.cgi/ports/devel/p5-BSD-stat
sudo 1.6.8p5: www.courtesan.com/sudo
tar 1.14: www.gnu.org/software/tar
tcl 8.4.7: tcl.tk
tcp_wrappers: ftp://ftp.porcupine.org/pub/security/index.html
tcpdump 3.6-cvs: www.tcpdump.org
tcsh 6.12.00: www.tcsh.org
texi2html 1.70: https://texi2html.cvshome.org
texinfo 4.7: www.gnu.org/software/texinfo
tidy (libtidy) 2004.12.14: tidy.sourceforge.net
tnftpd 20040810: ftp://ftp.netbsd.org/pub/NetBSD/misc/tnftp
Tomcat 4.1.24: jakarta.apache.org/tomcat
Twisted python framework library: twistedmatrix.com
velocity: jakarta.apache.org/velocity
vim 6.2: www.vim.org
WebCore: developer.apple.com/darwin/projects/webcore
werken-xpath: sourceforge.net/projects/werken-xpath
wordexp/wordfree: www.freebsd.org/cgi/cvsweb.cgi/src/lib/libc/gen/wordexp.c
X11 (XFree86) 4.4: www.xfree86.org
X11.app: developer.apple.com/darwin/projects/X11
Xdoclet 1.2b4: xdoclet.sourceforge.net
xinetd 2.3.11: www.xinetd.org
XML pull parser/xpp: www.extreme.indiana.edu/xgws/xsoap/xpp
xml/xp: www.jclark.com/xml/xp
xmlpull: www.xmlpull.org/v1/download
xmlrpc: ws.apache.org/xmlrpc
xt: asis.web.cern.ch/asis/products/JAVA/xt.html
yacc: www.freebsd.org/cgi/cvsweb.cgi/src/usr/bin/yacc
zip 2.3: ftp.info-zip.org/pub/infozip/Zip.html
zlib 1.2.2: www.gzip.org/zlib
zsh 4.2.3: zsh.org

Additional Resources

We invite you to explore Apple's website to learn more about Mac OS X Server and Apple server solutions.

To download documentation and technology briefs: www.apple.com/server/documentation

To learn about third-party products that extend or enhance the capabilities of Mac OS X Server: www.apple.com/server/resources

To learn about development resources: developer.apple.com/server

To access technical support resources: www.apple.com/server/support

For a list of Apple press contacts: www.apple.com/pr/contacts.html

For More Information

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

[1]Schema modifications may be required to manage Mac OS X client systems from the directory. [2]Remote server administration requires Mac OS X v10.3 or later. [3]Management of preferences requires client systems with Mac OS X v10.2 or later. [4]Apache versions 1.3 and 2.0 are installed in Mac OS X Server v10.4 and are accessible from the command line; Server Admin provides a user interface for configuring and managing Apache 1.3. [5]NetBoot requires Mac systems released in October 1999 or later and a physical Ethernet connection; it does not support AirPort wireless technology. Network Install requires Mac systems released in October 1999 or later; application installation requires client systems with Mac OS X v10.2 or later. Licensing terms apply to Apple and third-party software deployments. [6]Response times are not guaranteed.