

Mac OS X Server Deploying Mac OS X Computers for K-12 Education

For Version 10.3 or Later

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Deploying Mac OS X Computers for K-12 Education

Introduction

Deploying computers in a K-12 environment can be a technical challenge for many sites. The need to bring in outside resources and alter curriculum plans to adapt to technology have made deploying computers a chore. Mac OS X and Mac OS X Server make adopting computer technology easier for K-12 staff and students.

Desktop and mobile computers running Mac OS X offer K-12 students a powerful yet simple-to-use-and-manage learning environment.



Computers running Mac OS X Server software offer K-12 technical staff and teachers a centralized way to manage student computers and provide students with services (such as file and printer sharing) that promote educational goals.



This paper begins by highlighting some of the ways that these Mac OS X systems streamline setting up student computer environments that offer day-to-day support for specific classroom and lab activities and objectives:

• Centralized information and resources (page 7). Student computers are generally deployed either as systems that are shared by different students or as one-to-one systems that are designated for use by a single student. Apple provides the mechanisms for centrally managing student information and computer settings for both deployment scenarios.

- Managing student work environments (page 11). Teachers can simplify, customize, and control the student computer environment that takes effect when a student logs in. The login environment complements the learning context—for example, biology class, a publishing lab, or first grade. And teachers and students are able to exchange information electronically.
- Installing and booting over the network (page 18). Initial configuration of student systems is simple when you use a server-based NetBoot or Network Install image.
 Student computers install or boot from the centralized image, which can include particular applications and preconfigured desktop settings.
- Remote administration (page 20). Graphical administration applications help K-12 staff set up and manage server and student computers remotely—while working on their own computers.

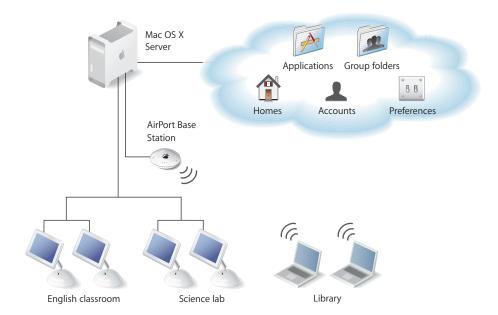
Next, the paper focuses on three example scenarios, using a step-by-step approach to illustrate ways to set up and manage different K-12 learning environments:

- Scenario 1: using a wired lab or classroom (page 26). Students use desktop computers that are connected to a local area network.
- Scenario 2: using one-to-one mobile computers (page 41). Students use mobile computers that they carry back and forth between home and school.
- Scenario 3: using NetBoot in a wired lab (page 48). Students use a lab in which desktop computers are refreshed to complement specific lab exercises.

A closing section (page 52) provides **guidelines and tips for planning** your own K-12 Mac OS X deployment.

Centralized Information and Resources

Mac OS X Server, software that runs on many Macintosh computers, is the key to managing students as they move from room to room and from computer to computer. The server makes directory services information as well as home directories, shared folders, and other shared resources accessible throughout a school.



Directory Services

Directory services are built-in services that Mac OS X operating system and application software use to access a repository of information about network users and resources.

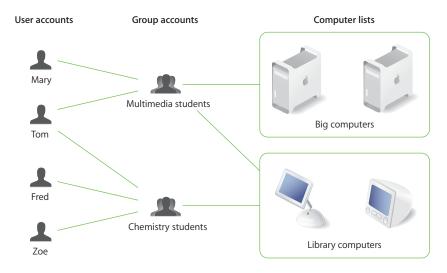
For example, when a student logs in to a Mac OS X computer, the login window uses directory services to determine whether the student is a valid user. The login attempt succeeds if the name and password the student typed are found in the repository. Later, if the student attempts to access a certain folder or application, directory services information is used again, this time by the file system to determine whether the student should be allowed to access files in that folder or launch an application.

In Mac OS X computers, directory services are provided by Open Directory. The repository used by Open Directory is referred to as a *directory domain*, a *domain*, or simply a *directory*.

All Mac OS X computers have a built-in directory domain, known as the *local* directory. It resides on every Mac OS X computer. It contains information specific to a particular computer, such as the computer administrator's name and password.

• Mac OS X Server lets you set up a *shared* Open Directory domain. The shared directory resides on the server. It contains information you want many student computers to be able to access. When you set up a shared directory, student computers find it automatically, thanks to a few simple settings you make when you set up the student computers.

Shared directory domains store many different kinds of information, but you need to be acquainted with only a few of them when planning and implementing K-12 computer deployments: user accounts, group accounts, and computer lists.



- User accounts. These accounts provide information about students, teachers, and other users of a school's computers. Each student, teacher, and other user has a user record, which contains such information as the user's login name and password and settings you make to customize the user's work environment.
 - When a student has an account in a shared directory, he or she can use different computers in various classrooms and labs and still experience the settings that have been defined for that student in the student's account. And you can manage the account settings centrally. When an account is stored locally, its settings can be managed only by changing them on the computer itself.
- Group accounts. These accounts represent collections of students, teachers, or other staff with similar working or learning requirements. Examples include Advanced Graphics, Teacher Prep, or Home Use.
 - While group accounts play a key role in controlling file system access to specific folders and files, one of their main functions is to provide the ability to manage group work environments. By defining preferences, you can set up group-specific application access, shared folders, printers, systems settings, and so forth. Groups with managed preferences are called *workgroups*.

Workgroups let you set up curriculum-specific or workflow-specific environments. For example, a language arts workgroup may use a folder for homework assignments and a hand-in folder for each project and have access to only the applications a teacher considers appropriate.

See page 11 for more information about defining preferences to manage work environments.

• Computer lists. Computer lists offer a way to manage collections of computers. For example, you can use a computer list to reserve high-capacity computers for film students who use Final Cut Pro. You'd assign film students to a group, then set up a computer list for computers you want to reserve for that group's use. A student who is not a film student can't log in to one of those computers.

Network-Visible Resources

Mac OS X Server lets you make various resources visible throughout your school network, so students can move from computer to computer and room to room and still access them.

There are several key network-visible resources.

• **Network home directories**. A *home directory*, often referred to as a *home folder* or simply *home*, is a place for each Mac OS X user to keep personal files. Users with records in a shared directory may have home directories that reside on the network, often on the same server where the user account resides.

A home directory contains several folders—such as Desktop, Documents, and Public—to help organize information. After logging in, a user accesses his or her network home directory by clicking the home icon in the Finder.



Group folders. When you set up a group account, you can associate a group folder with the group. A group folder is a place for group members to exchange ideas and research findings and a place for teachers to hand out and collect materials and assignments for the group. A group folder contains three folders by default—Documents, Library, and Public; the Public folder contains a Drop Box folder, useful for turning in assignments electronically. Group folders can be customized, as when you want to use multiple hand-in (Drop Box) folders or other folders tailored to the needs of the group.

Residing on the server for easy access throughout the school, a group folder can be shown in the Dock for easy network access—in the classroom, a lab, the library, anywhere a student wants to work on group activities.



- Other shared folders. Teachers can set up other folders on the server to provide student access to applications, handouts, announcements, class schedules, and other information. Using network-visible folders makes it easy to update student materials and collect assignments from students.
- Boot and install images. You can use boot images and install images located on the server to automate the setup of student computers.

A student's computer can start up from a *boot image* stored on the server. In fact, you can use the same computer for a science lab when it boots from one image and for a French lab when it boots from a different image. Each time a lab computer restarts, the system reflects the original condition of the selected boot image, regardless of what the previous student may have done on the computer.

An *install image* automatically installs software on student computers, making it easy to deploy the operating system, additional applications, and even custom computer settings remotely and without user interactions.

Read more about this topic in "Installing and Booting Over the Network" on page 18.

Managing Student Work Environments

You manage student work environments by defining preferences. *Preferences* are settings that customize and control a student's computer experience.



Many factors, including student grade levels, security issues, and curriculum needs, determine what computer work environment a student should be presented with. In some cases, setting up informal usage guidelines may be allowable. In other cases, extensively controlling the student computer experience, with each system setting defined and locked and each application controlled, may be necessary. The preferences you define implement system capabilities that best reflect your curriculum concerns.

The Power of Preferences

Many preferences, such as Dock and Finder preferences, are used to customize the appearance of student desktops. For example, you can set up Dock preferences and Finder preferences so that the work environment of lower-grade students is dramatically simplified.



Other preferences are used to manage what a student can access and control. For example, you can set up Media Access preferences to prevent students from burning CDs and DVDs or making changes to a computer's internal disk.

Here's a summary of how preferences affect the appearance of the student's desktop and the activities a student can perform:

This preference	Tailors the work environment	Limits access and control	By letting you manage
Applications		х	The applications a student can open
Classic	Х		Classic environment startup
Dock	х		The appearance and contents of the Dock
Energy Saver	х		Student computer wake, sleep, startup, and shutdown settings
Finder	х		The appearance of desktop icons and Finder elements
Internet	Х		Default email and web settings
Login	Х		The login experience
Media Access		х	Ability to use recordable media
Mobile Accounts	Х		The creation of mobile accounts
Printing		х	Which printers a student can use
System Preferences		х	Which system preferences are visible on the student's computer
Universal Access	х		Hardware settings for students with special visual, auditory, or other needs

Levels of Control

You can define preferences for user accounts, group accounts, and computer lists. A user whose account has preferences associated with it is referred to as a *managed user*. A computer assigned to a computer list with preferences defined is called a *managed computer*. A group with preferences defined is called a *workgroup*.

Except for Energy Saver preferences, which can be defined only for computer lists, you can manage the preferences listed above for user, workgroup, and/or computer lists:

• Printing, Applications, and some Dock preferences (items that appear in the Dock) are additive.

For example, if you define printing preferences for users *and* computers, a student's printer list includes printers set up for both the student and the computer being used.

Other preference settings defined at more than one level may be overridden at login.
 When a student logs in to a managed computer and chooses a workgroup, user preferences override redundant computer preferences, and computer preferences override redundant workgroup preferences.

For example, you may want to prevent all students from using recording devices attached to a school computer except for students who serve as lab assistants. You could set up Media Access preferences for workgroups or computer lists to limit all students' access, but override these restrictions for lab assistants using Media Access settings at their user account level.

Most of the time you'll use workgroup-level and computer-level preferences.

- Workgroup preferences are most useful if you want to customize the work environment (such as application visibility) for specific subjects and student levels, or if you want to use group folders.
 - For example, a student may belong to a group called "Class of 2011" for administrative purposes and to a workgroup called "Students" to limit application choices and provide a group shared folder for turning in homework. Another workgroup may be "Teacher Prep," used to provide faculty members access to folders and applications for their use only.
- Computer-level preferences are useful when you want to manage preferences for students regardless of their workgroup associations. At the computer level, you commonly want to limit access to System Preferences, manage Energy Saver settings, list particular users in the login window, and prevent saving files and applications to recordable discs.
 - Computer preferences also offer a way to manage preferences of students who don't have a network account but who can log in to a Mac OS X computer using a local account. (The local account, defined using the Accounts pane of System Preferences, resides on the student's computer.) You'd set up a computer list that supports local-only accounts. Preferences associated with the computer list and with any workgroup a student selects after login take effect. More about managing the login experience appears next.

Designing the Login Experience

You can set up Login preferences for computer lists to control the appearance of the login window. These login options



result in a login window that looks like this:



The first user is the local computer administrator. The next three are students who have accounts that reside on the server, the last of whom has a mobile account, which you'll learn about shortly.

To log in, a student selects his or her login name in the list, then types a password when prompted. If the student belongs to more than one workgroup, a list of workgroups appears so the student can select the environment of interest. Note that it's possible for a student to belong to a group that doesn't appear in the list; only workgroups (groups with managed preferences) are listed.

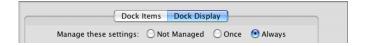


If the computer is associated with a computer list that supports local-only users, all workgroups given access to the computer by the computer list are listed after a local user logs in. The student can select any of them.

Any preferences that are associated with the student, the chosen workgroup, and the computer being used take effect automatically.

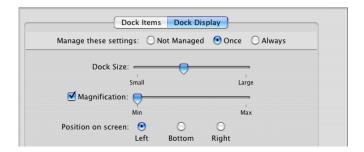
Degrees of Permanence

When you define preferences, you can choose to manage them once or always:



- Always causes the preferences to remain in effect until you change them on the server.
- Once is available for most preferences. It causes the preferences to take effect when a student first logs in after you've made the setting. But the student can override the settings locally.

For example, you can set a student's Dock to appear a certain way initially:



Because these preferences are managed once, the student can use the Dock pane in System Preferences to reset these Dock display options. If you want to give students this ability, make sure you don't set up System Preferences preference settings that prevent the student from accessing that preference locally. Also, remember that some preference settings, such as Accounts and Date & Time, require knowledge of a local administrator's name and password.

The next time you change the student's Dock Display preferences on the server, any student settings are overridden by the new settings. If they are still being managed once only, the student can once again override them.

Caching Preferences

Preferences are cached on Mac OS X computers, so they remain in effect even when the computer is off the network:

- Computer preferences and preferences for any workgroups that can use the computer are cached.
- User preferences are also cached for users who have mobile accounts.

When a client computer is off the network, only users with local accounts or network users with mobile accounts on that computer can log in.

Using Mobile Accounts

When your school uses computers dedicated for use by particular users, you can manage those users' work environment using a special kind of user account—a mobile account. While mobile accounts are used primarily for students who are assigned a portable computer for their own exclusive use, they can also be used to manage dedicated teacher or staff desktop systems.

A mobile account is useful for any user who needs to access network resources only occasionally. When most of the computer work done by users can be done on their own computer, and they need to use server resources only infrequently, users are good candidates for a mobile account.

Two key advantages of a mobile account are:

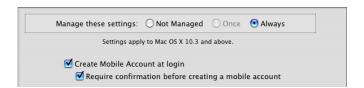
- They reduce network traffic on the school network, expediting server connections for users who *need* to access the server.
- They let a user work on and off the network and experience the same work environment.

When a user has a mobile account, his or her login name, password, and preferences defined for the user account, workgroups, and computer are the same at school and at home. If you change any of these items, the local versions are updated the next time the user logs in at school.

A mobile account is a managed local account. A user's authentication information is maintained in a network directory, but cached on the local computer. The primary home directory is located on the local computer. The network home directory—if there is one—becomes an optional backup storage site.

Because a student using a portable computer can't access network files and folders when not connected to the school network, he or she may need to copy files to the local home directory from a network home directory or a group folder before disconnecting from the network. The next time the student is at school, he or she can copy changed files back to a network folder, usually a network home directory. Local and network home directories are not automatically synchronized.

You enable the creation of mobile accounts by defining Mobile Accounts preferences for a network user account, workgroup, or computer list.



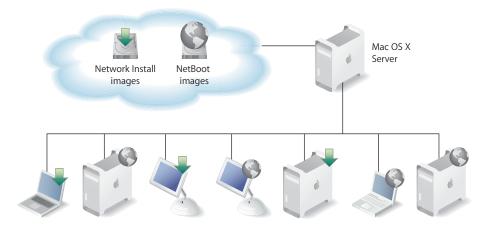
Like other preferences, the Mobile Accounts preference has a scope that depends on the level at which it's set:

- If the Mobile Accounts preference is set for a user account, the student gets a mobile account on any computer where he or she logs in.
- If it's set for a workgroup, any network user who picks the workgroup at login gets a mobile account unless he or she already has one on the computer.
- If it's set for a computer list, any network user who logs in to a managed computer gets a mobile account on that computer.

These methods offer considerable flexibility. For example, you might create a computer list for teacher desktops, iBooks, and graphics lab computers with the mobile account preference active. When *any* user logs into one of those systems, a mobile account and local home directory would be created for that user. On the other hand, you can set the mobile account preference to be active only for a select set of user accounts, so any *computer* those users log in to will have a mobile account and local home directory for the users.

Installing and Booting Over the Network

The key to fast initial setup of student computers and rapid refresh of lab computers is the use of Network Install and NetBoot images that reside on Mac OS X Server. Student computers start up using those images automatically.



You use Network Install images when you want to install software on student computers. You use NetBoot images when you want student computer environments to be refreshed every time the computer is started.

Using a network-based boot image provides many advantages over booting from a local hard drive:

- The NetBoot image is locked from the user perspective. It can't be accidentally or
 maliciously damaged. In a training lab where students may make mistakes or in a
 computer science class where system protection can't be used because of
 programming tool needs, a NetBoot image allows computers to be restored to their
 original state after each use. No matter what a student does while on the system, the
 image snaps back to the original condition at each startup.
- A network administrator who needs to perform maintenance doesn't need to carry a
 case full of diagnostic CDs. Instead, he or she can boot a system using a network
 image that contains all of the diagnostic and repair tools.

• Multiple images can be provided on the network from a single server, and multiple servers can be used to provide a single image for optimum throughput.

The server can host as many as 25 different images, so you can maintain a collection of customized software configurations for different workgroups and computers. For example, one image can be used for installing the latest applications needed by particular students, and another image can be used for booting computers in particular classrooms or labs.

Simplifying Initial Student Computer Setup

Setting up student computers individually from installation media is a time-consuming activity that requires the presence and supervision of the network administrator. Instead, you can use Network Install to automate the installation and initial setup of student computers.

You need to set up only one student computer, test it to make sure it works as intended, then clone the system into a Network Install image stored on the server. You remotely identify which student computers you want to use the image, and the computers automatically discover it and install its contents onto their hard drive.

Network Install images can set up computers without any user input. Alternatively, you can specify that certain actions occur before or after installation.

Keeping Student Systems Up to Date

Network Install images are also useful when you need to update the operating system on student computers or upgrade their applications.

You simply make an installation image that contains only the new software, and student computers are set to boot to this updater image, run the update installation, and reboot to normal operation.

Refreshing Lab Systems

Lab computers are easy to refresh when they start up using NetBoot images that reside on Mac OS X Server instead of using software stored on their own hard drives.

NetBoot images let you reset computers to a clean, known state for each new student who uses them. They make it easy to use the same computer for a science lab, a graphics lab—any environment that you want to customize for the duration of the lab.

When you want to use the local hard drive for certain classes but make it unavailable for other classes, such as a testing lab in which total control of the boot image is required, you can use diskless NetBooting. Diskless NetBooting prevents viewing or modifying a lab computer's hard drive after booting, and prevents data from being stored, even temporarily, on it.

Remote Administration

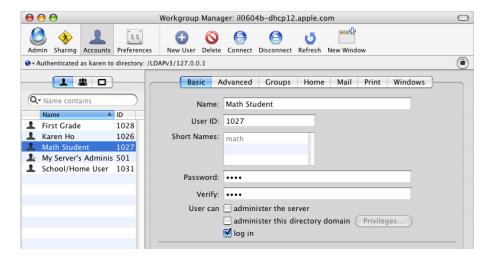
All the Mac OS X Server administration software is designed to be run remotely, across large and small networks. Administrators don't need physical access to a server to change user, group, and computer settings.

This section surveys the applications you use to manage accounts, preferences, sharing, and system imaging and to provide day-to-day student support.

Student Work Environment Administration

Workgroup Manager, which comes with Mac OS X Server, is the application you use to manage accounts and their preferences and to configure sharing. *Sharing* lets you set up folders containing files and applications so students can access them from anywhere on the school network.

To work with a particular kind of account, click Accounts in the Workgroup Manager toolbar and select the user, group, or computer list on the left side of the window. Here, the user account list has been selected and settings for a student named Math Student are displayed. Click buttons on the right to work with particular kinds of settings—Groups to add the user to a group, Home to specify where you want his or her home directory to reside, and so forth.

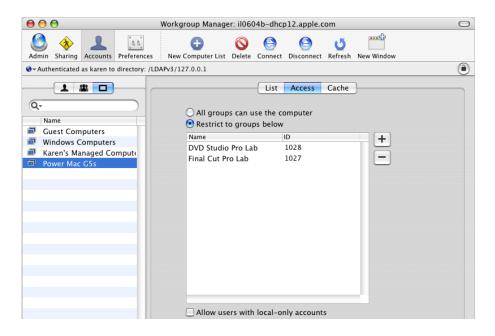


Notice the small globe just below the toolbar. It's used to select the directory whose accounts you want to work with. Here, the directory being worked with is a shared Open Directory domain that resides on the server where Workgroup Manager is being used.

Group account settings let you identify or remove group members and set up a group folder for the group.



Select the list of computer lists to create or work with computer lists. Click List to identify the computers you want to associate with a computer list. Click Access to optionally restrict access to the computers in the account by particular groups and by users who don't have network accounts.

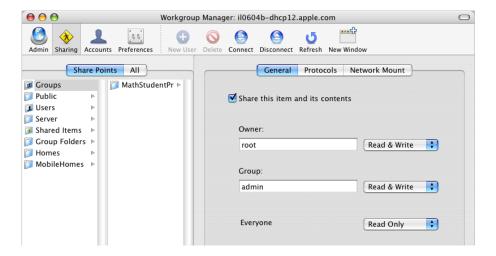


To work with preferences for a particular computer list, you'd select the list, click Preferences in the toolbar, and select a preference. For computer lists, you can set up Energy Saver preferences when you want to manage startup, shutdown, and sleep behavior for computers.



Click Sharing in the toolbar to work with share points. A *share point* is a folder, hard disk, hard disk partition, CD, or DVD that can be accessed over the network. Home folders, group folders—any folder you want students to be able to access that doesn't reside on their computers—should reside in a share point.

Here are some of the settings for a share point (Groups) in which a group folder named MathStudentProjects resides.



System Image Administration

Several applications—Network Image Utility and Server Admin—help you set up and manage NetBoot and Network Install images.

Network Image Utility lets you create NetBoot and Network Install images.



Network Install images can be created from installation CDs, but the easiest way to create an installation image for many student computers is to set up one computer, then use Network Image Utility to create an image that clones the configured system.

NetBoot images can also be created using installation media or a volume you've already configured with system and application software and settings you want Mac OS X computers to use when they start up.

After you've created NetBoot and Network Install images, you use the Server Admin application to make them available for client computers to use when they start up. There are several ways that a client computer can use the images:

- On the client computer, a user can select an image in the Startup Disk pane of System Preferences.
- NetBoot images can be set up for automatic discovery when a client computer starts with the N key pressed.
- You can use Apple Remote Desktop (ARD) to make client computers restart on demand using a NetBoot or Network Install image. ARD client software is built into Mac OS X version 10.2 and later. For the server, you purchase and install ARD administration application separately from Mac OS X Server.

Day-to-Day Student Computer Administration

Administering networked computers also requires recordkeeping, help desk operations, and minor updates while users are logged in and working. To accomplish these and other day-to-day tasks, you use ARD. It provides a remote management environment that simplifies student computer setup, monitoring, and maintenance:

- Screen observation. View student computer screens on your computer to monitor student activities or assess how well they're able to perform a particular task.
- Screen control. Show students how to perform tasks by controlling their screens from your computer.
- **Screen sharing**. Display your screen or a student's screen on student computers for training and demonstration purposes.
- **Screen locking**. Prevent students from using their computers when you want them to focus on other activities.
- **Text communications**. Exchange messages with one or more students, and host questions and requests from individual students.
- Hardware and software management. Audit hardware information and software installed. Search for specific files and folders on student systems.
- Software distribution and startup. Identify NetBoot or Network Install images for student computers to use. Initiate network installations and student computer shutdown and startup. Use ARD to deploy application packages or new system updates instead of running Software Update on individual computers.
- **Troubleshooting**. Perform basic network troubleshooting by checking network traffic performance for all your workstations and servers.

Introducing the Scenarios

The next three sections present scenarios that illustrate ways to deploy the Mac OS X features you've learned about in K-12 environments:

- Scenario 1: using a wired lab or classroom (page 26). Students use desktop computers that are connected to a local area network.
- Scenario 2: using one-to-one mobile computers (page 41). Students use mobile computers that they carry back and forth between home and school.
- Scenario 3: using NetBoot in a wired lab (page 48). Students use a lab in which desktop computers are refreshed to complement specific lab exercises by using NetBoot and Network Install images.

The major steps you might perform to set up each scenario are identified. The steps don't provide all the details for every step. Instead, they give you a sense of the sequence of activities you might use to implement similar scenarios in your own school and tell you where to find details if you need them.

While the scenarios feature using one Mac OS X Server, most of the time a school site will have several servers, depending on the number of students and the services needed. For some guidelines to help determine how many servers you may need, see page 53.

Actual implementation of any scenario is a team effort that requires both technical and instructional expertise:

- Technical staff or teachers with networking and computer administration expertise
 would set up the school network so that the servers and client computers can
 communicate. They'd configure servers to provide core services (such as DNS and
 DHCP). And they'd configure student and teacher computers, using Network Install
 and NetBoot images to expedite the setup of numerous computers.
 - Full details for how to use Mac OS X Server applications to perform these tasks are in various documents, available on the Administration Tools install disc (in the Documentation folder) and online (at www.apple.com/server/documentation).
- Teachers could create accounts and preferences. They could also set up home directories, group directories, and other folders for sharing information among students.
 - Instructions for these activities are in the user management guide on the install disc and website identified above.

Many of the steps required to deploy a particular scenario are common to most scenarios. For example, you always need to set up one or more servers and configure core services. You need to define accounts, set up preferences, and create Network Install images for setting up client computers. Information for these common tasks is provided for scenario 1, and included by reference for scenarios 2 and 3.

Scenario 1: Using a Wired Lab or Classroom

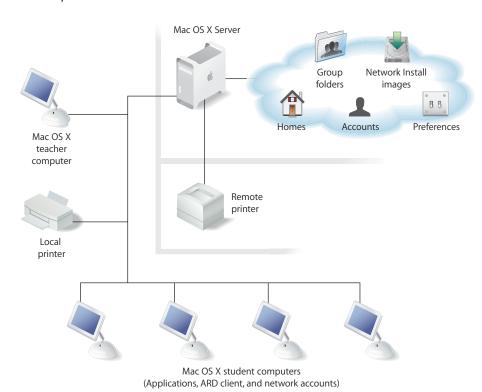
This scenario features a lab or classroom in which students and a lab coordinator or teacher use Mac OS X desktop computers plugged into an Ethernet local area network. The use of shared, networked computers is one of the most common K-12 deployment scenarios.

The user accounts are stored in a network directory, and all computers are available for use by any user. Students and teachers have network home directories that reside on the server, so all their documents and personal information are accessible no matter which computer they log into.

An advantage of this scenario is that the user experience is independent of the computer itself. If one of the computers breaks down, it can be replaced without affecting any of a user's documents or personal settings. The limitation of this scenario is that it does not support offline use of the computers, since all key account information and files are kept in a centralized network location.

Introducing the Scenario

The network connects student computers, the teacher's computer, the server and several printers.



- Students can print to a printer in the classroom or lab as well as to a high-capacity printer that resides in a remote location accessible to most students, perhaps the library.
- The data needed for authenticating students who use the computers and managing their computer work environments is stored on the server, which is also kept in a remote location. A shared Open Directory domain on the server stores user accounts, group accounts, and computer lists and their associated preferences.
- The server hosts student home and group folders as well as Network Install images.
- A Network Install image is used to initially set up the student computers with Mac OS X, some additional applications, and settings that let the teacher use ARD to manage the student computers.
- On the teacher's computer are server administration applications that enable remote management of data residing on the server. Most of the time the teacher uses Workgroup Manager, the primary application for managing server-based accounts, preferences, and shared folders.

The teacher's computer also has ARD administration software installed. Using ARD, the teacher can manage student computers: delete files and empty the Trash, restart computers, open applications, open documents, and so forth. Screen sharing and remote control let the teacher give presentations and demonstrations. The full range of ARD features are useful in this scenario.

- Computer list preferences are used to shut down student computers at the end of each day, put computers to sleep after a particular period of inactivity, control the login window appearance, provide access to the printers, and prevent students from copying files to disc media or changing System Preferences.
- Lower-grade students, such as first graders, might be set up to log in using the same generic account. The user name might be "First Grade" and the password very simple (none, or simply "1"). To simplify their environment, the teacher can give them no home directory, and set user preferences to configure a Dock with very few items and a very simple Finder.
- More advanced students have individual accounts and home directories. Disk quotas are used to limit the total amount of server storage a student's files can occupy.

The work environment of the advanced students is managed using workgroup-level preferences:

- A group folder for each workgroup, which appears in the Dock, offers a place for teachers and students to share files for a particular subject.
- Applications preferences enable access to workgroup-specific applications.
- Dock item preferences place icons for more common applications in the Dock.
- Internet preferences designate a location for files downloaded using Safari.

Setting Up the Scenario

Here is the sequence of steps that could be used to set up this scenario.

Step 1: Connect student and teacher computers, the server, and the local printer.

This scenario makes moderate to heavy demands on the network:

- Using Network Install images to set up student computers places a heavy load on the network, but this activity happens only periodically, perhaps once each semester.
- Placing student home directories and group folders on the server, however, results in significant day-to-day network traffic, especially when files are saved, read, or copied.

To avoid noticeable slowdowns, you'll need:

- A 100 megabit or gigabit Ethernet hub or switch with enough ports to connect the student and teacher computers, the server, and the printer
- Category 5 (often marked "CAT 5") Ethernet cables with connectors for connecting each computer and printer to the hub or switch

Take into account the local electrical and safety codes when you route the network and power cables. Before you begin, ask your facilities representative for assistance.

To connect the computers and printer:

- 1 Make sure the server computer is in a secure location. Except during installation and initial server setup, you probably won't need access to the server on a daily basis. All the applications you'll need to manage students and their computers using the server are installed onto the teacher's computer in a later step.
- 2 Place the student computers on their desks or in other areas in which students will be using them. Place the printer in an easily accessible location.
- 3 Place the Ethernet hub or switch near an electrical outlet and where the cables from the student computers, server, and printer can reach it.
- 4 Use category 5 Ethernet cables to connect the computers and printer to the hub or switch. Plug one end of each cable into the Ethernet port on the computer and the other into an available port on the hub or switch.
- 5 Connect the printer to the hub or switch. If the printer does not have a built-in Ethernet port, you'll need to connect a small Ethernet transceiver to the printer and connect the Ethernet cable from the hub to the transceiver.
- 6 If you already have an in-house network for Internet access, use an Ethernet cable to connect the uplink port on the hub or switch to the network.

Step 2: Set up the server.

If you purchased a new server, Mac OS X Server software is already installed. All you need to do to perform initial server setup is turn the computer on and answer the questions posed by Server Assistant.

If you need to install Mac OS X Server software, use the getting started guide to understand system requirements and installation options, and then use Server Assistant after the server restarts to perform initial server setup. Server Assistant is in /Applications/Server.

To perform initial server setup:

- 1 Make sure the server is connected to the network.
- 2 Open Server Assistant and proceed through the panes, entering appropriate information as you go. Be sure you:
 - Have a valid server serial number.
 - Enter a fixed IP address for the server, either static or using DHCP with a manual address.
 - Identify a DNS server, if one is accessible, in the TCP/IP Connection pane for the Ethernet interface. A DNS server is required to provide a fully qualified domain name for the server. If a DNS server isn't available, leave the DNS server field blank; you can set one up in the next step.
 - Make the server an Open Directory master if you want it to host network accounts and other network-visible information.

A properly configured DNS service must be set up before you make the server an Open Directory master. The DNS service must be configured to resolve the fully qualified DNS name of the server that you make a master, and DNS must also have a reverse lookup record for the Open Directory master server.

If the server you are setting up will provide the DNS service, you need to set up the server (in Server Assistant) as a standalone server, not as an Open Directory master. Afterwards use Server Admin to configure and start DNS service, and then use Server Admin to make the server an Open Directory master.

- Enable the AFP and NetBoot services so they are available for use immediately.

 During day-to-day use, AFP should always be available, since it's the protocol this scenario uses for accessing home and group folder and other shared folders. You can turn NetBoot on and off as needed to complement the need of school users for NetBoot and Network Install images.
- 3 Restart the server.

Step 3: Set up and start core services.

Required core services are DNS, DHCP, Open Directory, AFP, and NetBoot. Using Server Assistant in the previous step, you already started AFP and NetBoot. AFP and NetBoot services require no additional setup. The remaining services may require setup.

To set up core services on the server after installing the server:

- 1 If you don't have an existing DNS server on your network, you can set one up on the server. DNS provides name services for the server, the printers, and any local area network device that has a static IP address. DNS service lets users connect to a network resource, such as a web or file server, by specifying a host name (such as server.apple.com) rather than an IP address (such as 192.168.11.12).
 - See the network services administration guide for instructions for setting up and starting DNS service. DNS service can also be provided by an Internet Service Provider (ISP). However, all client DNS lookups for local servers must be done from the same subnet where the server resides, or from the same side of a firewall.
- 2 Each computer must have a valid IP address, which can be set manually or provided by a DHCP server.

Decide on an IP addressing scheme for your lab or classroom. If you are not connected to a larger school network or the Internet, you can choose all of your addresses from one of the following private ranges:

- 10.x.x.x with a subnet mask of 255.0.0.0
- 172.16.x.x with a subnet mask of 255.240.0.0
- 192.168.x.x with a subnet mask of 255.255.0.0

You probably need to set up DHCP service so that IP addresses are assigned dynamically by your server to each lab or classroom computer. From a block of IP addresses that you define, your server locates an unused address and "leases" it to client computers as needed. When you set up DHCP, configure it to identify the DNS server when it provides IP addresses to clients.

Optionally, configure the DHCP server to identify the directory server (the server set up as an Open Directory master) at the same time it provides IP addresses. This option makes the startup of mobile student computers faster when they're used away from the school network.

You may also want to set up Network Address Translation (NAT) service. NAT is a method of connecting multiple computers to the Internet (or any other IP network) using one IP address. NAT converts the IP addresses you assign to computers on your private, internal network into one legitimate IP address for Internet communications.

See the network services administration guide for setting up and starting DHCP and NAT services. As in the case of DNS, you can also use an ISP to provide DHCP service.

3 Open Directory service can be set up to provide password policy management and other authentication. See the Open Directory administration guide for details.

Other services are optional, but useful:

 Print service, documented in the print service administration guide, can be used to manage print jobs centrally, including print quotas.

- Mail service, documented in the mail service administration guide, can be set up for internal school use only. A site-wide email server can facilitate email training or provide a mechanism for internal communications that is free of spam and the distractions of external messaging.
- Web services, documented in the web technologies administration guide, can be used to provide help desk information, host student information, post homework, publish information about school events and science fairs, and so forth.
- Firewall and NAT services, documented in the network services administration guide, can be used to isolate school networks from the Internet when a site is directly connected to the Internet.
- Macintosh Manager service, documented in the user management guide, can be used to manage pre-Mac OS X systems.

Step 4: Set up the teacher/administrator computer.

The teacher's computer can be just like the student computers with the addition of remote server administration applications (and teacher-specific applications such as gradebooks) installed. Using remote administration applications allows the teacher to take care of routine administrative tasks such as adding student accounts and setting up shared folders without having to visit the server.

To set up the teacher/administrator computer:

- 1 If it's not already installed, install Mac OS X version 10.3.
- 2 Use the Administration Tools disc from the Mac OS X Server package to install the server administration tools.
- 3 Install the ARD management tool.

You can also create a Network Install image for setting up multiple teacher computers. A later step demonstrates how to use Network Install images to set up student computers.

Before the teacher can create accounts in the shared directory and perform other activities with the server administration applications, he or she needs a user account in the shared directory and the proper administrative privileges.

To set up the teacher/administrator user account:

- 1 On the administrator computer, open Workgroup Manager, authenticating as the administrator user created during initial server setup.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts, then click New User.
- 4 Click Basic to provide basic information for the teacher/administrator. Make sure you select "administer the server" and "administer this directory domain."
- 5 Click Save.

Now the remaining steps can be conducted by the teacher from the teacher/administrator computer.

Step 5: Set up the home directory share point.

Home directories for accounts stored in shared directory domains can reside in a share point that the student's computer can access. This share point must be *automountable*—it must have a network mount record in the directory domain where the user account resides.

An automountable share point ensures that the home directory is visible in /Network/ Servers automatically when a student logs in to a Mac OS X computer configured to access the shared domain. It also lets other users access the home directory using the ~home-directory-name shortcut.

While you can set up and use any share point you like, for this scenario we'll use the predefined Users share point, which is already set up. You only need to create a network mount record for it in the shared directory.

To prepare a home directory share point:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user created during the previous step.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Sharing.
- 4 If it's not already selected, click Share Points, and then select the Users share point.
- 5 Click General and make sure "Share this item and its contents" is selected.
- 6 Click Protocols, choose Apple File Settings from the pop-up menu, and make sure "Share this item using AFP" and "Allow AFP guest access" are enabled. Guest access to the share point lets users with home directories on different servers access the home directory using the ~home-directory-name/Public shortcut.
- 7 Click Network Mount, then click the lock to authenticate as an administrator of the shared directory. Choose the directory from the Where pop-up menu.
- 8 Select "Create a mount record for this share point" and "Use for User Home Directories."
- 9 Click Save.
- 10 Make sure that AFP is running.

Open Server Admin, select the server in the Computers & Services list, and click AFP. If AFP is not running, click Start Service in the toolbar.

Now you can create a network home directory for the teacher/administrator in the share point you just configured.

To create a network home directory for the teacher/administrator:

- 1 In Workgroup Manager, click Accounts, then select the teacher/administrator in the user list.
- 2 Click Home. In the share points list, select the Users share point.
- 3 Click Create Home Now, then click Save.
- 4 Restart the teacher/administrator computer so that the share point is visible on it.

See the user management guide for complete information about setting up and using home directory share points.

Step 6: Set up student accounts.

Now you can set up student user accounts and create home directories for them in the Users share point.

To set up your student accounts:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts, then click New User.
- 4 Click Basic to provide basic information for the student. Click Save when you are finished.
- 5 Click Home to create the student's network home directory.
 In the share points list, select an automounted share point, Users in this scenario.
 Click Create Home Now, then click Save.
- 6 You can also specify a disk quota to limit the disk space the student can consume to store files he or she owns in the partition where his or her home directory resides.
 - The quota doesn't apply to the home directory share point or to the home directory. It applies to the entire partition within which the home directory share point and the home directory reside.
 - To specify a disk quota, click Sharing, click All, and select the partition where the home directory share point resides. Click General and select "Enable disk quotas on this volume." Then click Accounts, select the student in the user list, click Home, use the Disk Quota field to specify a disk quota, and click Save.
- 7 Repeat steps 3 through 6 for each student.
 - Instead of interactively entering information for each student, you can use a batch approach, typing student information into a file and importing the file using Workgroup Manager. You can also use a preset to avoid re-entry of data that applies to many students. See the user management guide for details about these techniques.

Step 7: Set up a model student computer.

Instead of visiting each student computer to install and configure the OS and applications, you'll use the Network Install feature of the NetBoot service.

An easy way to prepare the student install image is to set up a computer exactly as you want your students to see it, then create an install image from that computer. You can install applications on and configure this model computer, make sure everything works as you expect, then use Network Image Utility to prepare an image that the NetBoot service can install on the remaining student computers. The system image administration guide provides full details about creating and using Network Install images.

In this step, you'll start with a basic Mac OS X version 10.3 installation, update it to version 10.3.1, install student applications, configure the directory services to use the network directory, and enable ARD management from the teacher's computer.

What you'll need:

- A student computer that can run Mac OS X version 10.3
- The Mac OS X version 10.3 install discs
- Version 10.3.1 install disks or an Internet connection for using Software Update

To set up the model student computer:

- 1 Make sure the computer is connected to the network.
- 2 If it is not already installed, install Mac OS X version 10.3 on the student computer. Use an administrator name and password for the default user. You'll need the administrator name and password for ARD administration and other computer administration activities.
- 3 Update the computer to the latest version of Mac OS X version 10.3 using install discs or the Software Update pane of System Preferences.
- 4 Install the applications that the students will need. You may want to copy some of the application icons into the Dock. You may also want to remove applications that you don't want the students to use, or you can control application access later using preferences.
- 5 Open Directory Access (in /Applications/Utilities/) so you can configure the search policy of the computer to connect to the Open Directory master server. Click Authentication, click the lock to authenticate as an administrator of the computer, then choose "Automatic" or "Custom path" from the Search pop-up menu.
 - Choose "Automatic" if you've set up a DHCP server to identify the location of the network directory when it provides an IP address to client computers. Otherwise, choose "Custom path" and click Add to identify the server hosting the network directory. Click Apply.

- See the Open Directory administration guide for more information about the behavior and setup of search paths.
- 6 Enable the monitoring and controlling of the computer from the teacher/administrator computer using ARD.
 - Open System Preferences, click Sharing, and choose Apple Remote Desktop. Choose "Show status in menu bar" if you want students to be able to send attention requests to the teacher.
- 7 Test the computer to make sure it works as you intend.

Log in as one of the students whose accounts you created earlier. Click the home icon in the Finder to make sure the home directory mounts. Make sure the Dock contains the items you want it to contain and that the applications you installed can be opened.

Step 8: Create the student computer install Image.

After you set up your model student computer, you can use the Network Image Utility (in /Applications/Server/) to create an install image of that computer.

What you'll need:

- If you save the install image on the server, you'll need a FireWire cable and Network Image Utility, which is already installed on the server.
- If you save the image on an administrator computer, you'll need a FireWire cable,
 Network Image Utility (install from the Server Admin disc), and free space equal to
 twice the size of the space used on the model computer. Use the Get Info command
 on the hard drive of the model computer to note the space used, ignoring free
 space.

To create the Network Install image:

- 1 Boot the model computer into FireWire target disk mode by holding down the T key on its keyboard before pushing the power button. Once the computer is booted, use a FireWire cable to attach the computer to the server or to an administrator computer with Network Image Utility installed. The model computer will appear as an external device on the desktop of the administrator computer or server.
- 2 Open Network Image Utility and create a new install image. Choose the internal drive of the student computer as the source for the image and either the NetBootSPn folder on the server or a temporary storage location as the destination for the new image.
 - To automate installation, choose "Enable automated installation." Choose "Install on volume" and type the common internal disk name for the student computers. (This only works if the drives all have the same name. On systems with a different volume name, you'll have to interact with the installer at those computers.) Also choose "Erase the target volume before installing" and "Restart the client computer after installing."
- 3 Turn off the model computer by holding down the power button until it shuts off. Disconnect the FireWire cable from the server or administrator computer.

4 Once the .nbi folder is created, if necessary copy the image to your server into the /Library/NetBoot/NetBootSPn folder.

Step 9: Set up other student computers.

You use Server Admin to configure NetBoot service, which lets you use the Network Install image you just created to set up other student computers.

To use the Network Install image:

- 1 On the server or the teacher/administrator computer, open Server Admin (in /Applications/Server/) and connect to the server.
- 2 Select the server in the Computers & Services list.
- 3 Click NetBoot, then click Settings.
- 4 Click General and make sure NetBoot is enabled on the Ethernet port that connects the server to the student computers.
- 5 Click Images and make sure the image you created from the model computer and copied to the server is enabled.
- 6 Start the NetBoot service.
- 7 NetBoot each student computer.

You have three ways to do so. You can set the Startup Disk System Preference to the Network Install image. You can start each computer while holding down the Option key and choose the Network Install image. Or you can start each computer while holding down the N key.

For subsequent installs, if they are necessary, you'll be able to set the Startup Disk System Preference remotely using ARD.

Step 10: Set up student user account preferences.

Most of the preferences in this scenario are managed at the workgroup or computer level. However, there are times you'll find user-level preferences convenient, as when you use a generic account for lower-grade students.

This step tells you how to create a generic user for first-grade students. The account uses no home directory, and it has preferences associated with it that create a very simple Dock and Finder.

To set up an account and preferences for first graders:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts and New User.
- 4 Enter "First Grade Students" in the Name field and "first" in the Short Names field.
- 5 Enter 1 in the Password and Verify fields, then click Save.

6 Set up user preferences that simplify the Finder.

Select First Grade Students in the user list, click Preferences, and click Finder. Select Always, then choose "Use Simplified Finder to limit access to this computer." Click Apply Now.

7 Set up user preferences that simplify the Dock.

Click Preferences, then click Dock. Select Always. Use the lists and their related Add and Remove buttons to indicate which applications and which documents and folders you want to appear in the students' Dock. You may want to use Sharing to set up a network-visible folder for exchanging files with students, then show the folder in the Dock.

Make sure you don't select "User may add and remove additional Dock items" so that students can't modify the Dock items you specify.

When you are done, click Apply Now.

8 Restart and log in to one of the student computers as a first grader. Notice that clicking the Finder icon in the Dock has no effect, and that the Finder menu basically limits the student's activities to logging out. The Dock should contain the Trash icon, the Finder icon, and any applications, folders, or documents you specified using Dock preferences.

Step 11: Set up group accounts and folders.

In this scenario, you would set up several groups in order to provide a group folder for group-specific information exchange and provide the basis for workgroups, groups with preferences defined.

This step sets up groups and group folders, and the next one describes making the groups into workgroups so they have managed preferences.

To set up groups and group folders:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts, select the group list, and click New Group.
- 4 Click Members to give the group a name and assign students to it.
- 5 Click Sharing to define a share point for the group folder.
 - Click Share Points and select the folder you want to use as a group folder share point. You can use the predefined Groups folder, or create a folder of your own in the Finder.
 - Click General. Set the Group privileges to Read & Write and the Group name to admin. Set Everyone privileges to Read Only.
 - Click Protocols and make sure AFP is enabled for sharing.
- 6 Define the group folder attributes.

Click Accounts, select the group in the group list, and click Group Folder. You'll use the Users share point in the list as a starting point for identifying the group folder share point.

Select the Users share point in the list and click Duplicate. In the dialog box, edit the URL and path to reflect where you want to locate the group folder. In this example, change Users to Groups in the URL field. Use the Path field to indicate the path from the share point (Groups) to the group folder, including the group folder but excluding the share point. For example, if the full path to the group folder will be Groups/MathStudentProjects, enter only MathStudentProjects. When you are done, click OK.

Select a group folder owner name to identify a group folder administrator, then click Save. Specify a teacher account as the group folder administrator so the teacher can post handouts, collect turned-in work, and modify the group folder as needed.

7 Create the group folder.

Open Terminal, and type "sudo CreateGroupFolder". Type the password for the root user when prompted. A successful response looks like this:

```
Successfully created group home directory for group 1027 at /Group Folders/MathStudentProjects".
```

8 Make sure the group folder permissions are correct for the group.

In Workgroup Manager, click Sharing, select the group folder share point, select the group folder, and click General. Change permissions to the group folder if needed. The group folder administrator should be the owner, with Read & Write privileges. The group name should appear in the Group field. Group privileges are usually set to Read & Write, but you can change them. For example, you can set the group privileges to Write Only if you want to use the group folder as a drop box.

Click Save.

9 Repeat steps 3 through 8 as required for additional groups.

Step 12: Set up workgroups.

Now you can set up preferences for the student groups, making them into workgroups.

In this step, you'll use group preferences to make a group folder visible in the Dock of students who are group members. You'll also set a few more preferences to manage application visibility and storage of files downloaded using Safari.

To set up workgroups:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts, select the group list, and select a group.

4 Make the group folder visible in the Dock.

Click Preferences, then click Login. In the Login Items settings, select Always and "Add group share point." Select the group share point in the list and select Hide. Make sure that "Mount with user's name and password" is selected. Click Apply Now.

Click Preferences, then click Dock. Select Always and "Add group folder." Click Apply Now.

5 Set up the workgroup application access so that the application environment on the student computers complements the purpose of the group.

Click Preferences, then click Applications. Select Always. Use the settings to identify which applications workgroup users can open, then click Apply Now.

Click Preferences, then click Dock. Use the Dock Items Applications list to indicate which applications you want to appear in the Dock. Be sure you include only applications that the workgroup has access to given the Applications preferences you've defined. When you're finished, click Apply Now.

Note that the path to an application is saved when you select an application. Therefore make sure that the application resides on student computers in the same location as on the computer you're using to set up application preferences.

6 Use Internet preferences to designate a folder in the group folder (Public) for storing files downloaded using Safari. Using ARD, the teacher/administrator could delete files from this folder if required.

Click Preferences, click Internet, and click Web. Select Always. Here are some sample entries for the fields:

Default Web Browser: /Applications/Safari.app Home Page: http://www.SomeHomePage.com

Search Page: leave blank

Download Files To: /Volumes/Groups/MathStudentProjects/Public

Step 13: Set up computer lists and preferences.

In this scenario, computer-level preferences are used to manage every student computer, regardless of who uses it and which workgroup is selected after login.

To set up computer-level management:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts, and select the computer list.
- 4 Click New Computer List to create a computer list that manages all the student computers in the classroom or lab.
- 5 Click List to name the list and identify each computer. Click Save when you are done.

- 6 If you want to restrict use of these computers to certain groups or allow students who don't have network accounts to use the computers, click Access. In this scenario, you won't change the default setting, "All groups can use the computer," as can local-only users.
- 7 To automate student computer shutdown at the end of each day, click Preferences and click Energy Saver, click Schedule, select Always, select Shut Down, select Every Day, specify a time of day, and click Apply Now.
- 8 To set up the appearance of the login window, click Preferences, click Login, and click Login Options. Select the items you want to appear in the login window and other optional login behaviors. When you are done, click Apply Now.
- 9 To provide printer access, click Preferences, click Printing, and select Always. Click Printer List to add the local and remote printers to the User's Printer List, then click Apply Now. While you won't in this scenario, you could click Access and identify a default printer and require administrator privileges to access a printer.
- 10 To prevent students from copying files to recordable discs, CDs, and CD-ROMs, click Preferences and click Media Access. Select Always. Click Disk Media and remove all the checks from the boxes. Click Apply Now.
- 11 To prevent students from changing System Preferences settings, click Preferences, click System Preferences, and select Always. Use the Show setting to indicate which preference you want to make accessible to students using the computers, then click Apply Now.

Step 14: Perform day-to-day and periodic management activities.

Now all the classroom or lab computers are ready for daily student use. Day-to-day monitoring, management, and maintenance activities can be done from the teacher/administrator computer:

- As students and computers come and go and as curriculum needs dictate, continue using Workgroup Manager to keep accounts, preferences, and shared folders up to date.
- When you need to update the operating system or add applications to student computers, use Network Install images and ARD.
- Use ARD for such activities as deleting files and folders and emptying the Trash on student computers, and restarting computers.
- Provide remote assistance to students with ARD by sharing your screen with students
 or controlling their screens, answering ad hoc questions, and monitoring student
 screens. When you don't want students to use their computers, use ARD to lock their
 screens.
- ARD generates hardware and software profiles useful when you need to conduct computer inventories.

Scenario 2: Using One-to-One Mobile Computers

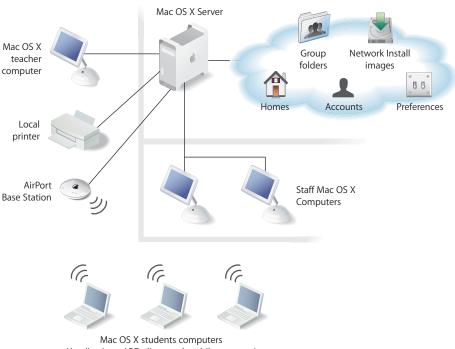
In this scenario, students are assigned portable computers for their exclusive use. They carry their computers from class to class while at school, and they take them home at the end of the school day. At school, wireless network connections are made using AirPort.

The students have mobile user accounts. They use their computer for running applications and using files that reside on their mobile computers. Home directories and group folders are available on the network, but used only at school, and then only long enough to back up files from the local computer or to pick up new files from the network.

Several staff members also have mobile accounts, because they also don't require ongoing access to the server for their day-to-day work. Staff computers are desktop systems that remain at school. These computers have wired connections to the server for network use as needed, but support users who spend most of their time locally.

Introducing the Scenario

At school, classrooms and labs have AirPort Base Stations for use by students with one-to-one mobile computers.



(Applications, ARD client, and mobile accounts)

The only time student computers need to be physically attached to the network is when using Network Install or NetBoot images, as for initial computer setup. However, users are authenticated using the network server whenever they are using the network over AirPort, and they receive updated user, group, and computer settings if the settings have changed since the last network login:

- A Network Install image sets up student computers with Mac OS X, some additional applications (including anti-virus software), and settings that let the teacher use ARD to manage the computers.
- As in scenario 1, the teacher's computer has server administration applications and ARD installed.
- The students and staff have mobile user accounts.

When a user has a mobile account, his or her authentication information and preferences are maintained in a network directory, but cached on the local computer. A student's login name and password as well as the preferences defined at the user, workgroup, or computer level are the same at school and at home. If you change any of these items, the cached versions are updated the next time the user logs in at school.

When the user is on the network, he or she is authenticated using the network account on the server. When off the network, the user is authenticated using a cached version of the network credentials.

- The primary home directory of a mobile account user resides on the local computer. Each mobile account user in this scenario also has a network home directory, which is used to back up files as required.
- To create mobile accounts, you use the Mobile Account preference, usually at the user or computer level.

You'd use user-level settings when mobile account users need to use different computers. When the user logs in to any computer on the network, he or she would get a local mobile account and home directory.

When mobile account users have dedicated computers, as in this scenario, computer-level settings are useful. When the user first logs in to the computer, a mobile account and home directory are created on it. Any other network user who logs in to the computer would also get a local mobile account and home directory.

You could also set the Mobile Account preference for a workgroup. Any network user who picks the workgroup at login gets a mobile account on the computer unless he or she already has one on it.

• When a mobile account user logs in at school to a computer on which he or she has a mobile account, the network version of the account is used to authenticate the user, but the network home directory is not mounted by default in order to minimize network traffic in a wireless situation.

To access the network home directory in this scenario, mobile account users log in and pick a workgroup specifically set up for exchanging files between local and network home directories. This workgroup has preferences that cause the network home directory to mount on the local computer, but denies the user access to all local applications, encouraging selection of a different workgroup after file transfers.

When the user logs in to a computer on which he or she has no mobile account and the Mobile Account preference isn't active for that login, the network home directory mounts automatically.

 In this scenario, workgroups are also used to regulate access to group folders on the network. Preferences at the workgroup level make network folder access easy and deny access to local applications. They also set up school printer access that's appropriate for the group.

You can set up workgroups for individual classes and labs or for larger groupings of students.

- Also set up a workgroup for home use or for school use when no network
 connection is needed. This workgroup provides no automated network folder
 visibility or network printer access. When students use this workgroup, they
 experience no delays while their computer attempts to make network connections
 for these resources.
- One computer list covers all the student computers. The computer list is set up to allow all workgroups access to its computers, minimizing the need to change settings when students need to use new workgroups.

A separate computer list is set up for the staff computers, so different computer-level preferences can be used if needed.

- In this scenario, we'll enable mobile account creation at the computer level. Other computer-level preferences for student computers look like this:
 - Energy Saver preferences display the battery status of mobile computers in the student computer menu bar.
 - Media Access and System Preferences settings restrict use of recordable media and changes to basic computer settings.
 - Login options display local users, which include users with mobile accounts.
- Using ARD in a wireless environment is faster when you follow the guidelines in the documentation, available at www.apple.com/remotedesktop/.

Setting Up the Scenario

Here's the sequence of steps that could be used to set up this scenario.

Step 1: Connect staff and teacher computers, the server, the AirPort Base Station, and the printer.

The printer, teacher and staff desktop computers, and the AirPort Base Station are directly connected to the school network using Ethernet.

What you need and the steps you use are explained in step 1 on page 28. The only difference is the student computers aren't connected to the network. Instead, the AirPort Base Station is plugged into the network.

Step 2: Set up the server.

See step 2 on page 28 for instructions.

Step 3: Set up core services and the base station.

See step 3 on page 29 for information about setting up core services of Mac OS X Server.

See *Designing AirPort Extreme Networks* (accessible at www.apple.com/airport/) for AirPort Base Station setup instructions. You'll set up the AirPort Base Station to allow bridging between the network's wireless and wired computers. With bridging turned on, AirPort computers have access to all services on the Ethernet network, including DHCP.

Step 4: Set up the teacher/administrator computer.

See step 4 on page 31 for instructions.

Step 5: Set up the home directory share point.

Even though mobile account users have local home directories, this scenario also provides network home directories for backing up of local files.

See step 5 on page 32 for instructions.

Step 6: Set up student accounts.

See step 6 on page 33 for instructions.

Step 7: Set up a model student computer.

See step 7 on page 34 for instructions. Also configure the computer to use AirPort.

To set up the computer for wireless AirPort connections:

- 1 Make sure the computer has an AirPort Card.
- 2 In the Network pane of System Preferences, choose Network Port Configurations from the Show pop-up menu. Make sure the AirPort box is checked. Click Apply Now if you make a change.
- 3 Choose AirPort from the Show pop-up menu, and click TCP/IP. In the Configure IPv4 pop-up menu, choose the method by which the computer will receive an IP address from the base station, usually "Using DHCP."

Step 8: Create the student computer install image.

See step 8 on page 35 for instructions.

Step 9: Set up other student computers.

See step 9 on page 36 for instructions. Before NetBooting student computers:

- Make sure they all have AirPort cards.
- Directly connect the computers to the Ethernet network.

Step 10: Set up student user account preferences.

Most of the preferences in this scenario are managed at the workgroup or computer level. However, you can optionally set up a user's preferences so that a local mobile account is created on any computer the user logs in to.

To set up user-level mobile account preferences:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 In the user list, select one or more users.
- 4 Click Preferences, click Mobile Accounts, and select Always.
- 5 Select "Create Mobile Account at login." Optionally select "Require confirmation before creating a mobile account."

Step 11: Set up student group accounts and folders.

Create several kinds of student groups:

- A group for home directory backup
- Groups for individual classes and labs
- A group for use when no network connection is needed

See step 11 on page 37 for instructions. Create group folders only for groups that support individual classes and labs.

Step 12: Set up workgroups.

Set up preferences at the workgroup level for each student group to facilitate network folder access.

To set up the home directory backup workgroup:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 In the group list, select the group you created for use when backing up local home directory files.
- 4 Make the home directory visible in the Dock. After login, the network home directory appears as a folder in the Dock with the same name as the local home directory, accessible using the home icon in the Finder.

Click Preferences, then click Login. In the Login Items settings, select Always and "Add network home share point." Select the share point in the list, and select Hide. Make sure that "Mount with user's name and password" is selected. Click Apply Now.

Click Preferences, then click Dock. Select Always and "Network Home." Click Apply Now.

5 Set up Applications preferences so students can't run local applications when using this workgroup.

Click Preferences, then click Applications. Select Always. Select "User can open all applications except these" to deny student access to applications listed. Select "User can also open all applications on local volumes" to deny student access to other local applications. Click Apply Now.

To set up a classroom or lab workgroup:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 In the group list, select a classroom or lab student group.
- 4 Make the group folder visible in the Dock.
 - Click Preferences, then click Login. In the Login Items settings, select Always and "Add group share point." Select the group share point in the list and select Hide. Make sure that "Mount with user's name and password" is selected. Click Apply Now.
 - Click Preferences, then click Dock. Select Always and "Add group folder." Click Apply Now.
- 5 Set up Applications preferences so students can't run local applications when using this workgroup.
 - Click Preferences, then click Applications. Select Always. Select "User can open all applications except these" to deny student access to applications listed. Select "User can also open all applications on local volumes" to deny student access to other local applications. Click Apply Now.
- 6 Click Preferences, then click Printing if you want students to be able to print when using the workgroup.

Step 13: Set up computer lists and preferences.

Define a computer list and associated preferences for student computers and another one for staff computers.

To set up computer-level management of student mobile computers:

- 1 On the teacher/administrator computer, open Workgroup Manager, authenticating as the teacher/administrator user.
- 2 Access the shared directory by clicking the small globe beneath the toolbar.
- 3 Click Accounts, and select the computer list.

- 4 Click New Computer List to create a computer list that manages all the student computers in the classroom or lab.
- 5 Click List to name the list and identify each computer. Click Save when you are done.
- 6 To display the status of the mobile computer battery, click Preferences and click Energy Saver, click Battery Menu, select Always, select "Show battery status in the menu bar," and click Apply Now.
- 7 To set up the appearance of the login window so that it lists all local users, including mobile accounts, click Preferences, click Login, and click Login Options. Select "Show local users," then click Apply Now.
- 8 To prevent students from copying files to recordable discs, CDs, and CD-ROMs, click Preferences and click Media Access. Select Always. Click Disk Media and remove all the checks from the boxes. Click Apply Now.
- 9 To prevent students from changing System Preferences settings, click Preferences, click System Preferences, and select Always. Use the Show setting to indicate which preferences you want to make accessible to students using the computers, then click Apply Now.

Step 14: Perform day-to-day and periodic management activities.

Now all the mobile computers are ready to give to students.

Day-to-day monitoring, management, and maintenance activities can be done from the teacher/administrator computer:

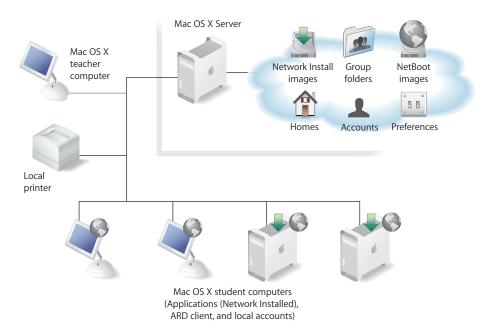
- As students and computers come and go and as curriculum needs dictate, continue using Workgroup Manager to keep accounts, preferences, and shared folders up to date.
- When you need to update the operating system or add applications to student computers, use Network Install images and ARD. Students need to plug their computers into the school network when using Network Install images.
- You can use ARD, but follow instructions in the documentation available at www.apple.com/remotedesktop/ to ensure adequate performance and correct behavior in a wireless AirPort environment.

Scenario 3: Using NetBoot in a Wired Lab

This scenario's network layout is similar to that of scenario 1. Students and a teacher/lab coordinator use Mac OS X desktop computers plugged into an Ethernet local area network. The key difference is that student computers are NetBooted so they get fresh system environments each time they start. In addition, Network Install images are used to install applications on lab computers when the applications would be slow to use over the network.

Introducing the Scenario

An Ethernet local area network connects student computers, the teacher/lab coordinator computer, the server, and a local printer. Students log in using a local account to perform lab assignments, and connect to the server to pick up or save files as required.



- The student computers boot using a server-resident NetBoot image.
- The NetBoot system image sets up access to the lab printer and local user account options, including autologin as administrator for students who need administrator privileges for their lab work.
- Network Install images install applications locally on lab computers when they would be slow to use over the network, as when they're I/O intensive or use very large files.
- Students use local accounts for lab work, and connect to the server (using Go >
 Connect to Server) and authenticate using their network user account to copy files from or save files to group folders or home directories.

 ARD is used to control student computer restarts, observe lab activities, demonstrate tasks, and so forth.

Setting Up the Scenario

Here is the sequence of steps that could be used to set up this scenario.

Step 1: Connect student and teacher computers, the server, and the local printer.

For instructions, see step 1 on page 28.

Step 2: Set up the server.

For instructions, see step 2 on page 28.

Step 3: Set up core services.

For instructions, see step 3 on page 29.

Step 4: Set up the teacher/lab coordinator computer.

For instructions, see step 4 on page 31.

Step 5: Set up the home directory share point.

See step 5 on page 32 for instructions.

Step 6: Set up student accounts.

See step 6 on page 33 for instructions.

Step 7: Set up a model student computer.

Instead of visiting each lab computer to install and configure software, you'll use the NetBoot service to start computers from a single image. In this step, you set up a model student computer that has the image you want to use to boot other lab computers.

To set up a model student computer:

- 1 Make sure the computer is connected to the network.
- 2 If it is not already installed, install Mac OS X version 10.3 on the student computer. Use an administrator name and password for the default user. You'll need the administrator name and password for ARD administration and other computer administration activities.
- 3 Update the computer to the latest version of Mac OS X version 10.3 using install discs or the Software Update pane of System Preferences.
- 4 Install applications that students can run over the network without a reduction in performance. You can also remove applications you don't want students to use.
- 5 Open Directory Access (in /Applications/Utilities/) so you can configure the search policy of the computer to use the local directory only. Click Authentication, click the lock to authenticate as an administrator of the computer, then choose "Local directory" from the Search pop-up menu.

- 6 Enable the monitoring and controlling of the computer from the teacher/administrator computer using ARD.
 - Open System Preferences, click Sharing, and choose Apple Remote Desktop. Choose "Show status in menu bar" if you want students to be able to send attention requests to the teacher.
- 7 Use the Accounts pane of System Preferences to create one or more local accounts for lab student use.
 - For students who need administrator privileges on the computer, enable autologin as an administrator. Students who use the autologin account won't know the administrator password, so won't be able to enter it to make certain changes on the computer. In the Accounts pane, select the student account, click Login Options, and choose the administrator user from the "Automatically log in as" pop-up menu.
- 8 Set up access to the lab printer using the Print & Fax pane of System Preferences.
- 9 Test the computer to make sure it works as you intend.

Step 8: Create the boot image.

After you set up your model student computer, you can use the Network Image Utility (in /Applications/Server/) to create a boot image of that computer.

What you'll need:

 An external FireWire hard drive with a bootable OS, the Network Image Utility, and 5 GB of free space

To create the boot image:

- 1 Connect the external drive to the server or the teacher/administrator computer. Place a copy of the Network Image Utility on the external drive.
- 2 Connect the external drive to the model computer and reboot from the external drive. (You can't make an image of the volume that a computer uses for startup.)
- 3 Open Network Image Utility and create a new boot image. Choose the internal drive of the student computer as the source for the image and the external drive as the destination for the new image.
- 4 Turn off the model computer or reboot it from its internal drive. Then connect the external drive to the server.
- 5 Copy the image folder (.nbi) from the external drive into /Library/NetBoot/NetBootSPn.

Step 9: Prepare an application install image.

Now you'll create a Network Install image for installing applications that you don't want to run over the network.

To create a Network Install image:

- 1 Copy installation packages for the applications to the server.
- 2 Open Network Image Utility and create a new install image.

- 3 On the Contents pane, add the application install packages to the Other Items list. (You may have to insert an OS install CD in the server's drive to see the "Include Mac OS X" checkbox that you disable to create an application-only image.)
 - To automate installation, choose "Enable automated installation." Choose "Install on volume" and type the common internal disk name for the student computers. (This only works if the drives all have the same name. On systems with a different volume name, you'll have to interact with the installer at those computers.) Also enable "Erase the target volume before installing" and "Restart the client computer after installing."
- 4 Save the image in the NetBootSPn share point on the server.

Step 10: Set up other lab computers.

Use Server Admin to configure NetBoot service, which lets you use the images you just created to set up other lab computers.

To use the boot and install images:

- 1 On the server or the teacher/administrator computer, open Server Admin and connect to the server.
- 2 Click NetBoot, then click Settings.
- 3 Click General and make sure NetBoot is enabled on the Ethernet port that connects the server to the lab computers.
- 4 Click Images and make sure both the OS boot image you created from the model computer and the application install image are enabled.
- 5 Set the boot image as the default image.
- 6 Start NetBoot service.
- 7 NetBoot each student computer.

You have three ways to do so. You can set the Startup Disk System Preference to the boot image. You can start each computer while holding down the Option key and choose the boot image. Or you can start each computer while holding down the N key.

Step 11: Set up group accounts and folders.

Group folders offer a way to provide students with lab-specific instructions and files and collect finished files when exercises are completed.

For instructions, see step 11 on page 37.

Planning Your Own Mac OS X Deployment

This final section contains a few pointers you may find useful when planning your own Mac OS X computer rollout.

For more planning guidelines, see the documents on the Mac OS X Server Administration Tools install disc (in the Documentation folder) and online (at www.apple.com/server/documentation):

- The getting started guide has a chapter entitled "Before You Begin." It provides food for thought to use before installing and setting up Mac OS X Server.
- Administration guides for individual services provide service-specific planning guidelines. For example, the Open Directory administration guide has a chapter called "Open Directory Planning."

Also see the documents for AirPort and ARD, available online:

- For AirPort, see www.apple.com/airport/.
- For ARD, see www.apple.com/remotedesktop/.

Where to Start

You generally don't plan deployment for a single lab or classroom. You usually start planning at the building level.

For example, a common wired school site would contain:

- A wiring closet that contains:
 - A connection to the Internet or a wide-area network that belongs to the district
 and interconnects various school sites over a router or switch. This connection is
 often configured by an ISP or by a network coordinator for the school district
 rather building-level staff.
 - A wiring rack containing switches that cross-connect all the computers in the building. The building itself might be wired with gigabit fiber connections to each classroom and 100 MB CAT 5 Ethernet connections to each computer.
 - One or more servers, the number of which is based on the number of computer systems to be supported and services to be provided. Some services are best done using a dedicated server, while other services can share a computer. See "Determining Server and Storage Requirements" on page 53.
- A lab with more than 10 student systems and a teaching computer.
- Classrooms with computers. Classrooms often have fewer student computers, perhaps 2 or 3, plus a teaching machine (for assignment tracking, grades, and so forth). Some classrooms have more, some fewer computers, but most have at least one.

Identifying Computer Management Goals

Answering questions such as these help you understand the tasks you'll need to accomplish:

- How will students and staff use computers?
- What services should be set up on the server?
- What account information and folders are best maintained centrally, on the server?
- What levels and depth of preference management are desirable?
- Will mobile computers and mobile accounts be used?
- Which computers should students and staff have access to? Why?
- Do you need to implement a password policy?

Determining Server and Storage Requirements

These requirements vary with the number of users and computers:

- For fewer than 450 users and fewer than 150 computers, one server is adequate for
 account management and authentication, home directories, and group folders. This
 guideline assumes 1 GB/user of storage space per drive module in an Xserve
 computer. More storage can be provided with additional drive modules and/or RAID.
- For 450–1000 users and 150–450 computers, one server is required for account management and authentication. You'll need one home directory and group folder server for every 150 computers; the server should provide about 180 GB of storage.
 - One server acts as the Open Directory master; this server also hosts primary services such as DNS, DHCP, and web as needed. If more dedicated services are needed, explore using servers specifically for those tasks, such as QuickTime streaming.
 - Group folders are often shared among many computers at the same time. Avoid more than 150–300 concurrent connections to a group folder by establishing multiple workgroups and distributing users into more than one workgroup.
- For over 1000 users and over 450 computers, you'll need multiple servers for account
 management and authentication; see the Open Directory administration guide for
 replication guidelines. You'll also need one home directory and group folder server
 and 180 GB of storage for every 150 computers.
- Do not use more than 6 automountable share points per server.

Assessing Imaging Requirements

For Network Install images, determine how many different images you'll need. Often this decision is affected by the extent to which you manage preferences:

- One option is to create distinct Network Install images for different kinds of users (teachers, students, staff). Distinct images physically limit the characteristics of a computer. If it's set up for a student, a computer wouldn't support the special application needs of teachers or staff members.
- Alternatively, you can create some general-purpose images and use preferences to manage which components on the computer are accessible to different kinds of users.

Staff computers, used by administrators, accountants, and other school staff, have special requirements and may be less amenable to preference management. Other special cases include student computers used in labs for advanced graphics or programming students. Special-purpose computers may require individual handling.

If you need to use NetBoot images frequently, you'll probably want to devote a server to image serving. On the other hand, if you can limit system image usage to installing software during student breaks, you can use an existing server, turning NetBoot service on and off as required.

Organizing User Information

Establish conventions for various items:

- For names, use characters that are URL compliant: A-Z, 0-9, 0, -, _. See the user management guide for complete information on valid names and recommended conventions.
- UIDs should be unique throughout the network. Don't assign students IDs that are the same for multiple students. UIDs can range from 501 to 2,147,483,648.
 - Part of the UID can be set up so it identifies particular kinds of students. For example, UIDs for students in the class of 2011 might all start with 211.
 - Take into account the duration of time a student will be in the system. If a student's ID needs to be good for only 2 years, you have more numbers available than in scenarios where the ID needs to last 8 years.
- Passwords shouldn't be easy to guess. You can force users to change their passwords regularly to make them more secure. See the user management guide for ideas.

Defining Groups

Identify groups and their members. For example:

This group	Will have these users as members
Freshmen	Students in the current 9th grade class
Design Classes	Students in graphical design classes
Library	All students and staff
Teachers	All instructional staff

Defining Computer Lists

Identify the computers you want to manage using specific computer lists. For example:

	Will have these	Will have these computers associated with it		
This computer list	Ethernet address	Computer name		
Graphics Lab	00:50:e4:60:a8:2e	Power Mac G5 1936aa		
	00:60:e5:99:ae:22	Power Mac G5 19867c		

Defining Workgroup Access to Computers

For computer lists, indicate which groups should have access to member computers. For example:

	Can ac	Can access computers in these computer lists		
This group	Home room 5	Graphics Lab	Office	Library
Freshmen	Х			Х
Design Class		х		Х
Library				Х
Teachers	Х	х	Х	Х

Picking Preferences to Manage

Determine which preferences you want to manage and at which level(s). For example:

	Set these preferences		
For these items	Dock	Applications	Printing
First Grade Students (generic user account)	Always; show only Calculator and network Teacher's folder		Always; access to classroom printer
Design Class workgroup	Always; show group folder		Always; access to classroom printer
Graphics Lab computer list	Always; show graphics applications	Always; enable access to graphics applications	Always; access to color printer in lab

Defining Shared Folders

Determine the share points you'll need for home directories, group folders, and other shared folders. For example:

			Share point or subfolder privileges		rivileges
Purpose	Share point	Subfolder	Owner	Group	Everyone
Student home directories	/StudentHomes		serveradmin, RW	admin, RW	Read Only
		default (user's short name)	default (user)	default (staff, RO)	default (RO)
Staff home directories	/StaffHomes		serveradmin RW	admin, RW	RO
		default (user's short name)	default (user)	default (staff, RO)	default (RO)
Design Class group folders	/GroupFolders		serveradmin, RW	admin, RW	RO
		/DesignClass	smitty, RW	designclass, RW	RO

Blank Forms

You can use the forms on the following pages to document your own deployment decisions.

Groups

This group	Will have these users as members

Computer Lists

	Will have these computers associated with it			
This computer list	Ethernet address	Computer name		

Workgroup Access to Computers

	Can access computers in these computer lists		
This group			

Preferences to Manage (1 of 4)

	Set these preferences			
For these items	Applications	Classic	Dock	

Preferences to Manage (2 of 4)

	Set these preferences			
For these items	Energy Saver	Finder	Internet	

Preferences to Manage (3 of 4)

	Set these preferences			
For these items	Login	Media Access	Mobile Accounts	

Preferences to Manage (4 of 4)

		Set these preferences	
For these items	Printing	System Preferences	Universal Access

Shared Folders

			Share point or subfolder privileges		
Purpose	Share point	Subfolder	Owner	Group	Everyone