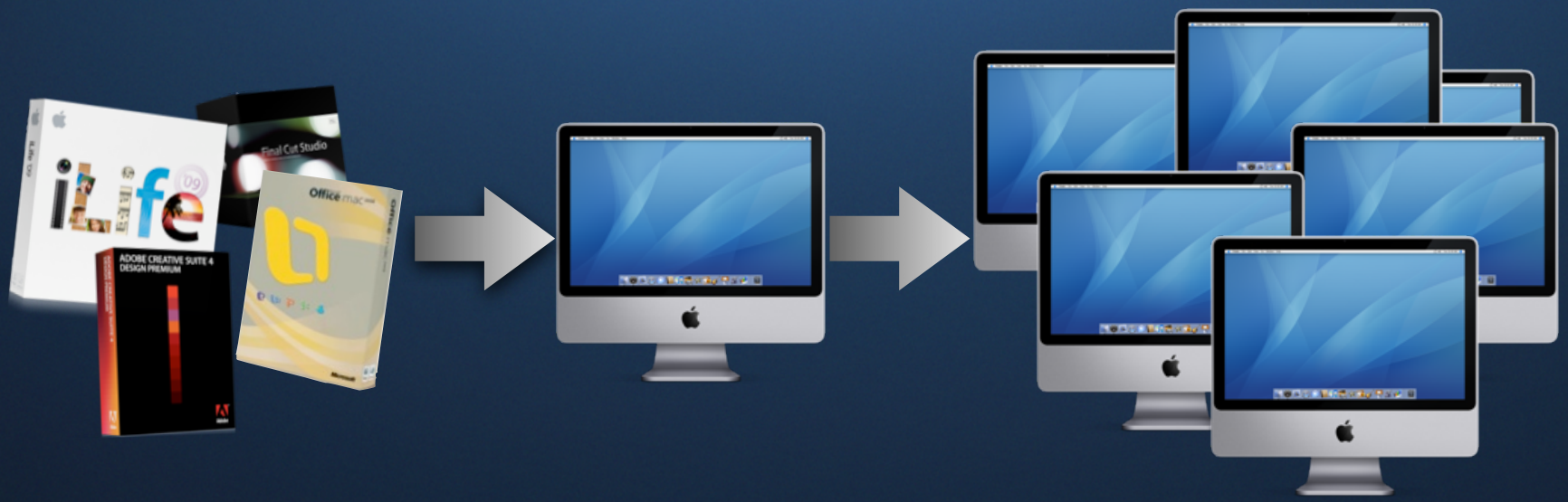
# Apple Tech Series
## System Imaging & Deployment

Steve Ragalevsky
Sr. Systems Engineer
sfr@apple.com


The Big Picture

# What's it all about

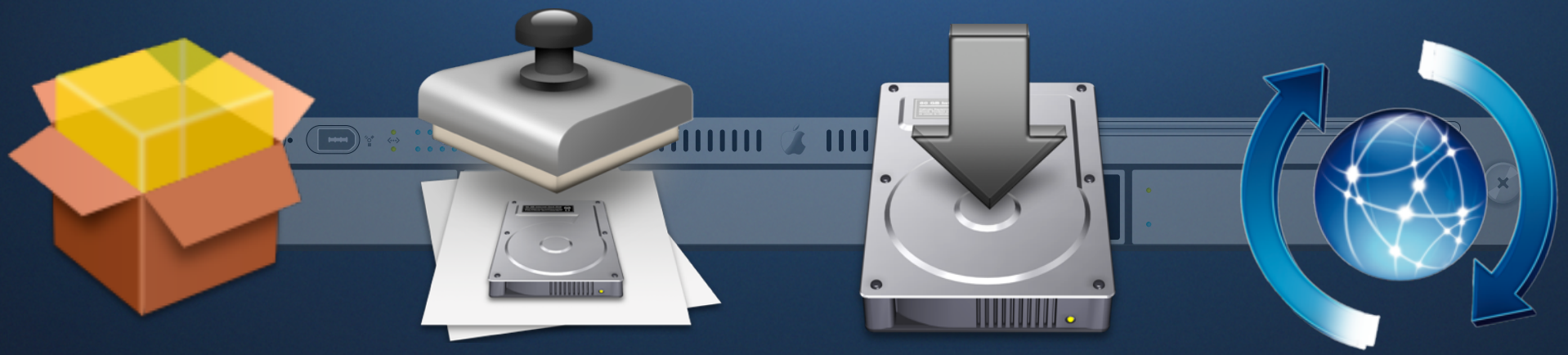
## From Software Distribution to Imaging



# Imaging Lifecycle Management

# The Software Imaging & Deployment Process

## Major steps



Preparation

Imaging

Distribution

Maintenance

# Terminology

UDIF

Image

HFS+

Boot Camp

Virtualization

NetBoot

Package

Payload

NetInstall

Remote Desktop

Hypervisor

Bundle

Receipt

Cloning

ASR

Multicast

Extended Attributes

PackageMaker

# What is an image?

"Disk images are files that behave like disk volumes"

# What is NetBoot?

"A service that boots clients over the network from an image that looks and acts like a mountable disk or volume and contains all the system software needed to act as a startup disk."

# What is NetInstall?

"Starts up the client computer long enough to install software from the image. The client can then start up from its own hard drive."

# What is Apple Software Restore?

"ASR (Apple Software Restore) is a tool that is used to clone disks and to restore a disk image to a machine's hard drive.

# What is a Package?

"Contains product files (the *payload*), instructions on how to add them to a Mac OS X-based system, and information used to create the install experience for the user."

## Use Cases

### Some scenarios we are covering

- Kiosk Systems or other isolated units
- Custom installed roll-out machines
- Classroom or Computer Lab
- Department installations

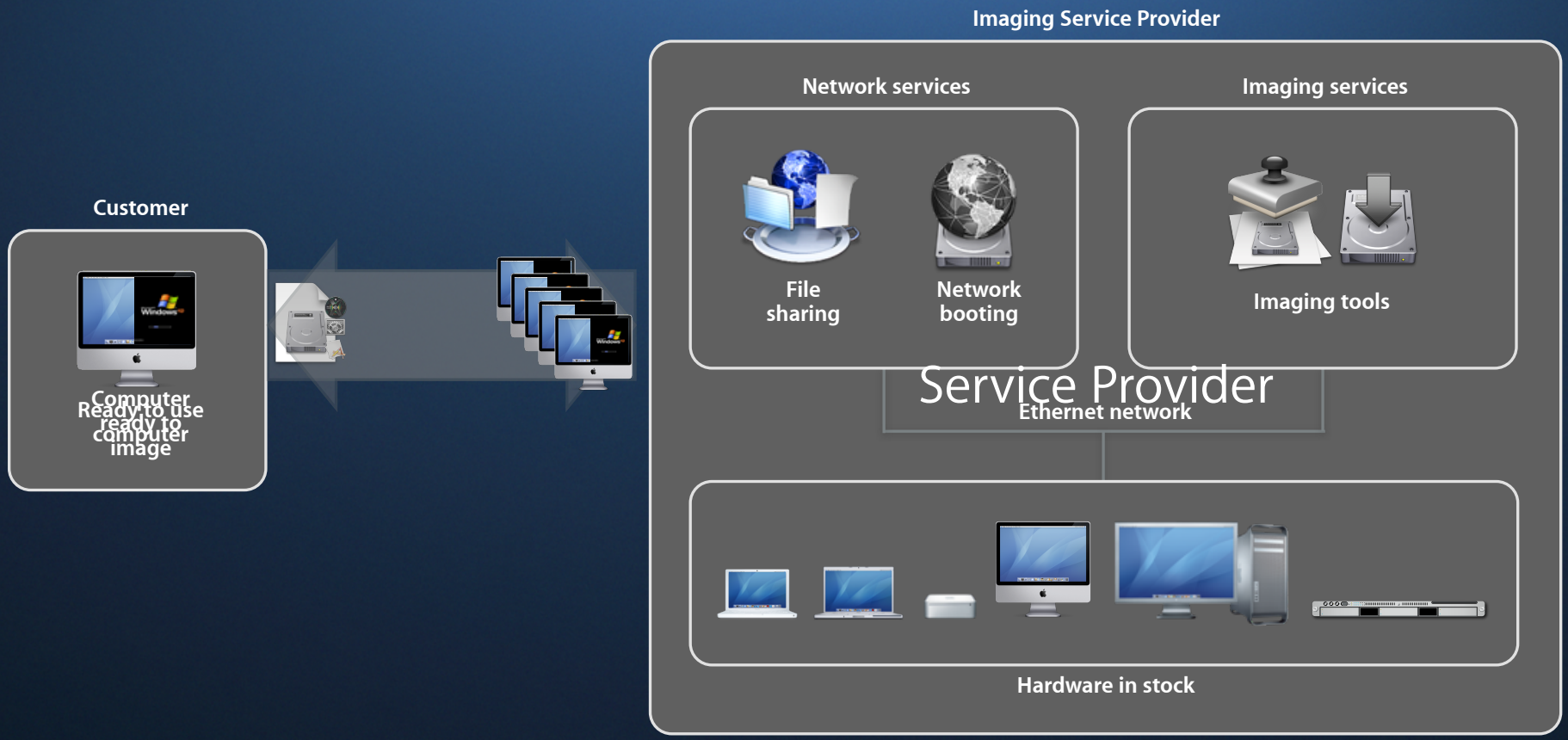
# Isolated Machines

## A Kiosk System Example

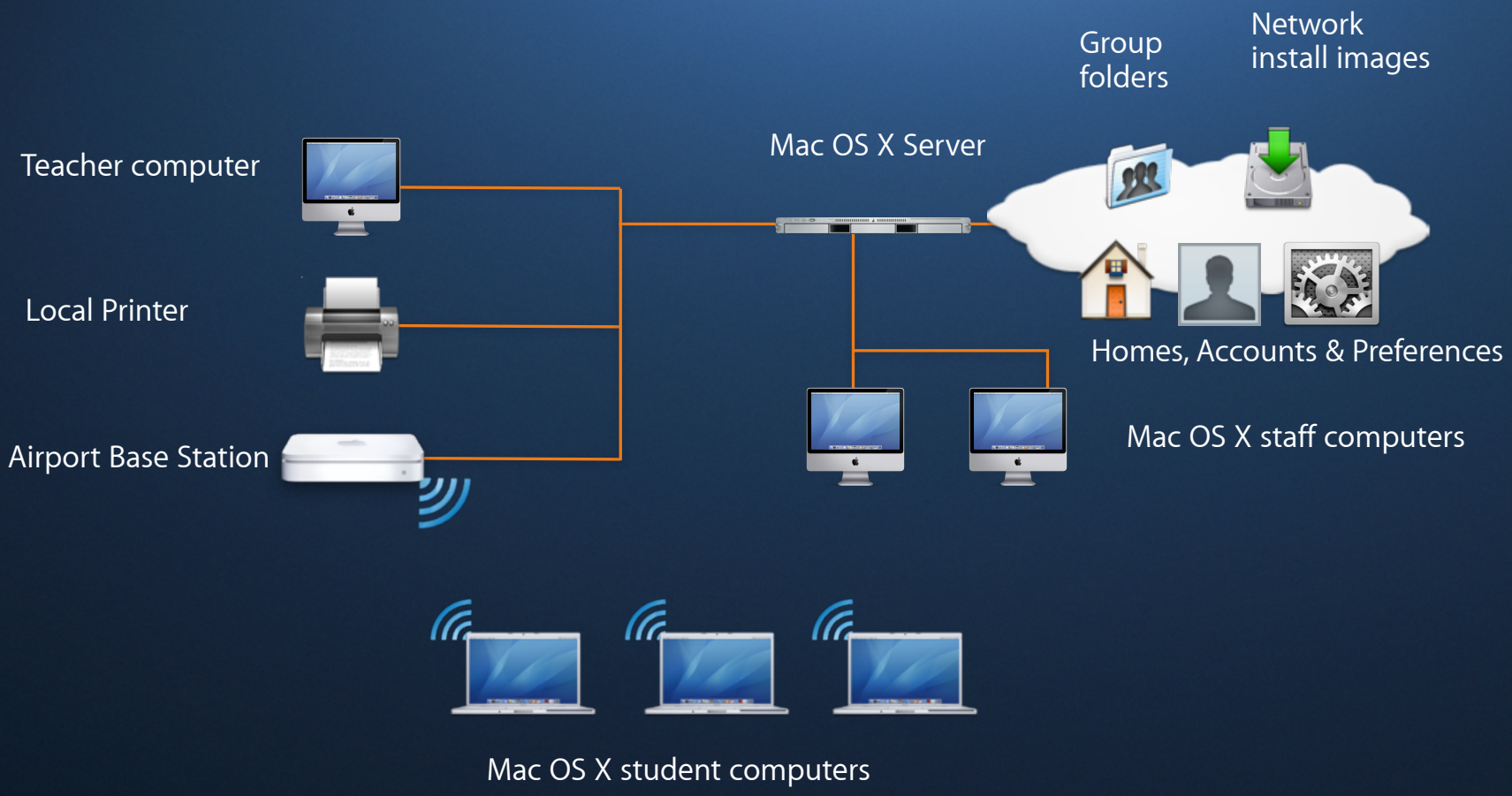
- Typical usage
  - Conference stands or public-facing machines
  - Restricted capability
- Considerations
  - Functionality
  - Security
  - Ease of Restoration
  - Useful tools

# Preinstalled machines

## Solution example



# Classroom or Lab

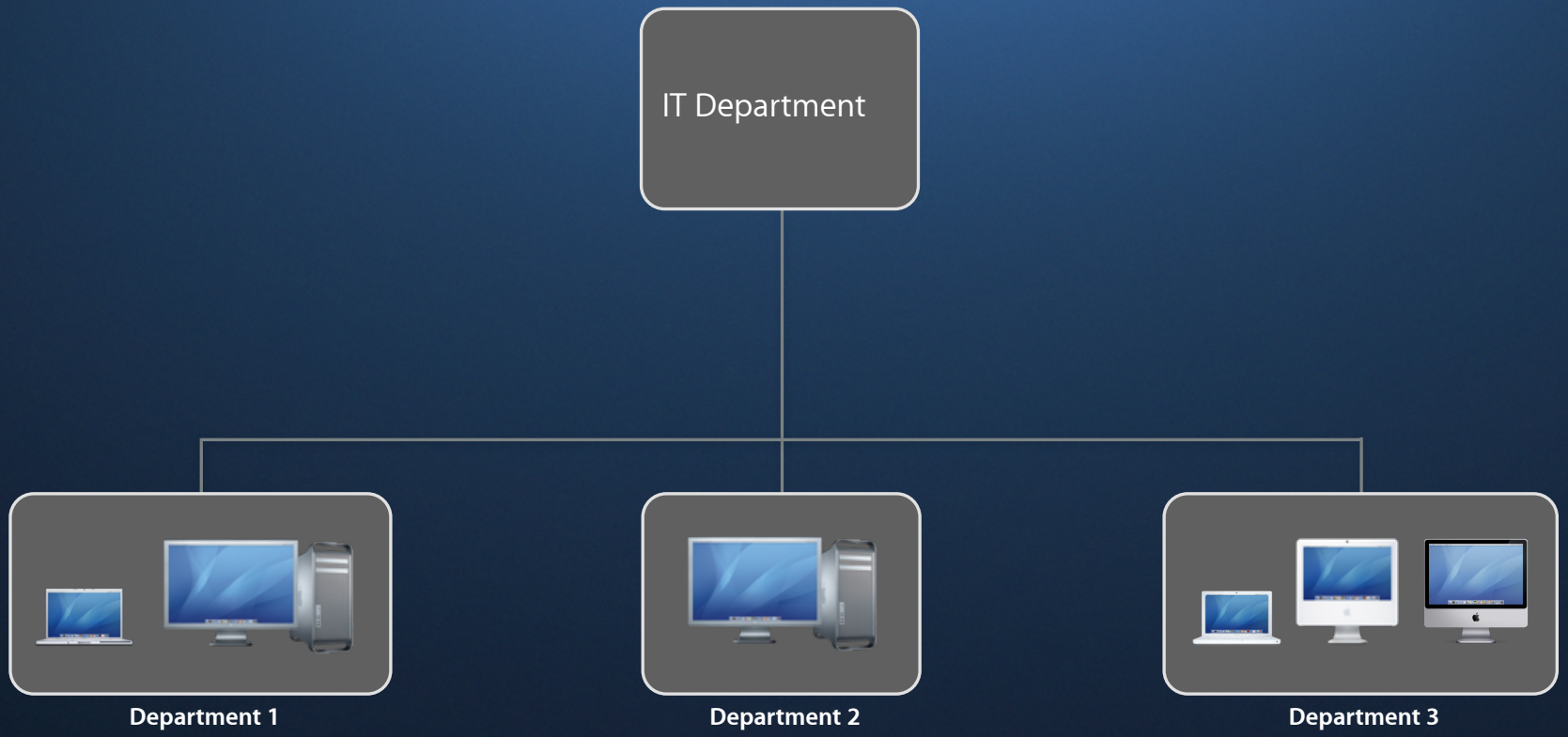


# Multiple Operating Systems

- Use of multiple OS is often needed in lab environment
- Two different strategies
  - Boot camp
  - Virtualization
- Licensing and activation issues

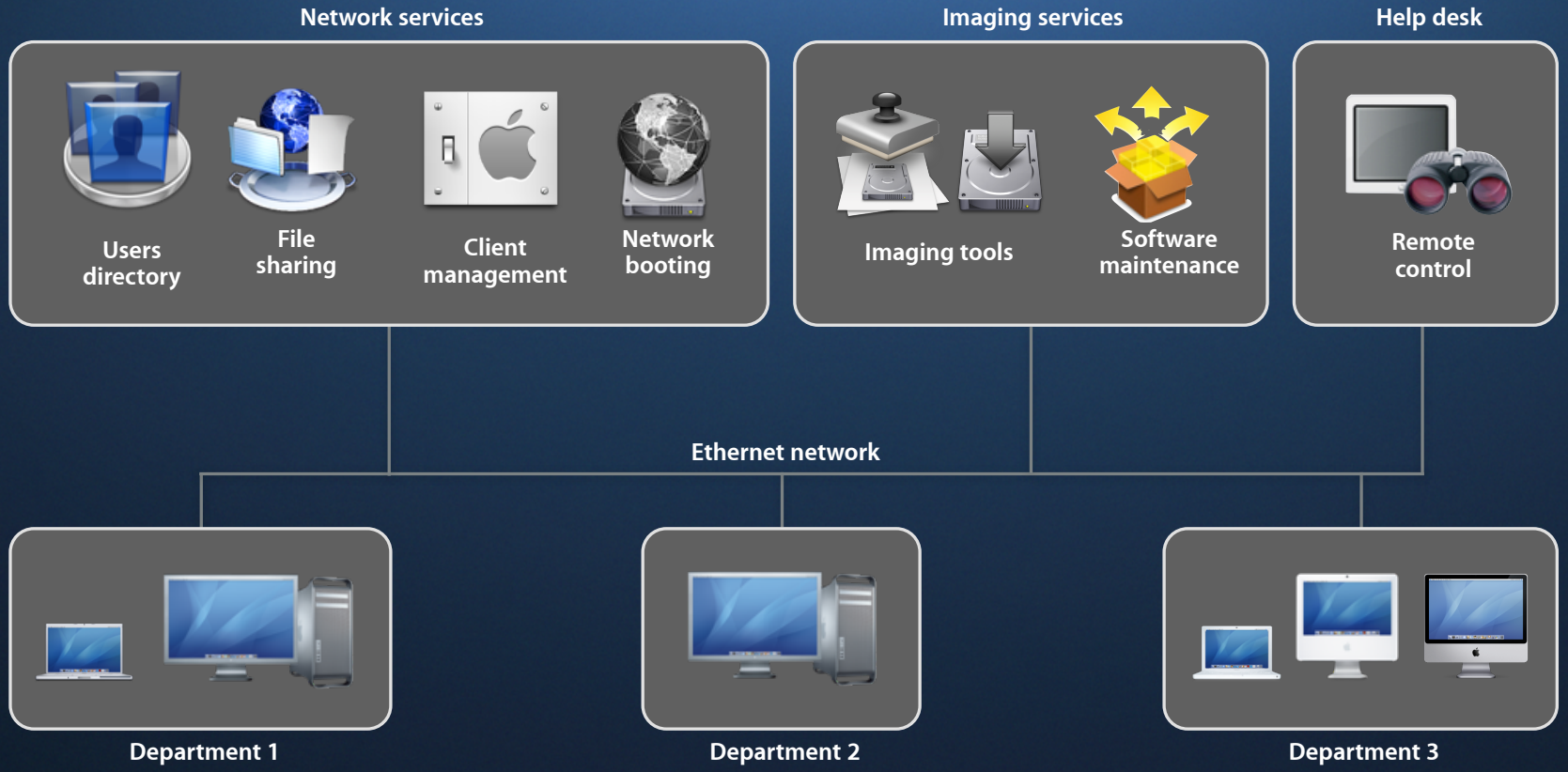
# Department installations

## Typical solutions acting together



# Department installations

## Typical solutions acting together



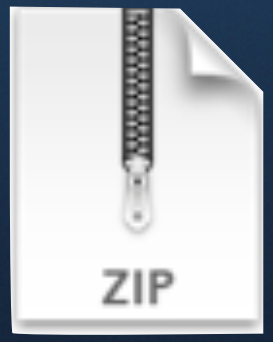

Software Distribution
& Packaging

# File Containers

## Built-in to OS X

- Archive file—This container file type allows you to store individual or multiple files and folders in a single compressed monolithic file.
- Disk image—This container file type allows you to store the contents of an entire file system in a single monolithic file. There are many disk image variations and options.

Disk Image.dmg




Archive.zip

When creating ZIP archive files using the Finder, the resource fork, bundle, and package elements are retained. However, the Finder does not preserve certain extended file attributes, such as file access control lists (ACLs), when creating ZIP archive files. The tar command in MacOSX v10.5, on the other hand, properly retains all file elements.

# Software Installation Techniques

## Drag & Drop installations


Drag to Install

# Software Installation Techniques

## Packages

Different Locations

Bill of Material (BOM)

# Software Installation Techniques

## 3rd party installers


Different Folders


Installed Files Listing

# Three Concepts

01 Package Making

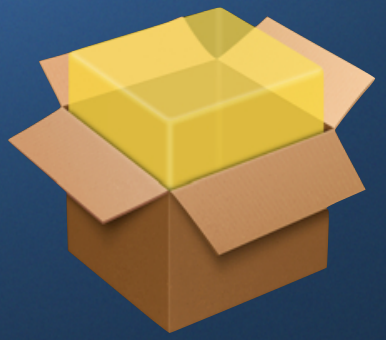
02 InstaDMG

03 DeployStudio

# What are packages

## Overview of Packages

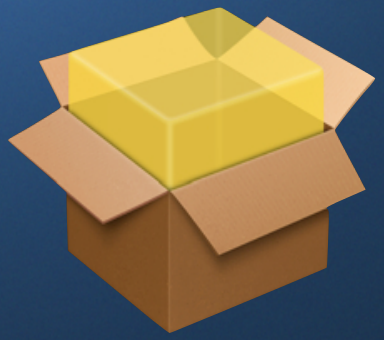
- Installation package files contain
  - Product files
  - Post/Pre/Upgrade Scripts
  - RTF files for the Installer's user experience
  - Installation requirement properties
  - Version + Copyright information



# What are packages

## Overview of Packages

- Delivery mechanisms
  - Hosted on a server for manual installation
  - SSH
  - Apple Remote Desktop
  - Third party tools
- Installation receipts
  - Stored in /Library/Receipts
  - Used by Disk Utility to repair file permissions

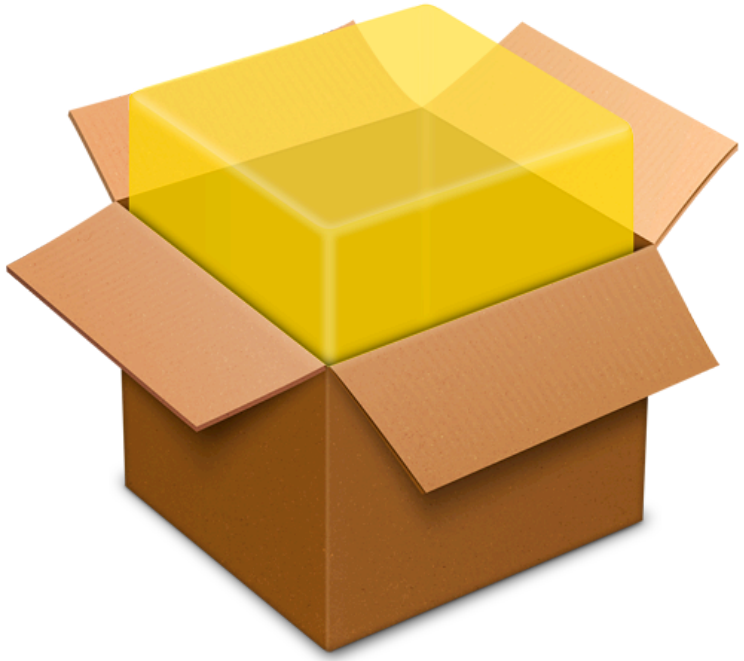


The repair permissions process uses the BOM information stored in the receipt database to determine the correct permissions for a specific list of system items. This list, known as the standard packages list, is set by Apple and repairs only items that are part of the standard MacOSX operating system.

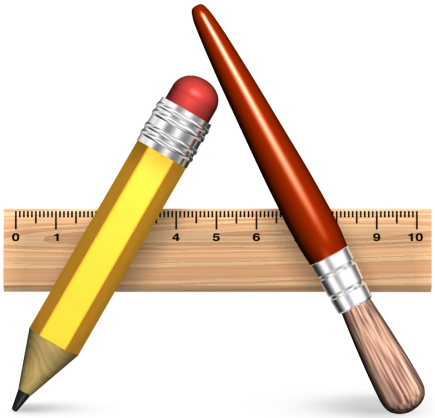
# Packages

## Types and payload of packages

- Single package
- Multiple packages (MetaPackages)
- Can contain (one or all of …)
  - Applications
  - Folder structures with/without files
  - Scripts



# What Can We Package?


0
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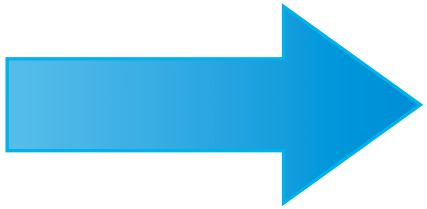
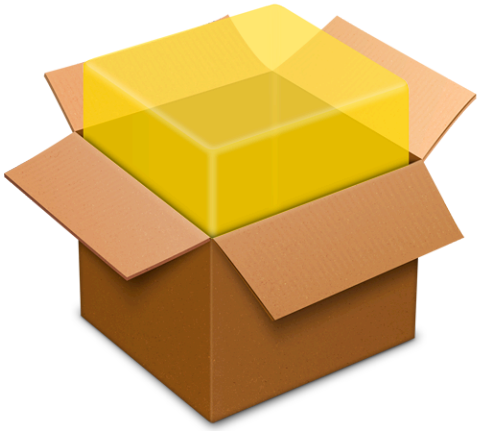
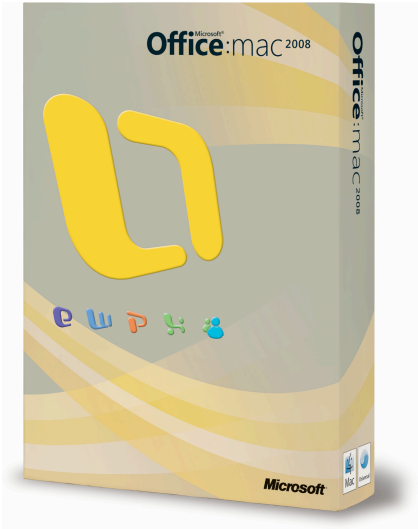
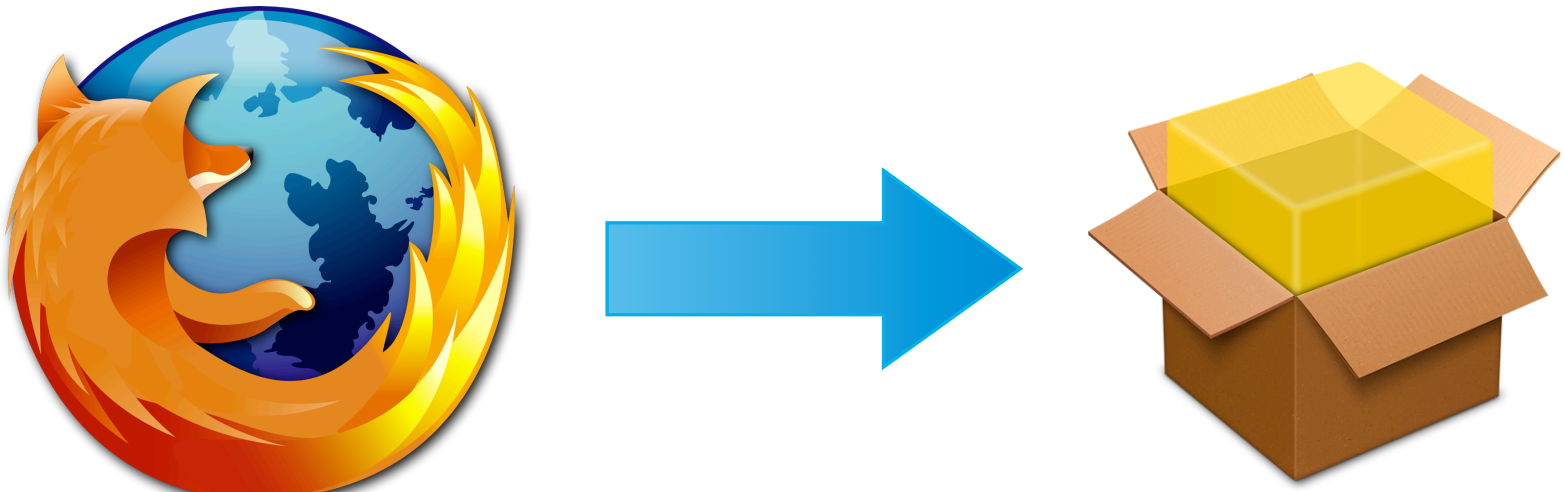
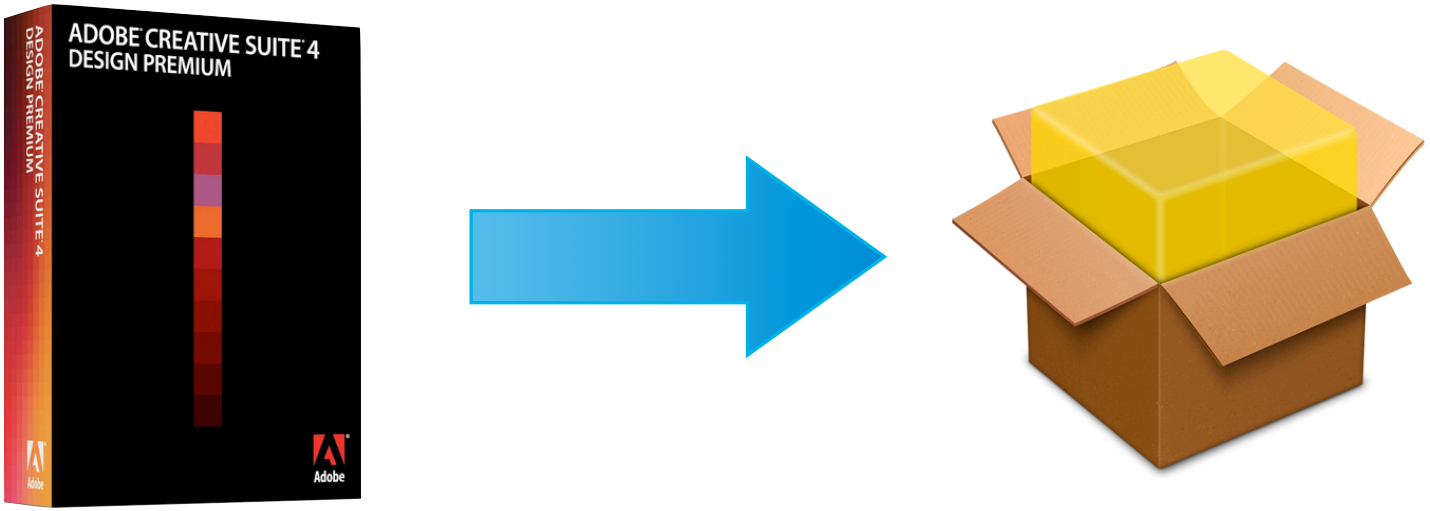
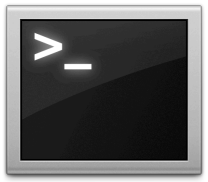





Office:mac 2008
Office:mac 2008
Microsoft




ADOBE CREATIVE SUITE 4
DESIGN PREMIUM
Adobe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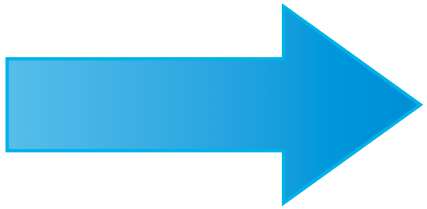
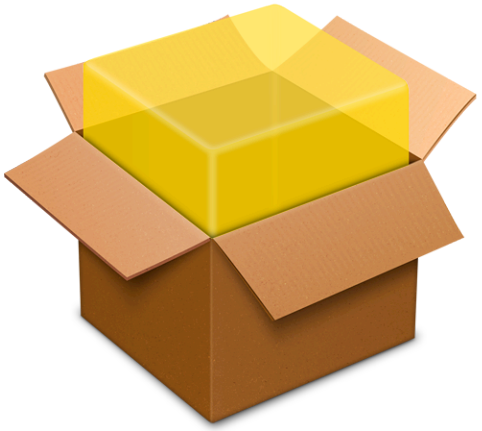
PLIST





# Use Packages

# Packages

## Available build tools

- PackageMaker
- Iceberg
  - Free
- InstallEase
  - Free, part of the LANrev management suite
- JAMF Composer
  - Commercial, part of Casper tools
- VISE X 3
  - Commercial, proprietary installation architecture

# Demos

# Summary

## Using PackageMaker for

- Re-Packaging a drop in Application (e.g. from DMG)
- Re-Packaging a system change after custom installation
- Creating a payload free package

# Apple Remote Desktop

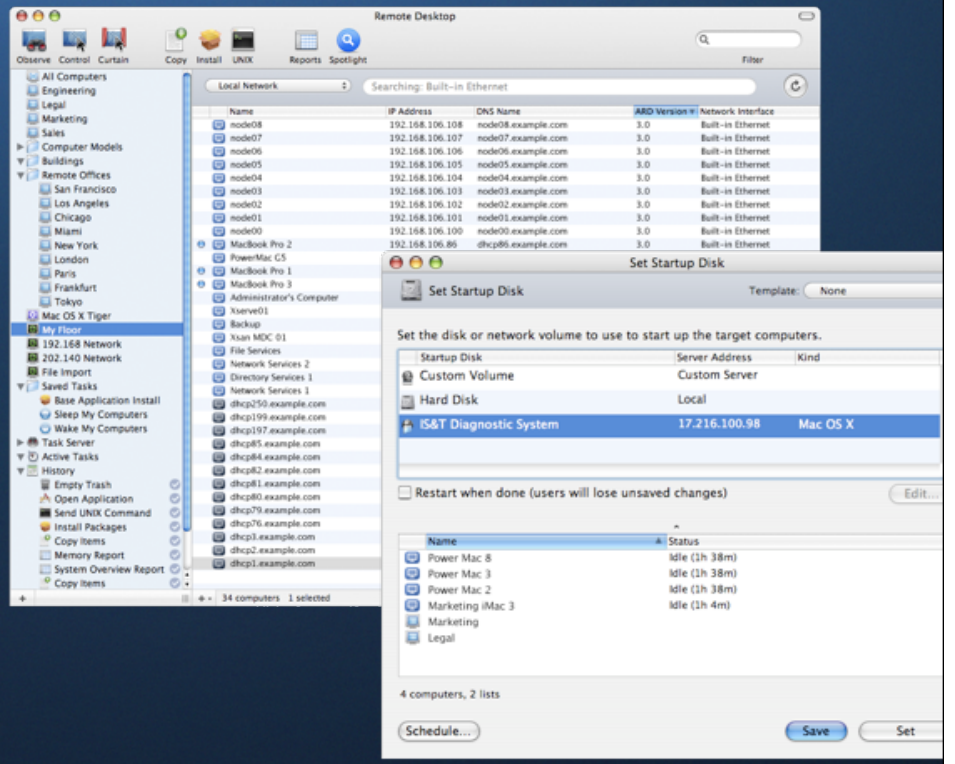
## Core Features for Software Management

- Group machines for management
- Automatically track installed software
- Search for data of any kind with Spotlight
- Easily copy software in multi-cast mode
- Execute any UNIX tasks
- Automate everything for fast re-use of workflow tasks
- Let Task Server handle your orders even for off-line clients

# Remote Administration

## Common tasks

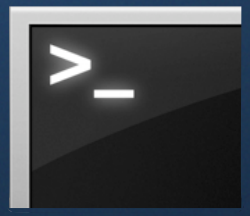
- Rename computers
- Set Startup Disk
- Send UNIX commands



# Send UNIX command

## Using the power of the command line

- Encrypted execution of shell scripts
- Use any available tools to the client
- ARD CLI tools now at system level
  - networksetup
    - `/usr/sbin/networksetup`
  - systemsetup
    - `/usr/sbin/systemsetup`
  - kickstart
    `/System/Library/CoreServices/RemoteManagement/ARDAgent.app/Contents/Resources/kickstart`



# Tasks

## Repeatable Activities

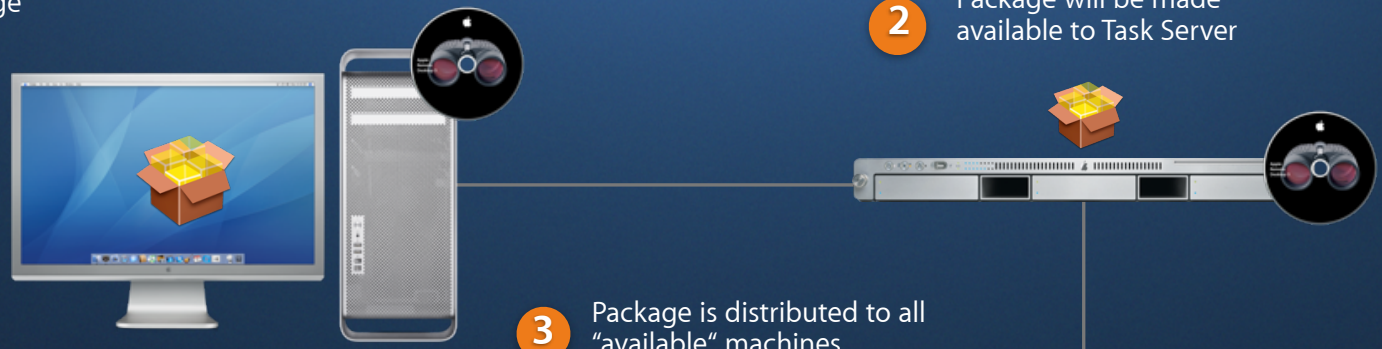
- ARD keeps track of a history of the tasks performed
- These tasks can be rerun at any point
- Also possible to save tasks as a template for later use
  - These show up in the Saved Tasks area of the sidebar
  - Task notification scripts can be executed on completion - a default script sends out notification mail to admin....

# Package Distribution

## Wired and Wireless

1. Administrator decides to distribute a package

2. Package will be made available to Task Server



3. Package is distributed to all “available“ machines

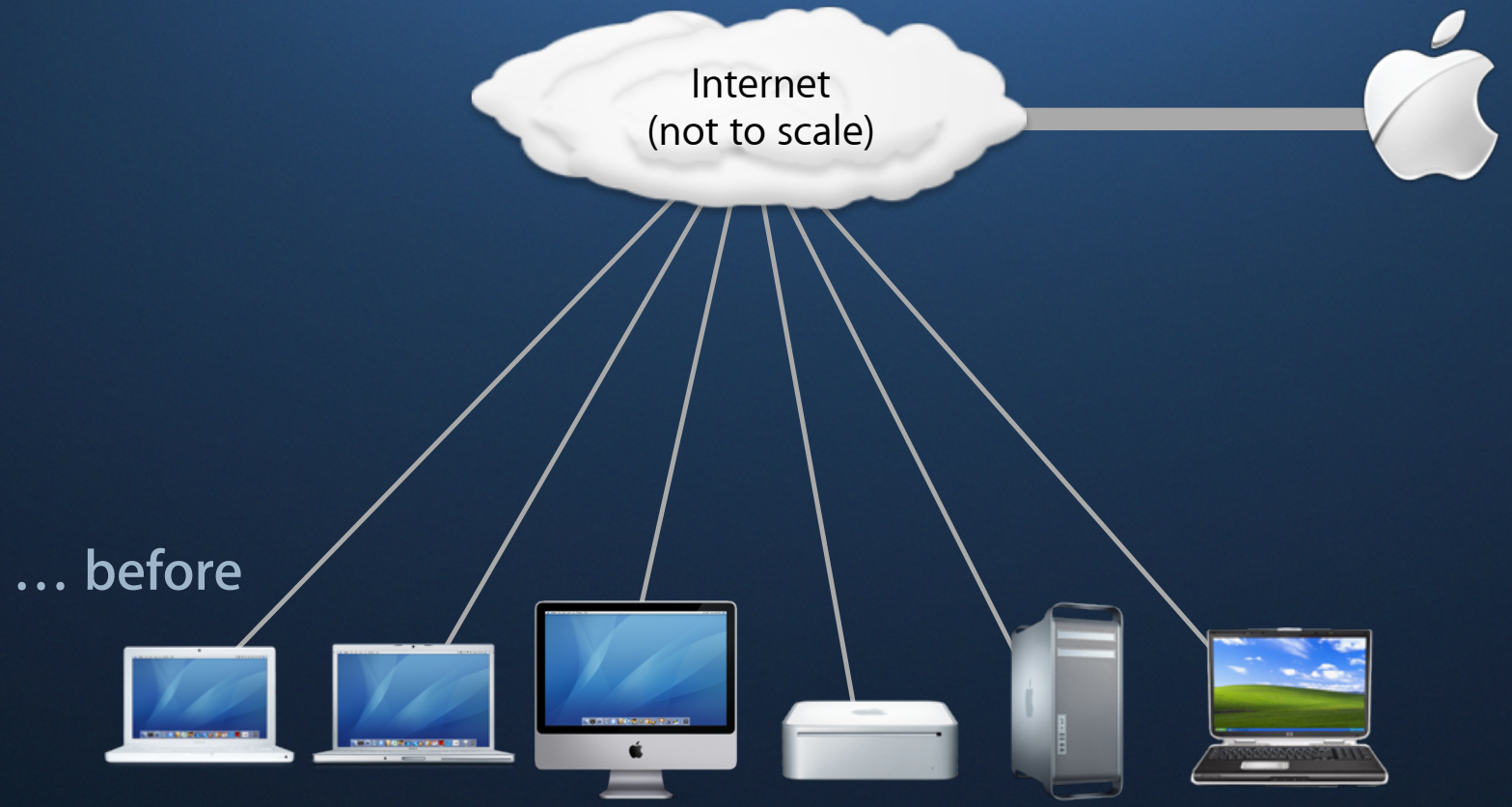
4. If a machine becomes available later on, it will be covered, too.

# Demo - ARD

**Simple** **Complex**

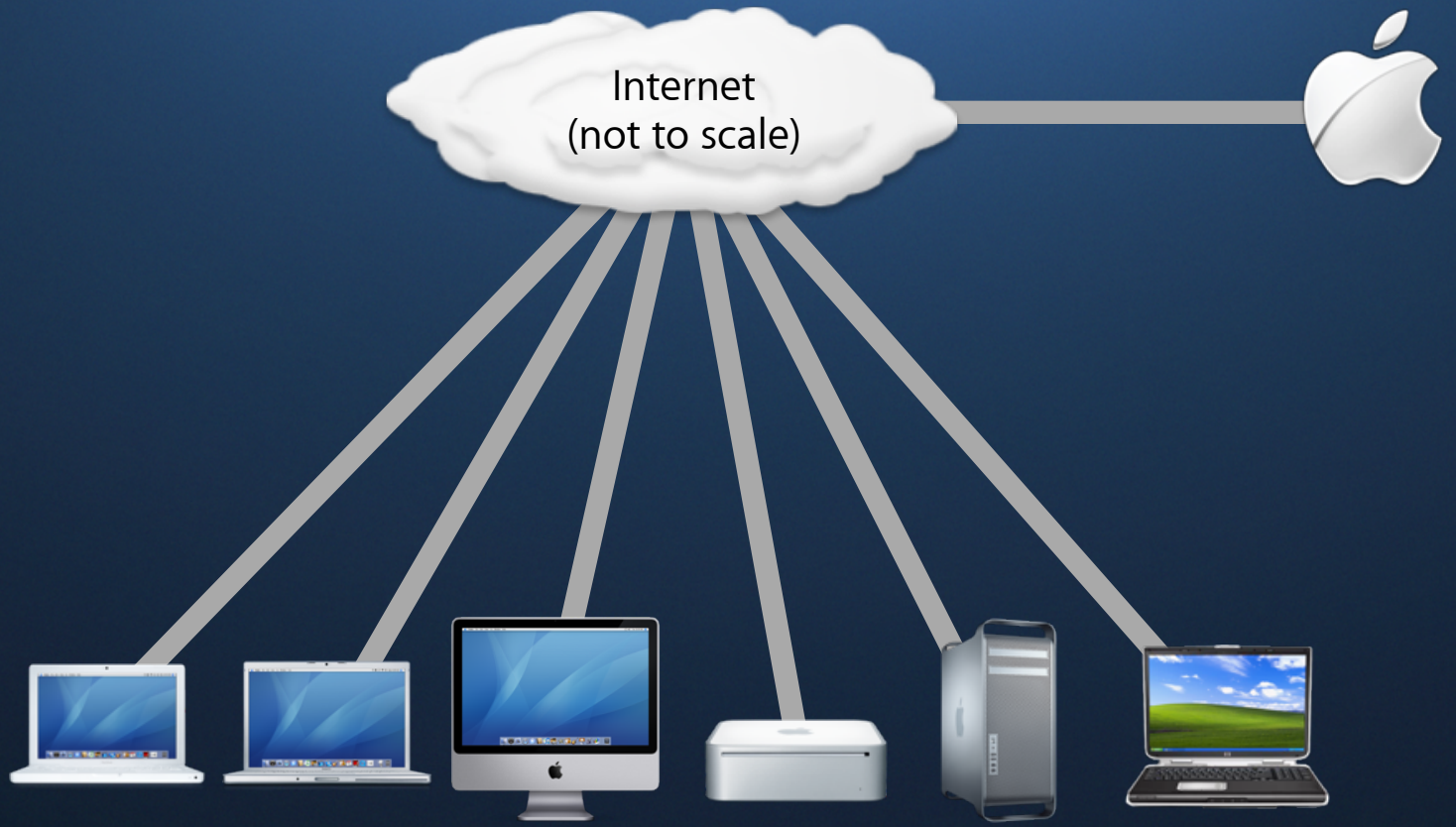
| Users | Software Update Server | Build your own SUS | Apple Remote Desktop | Commercial Solutions | radmind |
|---|---|---|---|---|---|
| "self-updating" | Only the updates you want<br>Reduced network needs | Update anything | Automation<br>Task Server | Fully automated<br>No local boot<br>Many image options | More things than you would ever want to do |
| Users have to be admins<br>Don't know if they've done it or not | Only Apple updates | Work to script<br>Updating the system is hard | Server<br>Networking needs | Server<br>Knowledge | More things than you would ever want to do |
| 1 hr<br>write a memo | 2 hr<br>read the manual | 1 week<br>learn to script | 1 day<br>purchase ARD | days to weeks<br>talk to vendors | months<br>forget your day job |

# Software Update Server



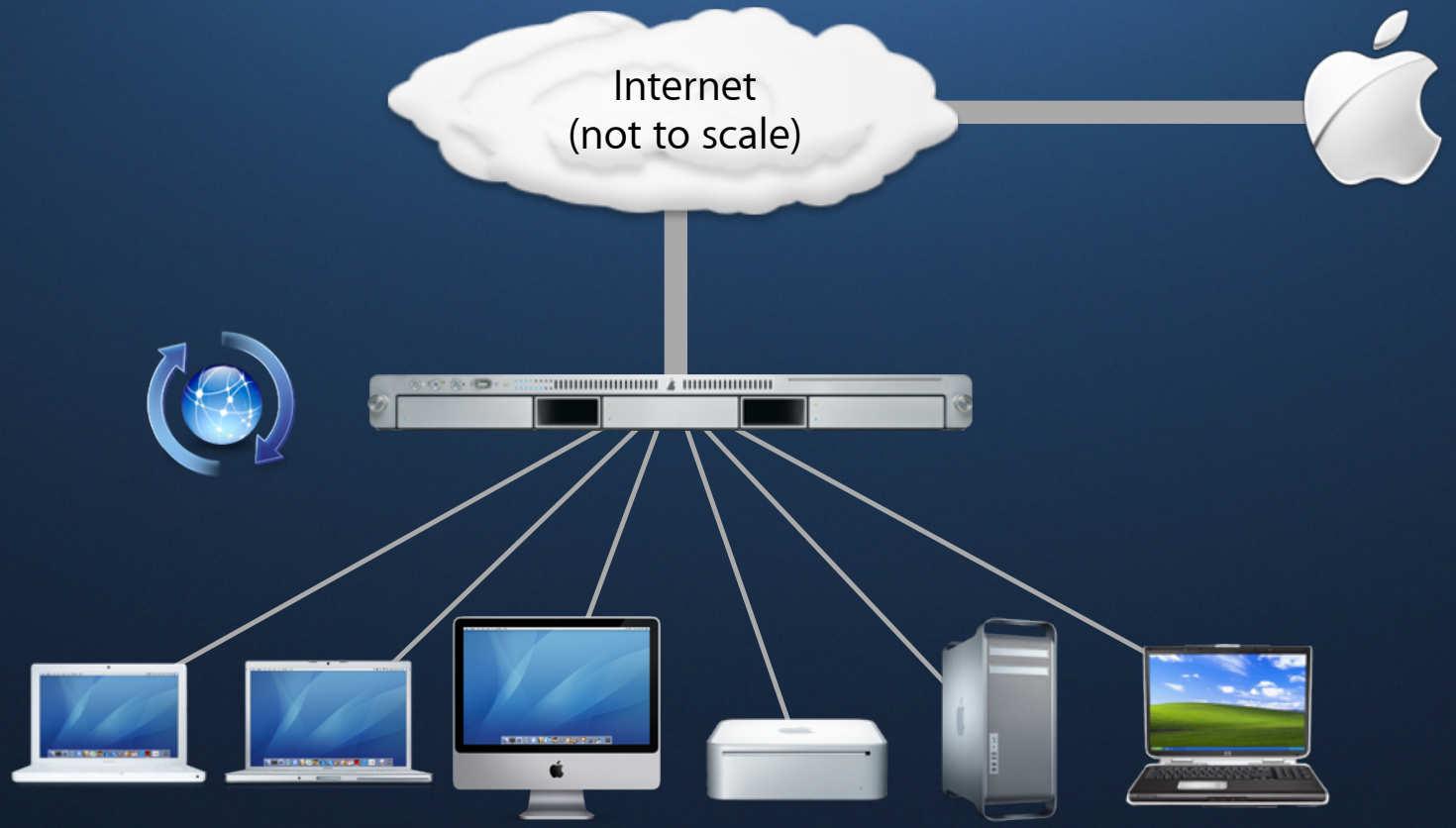
# Software Update Server

… before



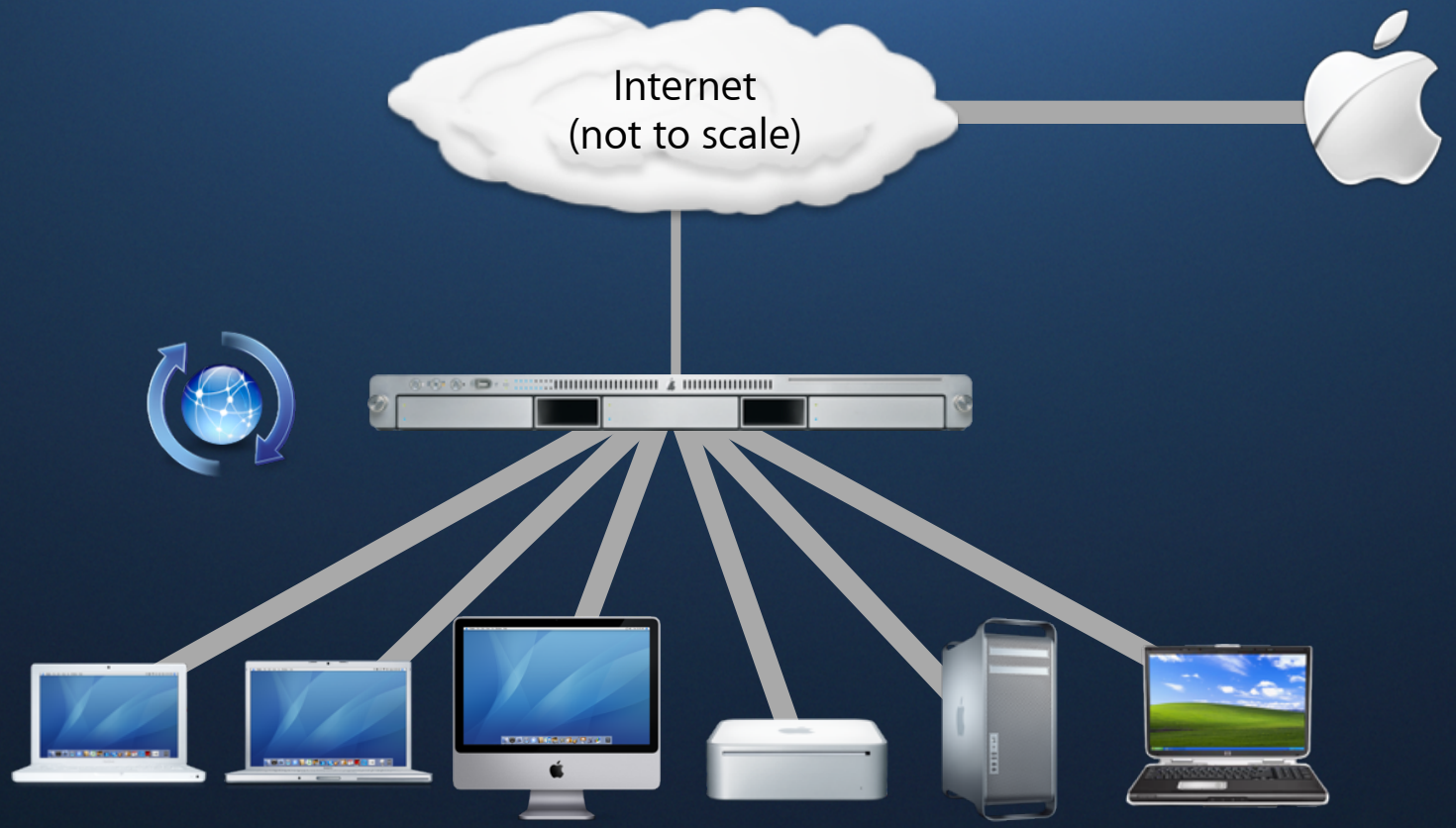
# Software Update Server

… after



# Software Update Server

… after



# Software Update Server

# Software Update Server

## What's new in Leopard Server

- Sync daemon rewritten for Leopard
- Tiered hierarchies of SUS now supported
  - `metaindexURL` key in `swupd.plist`
  - default points to `swscan.apple.com`
  - Downstream servers only see updates enabled in upstream server
  - If you have a load balancer, SUS can be redundant to clients
- Support for "revocation" updates
  - Tells downstream SUS to remove an update from catalog, index and cache

# Software Update Server

## Planning

- Networking

| < 10 clients | 10 - 50 clients | > 50 clients |
| --- | --- | --- |
| 100 Mb Ethernet | **100 Mb Switched Ethernet** | **Gbit Ethernet** |

- Capacity
  - Hard disk space on server volumes
  - Number of Ethernet ports on the switch
  - Number of SU servers on network

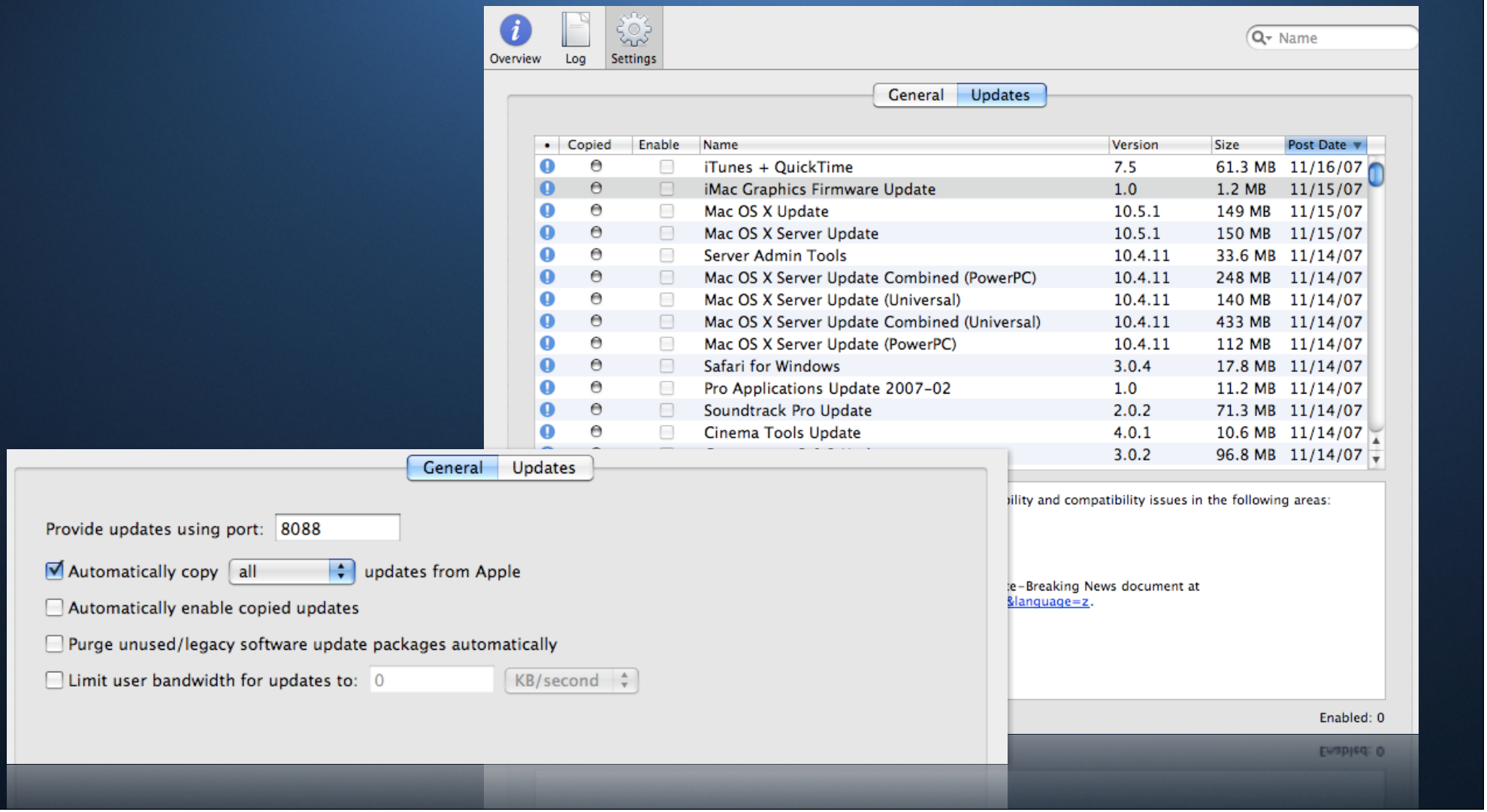
# Software Update Server

## Planning with Imaging

- Policy implementation
  - Maintain software update policy
  - Provide all or part of Apple's software update?
  - Restrict access by disabling automatic mirror-and-enable functions in General Settings pane
- Client configuration
  - Enable and set server for software updates via managed client setting
  - Use `defaults` command for unmanaged clients:

```
$ sudo defaults write \
  com.apple.SoftwareUpdate CatalogURL
                          http://myserverURL:8088/
```

# Software Update Server




Demo - SUS


System Imaging for
Setup and Booting

# Image formats

"A disk image is a computer file containing the complete contents and structure of a data storage medium or device, such as a Hard drive, CD or DVD."

# Images formats

## UDIF

- Native Mac OS X disk image format
- Types
  - Read only with compression or encryption options
  - Read/Write with a fixed size or sparse
- Supported file systems:
    - HFS flavors
    - MS-DOS
    - UFS

# Images formats

## Other formats

- Boot Camp enables installation of third party operating systems
- Tools available for Mac OS X will produce:
  - Raw disk images (out-of-the box)
  - Proprietary format disk images (third party tools)
- Cons
  - Larger disk images
  - Longer imaging / restoration duration
  - No multi-cast support

# Image formats

## Mac OS X supported disk images formats

| Format | Mountable | Multi track | File System | Extension |
|---|---|---|---|---|
| **UDIF** | Yes | Yes | HFS flavors<br>MS-DOS<br>UFS | .dmg<br>.sparseimage |
| **ISO** | Yes | No | ISO9660 | .iso<br>.cdr |
| **IMG** | According File System | Yes | Whatever | .img |

# Well Known Imaging Tools

- Disk Utility
- System Image Utility

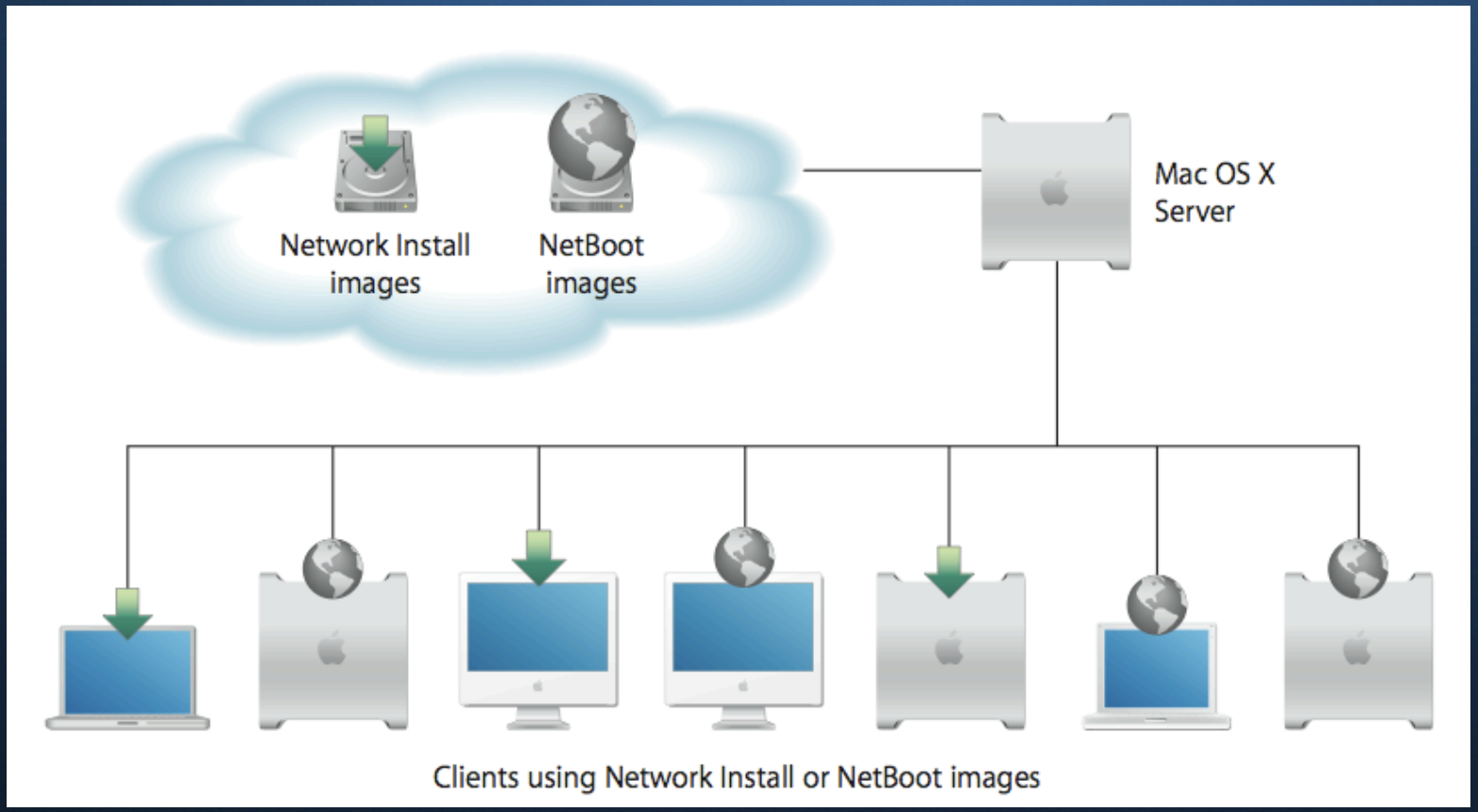
# System Image Utility

## What's new in Leopard

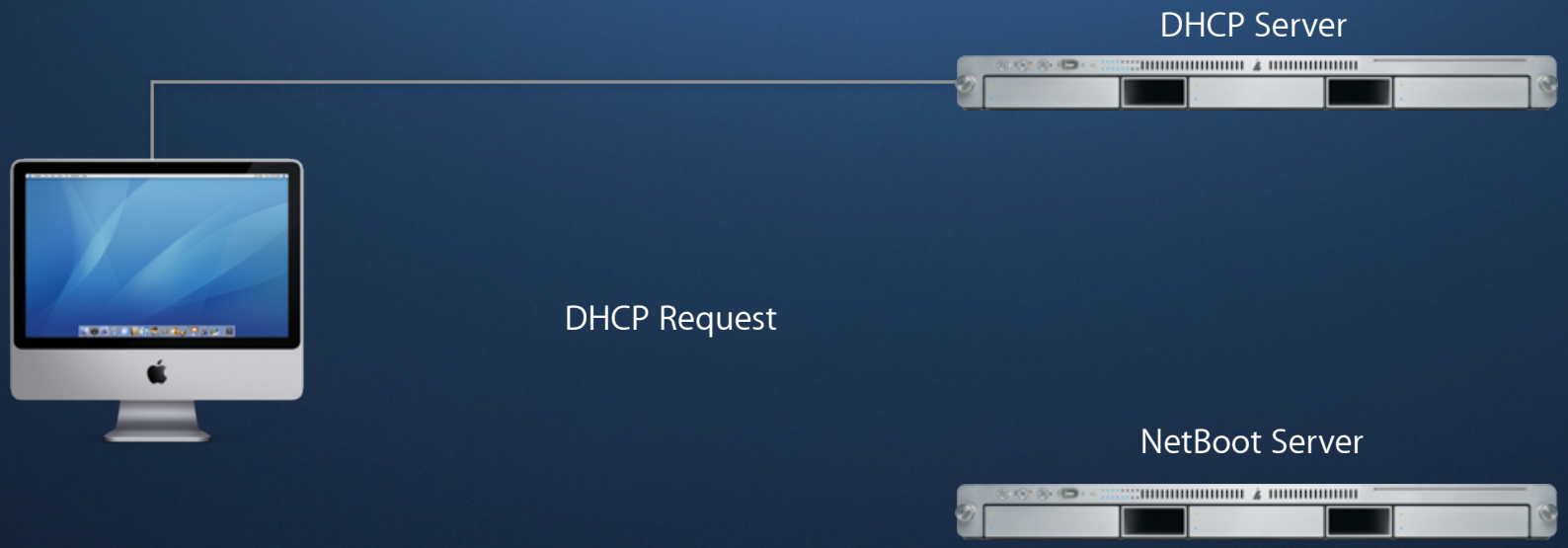
- System Image Utility Assistant
- Workflow based editor
- Automator actions
- Boot Camp support
- Command-line image creation

# Install, Boot, Restore

## From booting and fresh install to cloning



# NetBoot/Install/Restore



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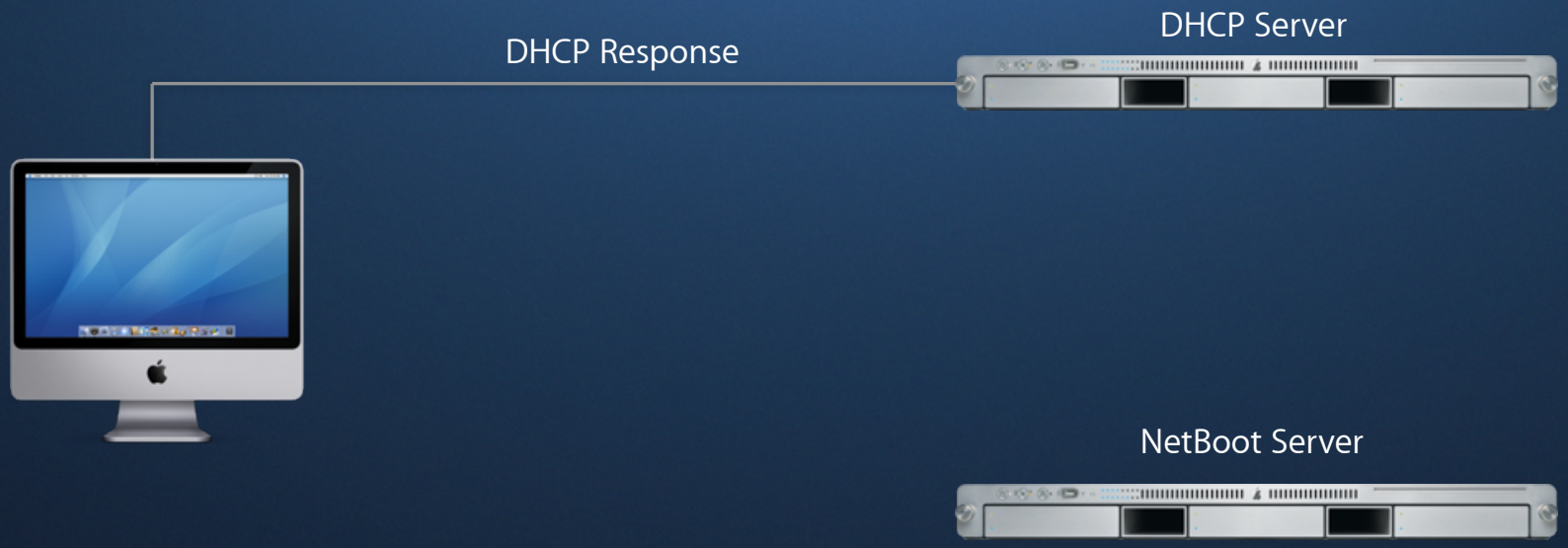
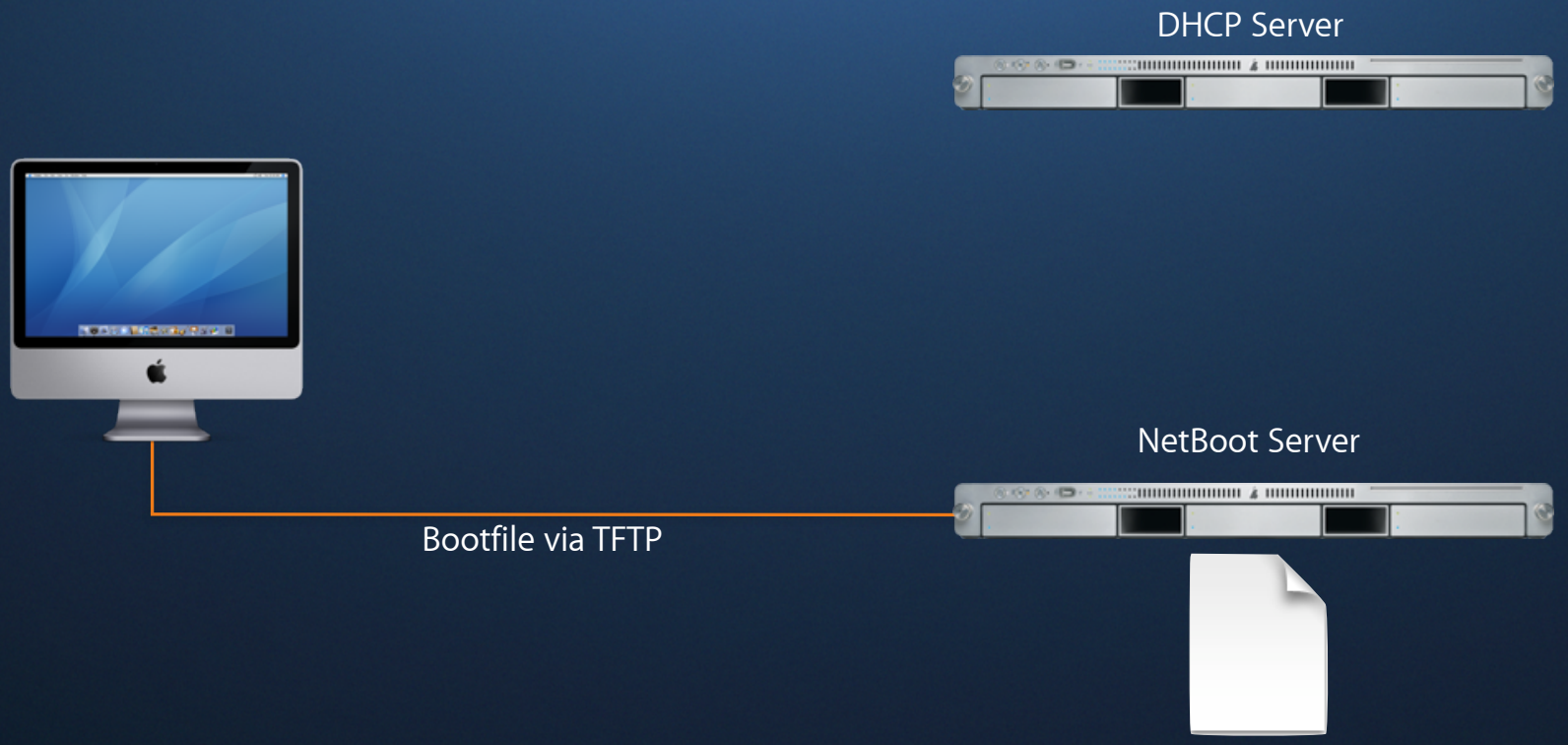


# NetBoot/Install/Restore

# NetBoot/Install/Restore



# NetBoot/Install/Restore

# NetBoot

## Characteristics

- User's perspective
  - Slower Boot and initial application starts
  - System is changeable, user has full access
- Administrator's perspective
  - System doesn't actually change
  - Cannot be accidentally or maliciously damaged
  - Image returns to original condition at startup

# NetInstall

## Differences from NetBoot

- Technically the same booting process
- Startup with OS installer
  - Completes OS installation with additional tasks
  - Image prepared (scanned) specifically for installation

# NetBoot vs. NetInstall

- Use NetBoot when...
  - You want to discard changes *every time* the machines are restarted
  - You want to test NetInstall images first on multiple hardware
  - Serve specific client environments
  - System is online all the time

- Use NetInstall when...
  - You want to reimage a computer periodically
  - Startup time matters
  - System is likely to be disconnected from network

# Three Concepts

01 Package Making

02 InstaDMG

03 Deploy Studio

# Creating Images

# Cloned

# Modular

# The Traditional Way

## Monolithic Image Creation

# Monolithic Image Creation

## Basics

- Block out 3-5 days in your calendar
- Build a “Golden Master” machine
- Do some sociability and environmental testing
- Launch Apps
- Check connectivity & behavior
- Clean up machine and user-specific cruft
- Deploy to group of pilot users
- Repeat each time you need to revise

# Monolithic Image Creation

## Updating master

- Block out 3-5 days in your calendar
- First approach
  - Build a new master with the new machine OS version
  - Test on old hardware
- Second approach
  - Wait for next software update
  - Apply to old master
  - Test on new hardware

# Monolithic Image Creation

## Discussion

- Pros
  - Fastest way to restore a Standard Operating Environment (SOE)
  - Easy method for one shot deployments on homogeneous hardware
- Cons
  - No guarantee a single image works on all machine types
  - Doesn’t work all the time
  - Multiple masters to maintain
  - Time consuming

# Leveraging Packages

## Wrapping customizations into packages

# Leveraging Packages

## Benefits

- Repeatable way to customize the system and user environment
- Reduces dramatically hardware dependency
- Fine grain maintenance

# Leveraging Packages

## Benefits for update maintenance

- Core system
  - Apple Software Update
- Applications
  - Update package
  - Reapply **or** distribute
- Settings & Scripts
  - Update package
  - Reapply **or** distribute

# Packages for Imaging

## Core system production workflow

- Core system install
- Software update
- Imaging

# Packages for Imaging

## Combined installation process

- Core system block-copy restoration
- Packages install (applications and customizations)

# Hybrid Image Creation

## Efficient master production workflow

- Core system install
- Software update
- Packages install (applications and customizations)
- Imaging

# Automating Workflows

## Efficient master production workflow

# System Imaging

## More tools

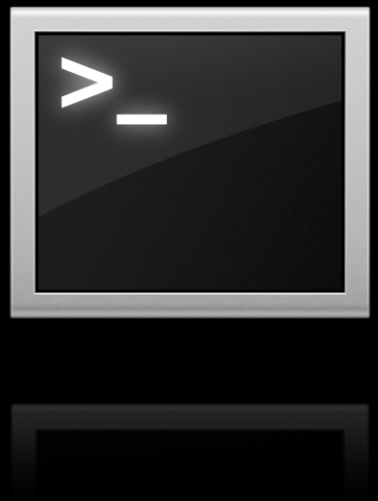
- Tools for imaging and deployment
  - asr
  - hdiutil
  - diskutil

- Automator
  - Gives access to System Utility Application
  - Can combine Shell + GUI Workflows

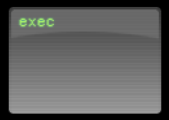
# InstaDMG

www.afp548.com

- Modular System Image Creation
- Un–booted Mac OS X Images
- Machine Independent Build Train
- Uses Apple's Native DMG/Installer Formats
- Can Be Deployed Universally
- Images Easily Updated



# Structure




instadmg.bash

BaseOS Folder

InstaUp2Date Folder

InstaUp2DatePackages Folder


InstallerChoices.xml

# InstaDMG Folders

BaseOS Folder

OS X Retail DVD

GOLDEN TICKET!

InstaUp2Date Folder

Catalog Files

InstaUp2DatePackages Folder

Custom Installer Packages

# InstallerChoices.xml

- Provides Installer Customization
- Located In The Installers Folder
- Same As Checking/Unchecking Installer Options
- Works With Any Apple Package Format Installer
- OS X v10.5 Only

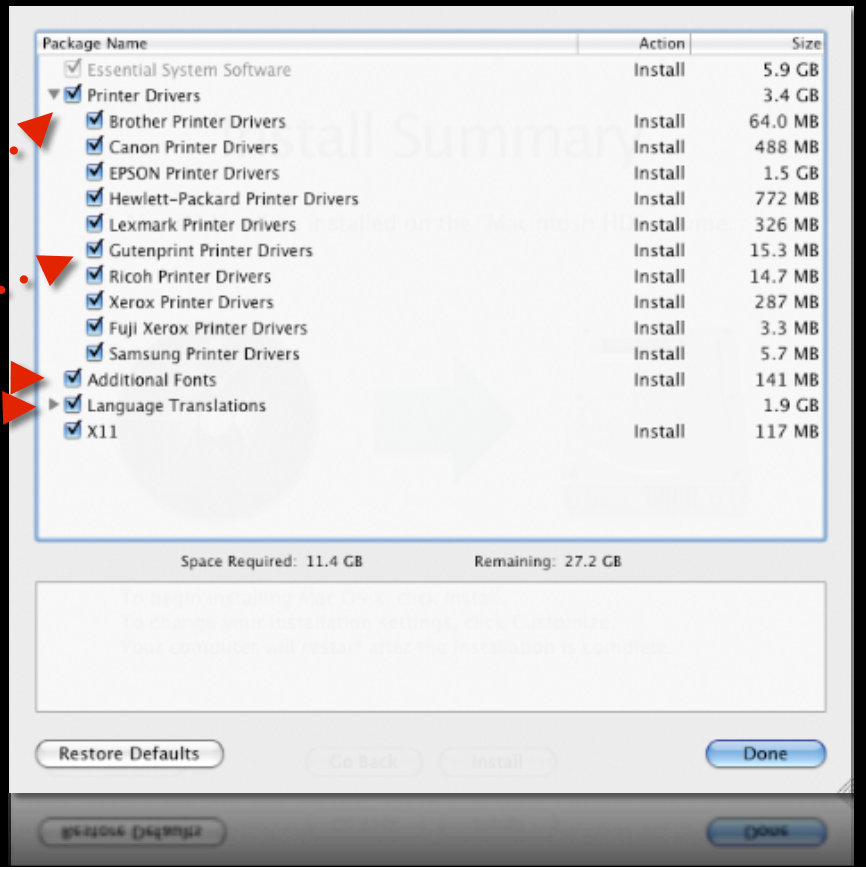
# InstallerChoices.xml


```
<array>
    <string>PrinterDriversGroup</string>
    <string>Guten_Printer_Drivers</string>
    <string>AdditionalFonts</string>
    <string>LanguageTranslations</string>
</array>
```

# InstallerChoices.xml


InstallerChoices.xml

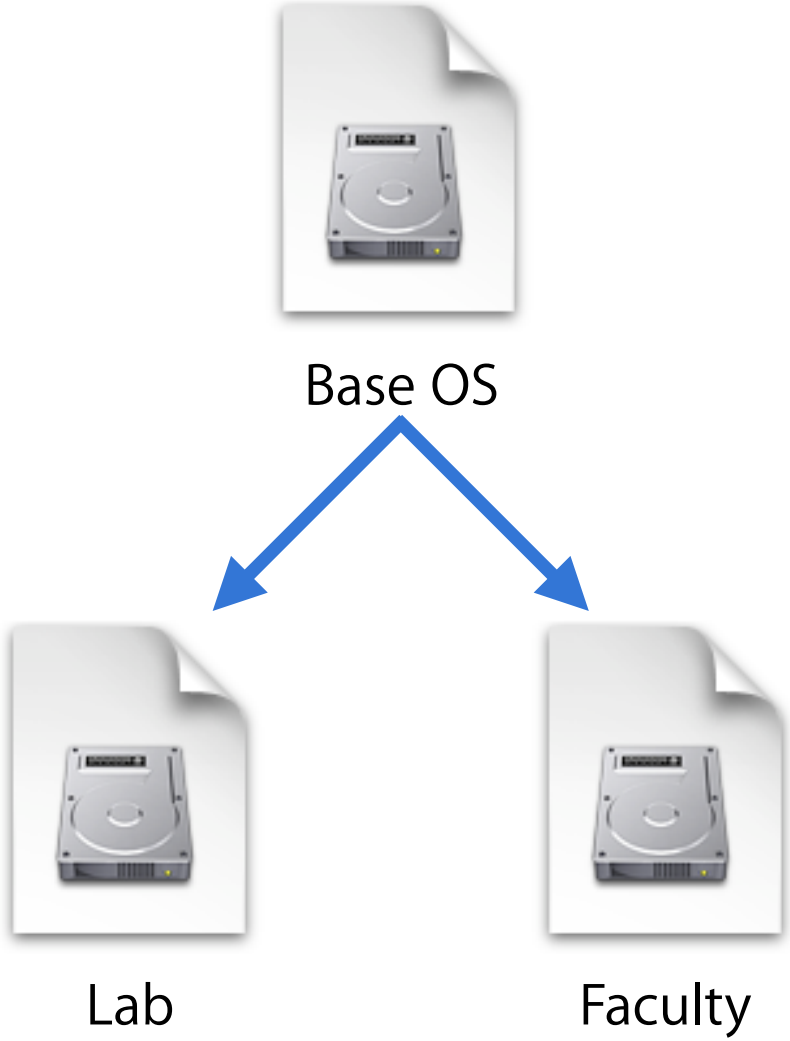
```
<array>
     <string>PrinterDriversGroup</string>
     <string>Guten_Printer_Drivers</string>
     <string>AdditionalFonts</string>
     <string>LanguageTranslations</string>
</array>
```

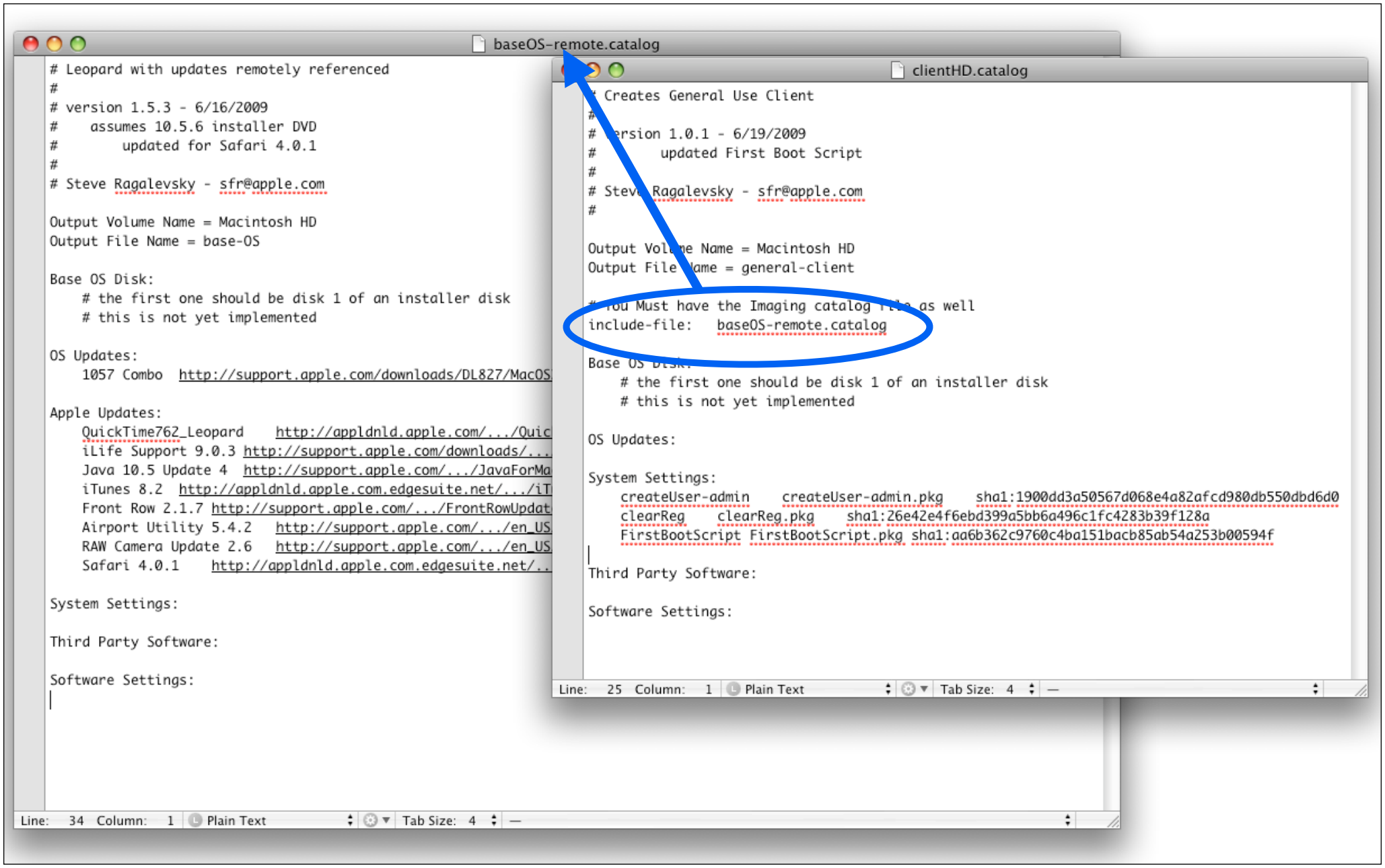


# InstaUp2Date

## Further Simplifies

- Catalog files build a customized image
  - Create additional layered images
- Remote download of packages
  - Easy to share
- Utilize checksums
  - Never corrupted




baseOS-remote.catalog
# Leopard with updates remotely referenced
#
# version 1.5.3 - 6/16/2009
#    assumes 10.5.6 installer DVD
#        updated for Safari 4.0.1
#
# Steve Ragalevsky - sfr@apple.com
Output Volume Name = Macintosh HD
Output File Name = base-OS
Base OS Disk:
# the first one should be disk 1 of an installer disk
# this is not yet implemented
OS Updates:
1057 Combo http://support.apple.com/downloads/DL827/MacOS
Apple Updates:
QuickTime762_Leopard http://appldnld.apple.com/.../Quic
iLife Support 9.0.3 http://support.apple.com/downloads/...
Java 10.5 Update 4 http://support.apple.com/.../JavaForMa
iTunes 8.2 http://appldnld.apple.com.edgesuite.net/.../iT
Front Row 2.1.7 http://support.apple.com/.../FrontRowUpdat
Airport Utility 5.4.2 http://support.apple.com/.../en_US
RAW Camera Update 2.6 http://support.apple.com/.../en_US
Safari 4.0.1 http://appldnld.apple.com.edgesuite.net/..
System Settings:
Third Party Software:
Software Settings:
Line: 34 Column: 1 Plain Text Tab Size: 4
clientHD.catalog
# Creates General Use Client
#
# Version 1.0.1 - 6/19/2009
#        updated First Boot Script
#
# Steve Ragalevsky - sfr@apple.com
#
Output Volume Name = Macintosh HD
Output File Name = general-client
# You Must have the Imaging catalog file as well
include-file: baseOS-remote.catalog
Base OS Disk:
# the first one should be disk 1 of an installer disk
# this is not yet implemented
OS Updates:
System Settings:
createUser-admin createUser-admin.pkg sha1:1900dd3a50567d068e4a82afcd980db550dbd6d0
clearReg clearReg.pkg sha1:26e42e4f6ebd399a5bb6a496c1fc4283b39f128a
FirstBootScript FirstBootScript.pkg sha1:aa6b362c9760c4ba151bacb85ab54a253b00594f
Third Party Software:
Software Settings:
Line: 25 Column: 1 Plain Text Tab Size: 4

# Format

<TAB>Display Name<TAB>Location<TAB>Checksum

- Download and Cache

  - `QuickTime7.6` <TAB> `http://appldnld.apple.com/QuickTime76_Leopard.dmg` <TAB>
    `sha1:2b09c606ad381642d3ba34a32aaa6b50c7fc7ce7`

- Locally Stored

  - `CreateAdminUser` <TAB> `createUser-admin.pkg` <TAB>
    `sha1:1900dd3a50567d068e4a82afcd980db550dbd6d0`

# How-To

1 OS & Custom Packages


InstallerFiles


BaseOS



InstaUp2DatePackages

2 Create .catalog files


AddOns


InstaUp2Date

checksum.py


CatalogFiles

instaUp2Date.py

3

## Run instaUp2Date


AddOns


InstaUp2Date

checksum.py


CatalogFiles

include example code

instaUp2Date.py

4

## Collect Created .dmg

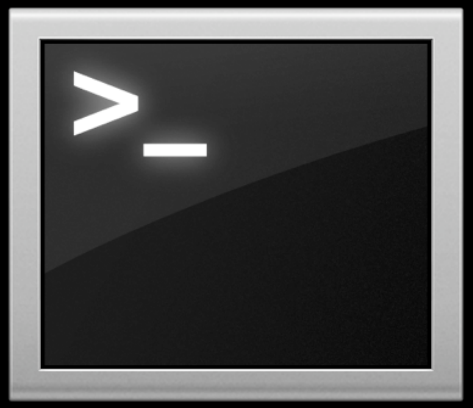

OutputFiles

# Tools

Composer

PackageMaker

TextMate

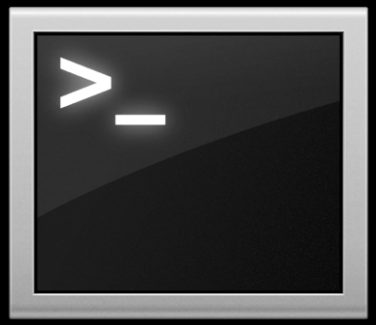


Demo

# Review

## InstaDMG

- Modular System Image Creation
- Un–booted Mac OS X Images
- Machine Independent Build Train
- Uses Apple's Native DMG/Package Formats
- Universally Deployable
- Easily Updated




Multi-OS Scenarios

# Boot Camp

- Install and run Microsoft Windows on an Intel-based Macintosh
- Start up using Mac OS X or Windows
- Run Windows natively
- Apple does not sell or support Windows

# Boot Camp Assistant

- Included in Mac OS X Leopard
- Drivers pre-burned to Leopard Installation DVD
- Simple setup

# BootPicker

- Works with Firmware password
- Doesn't interfere with ARD
- Can be disabled at any time
- Always boots into Mac OS X and shows Boot Picker screen
- Can be managed via MCX
- Can provide info to user to help select OS
- Collects usage stats

# Multi-OS Systems

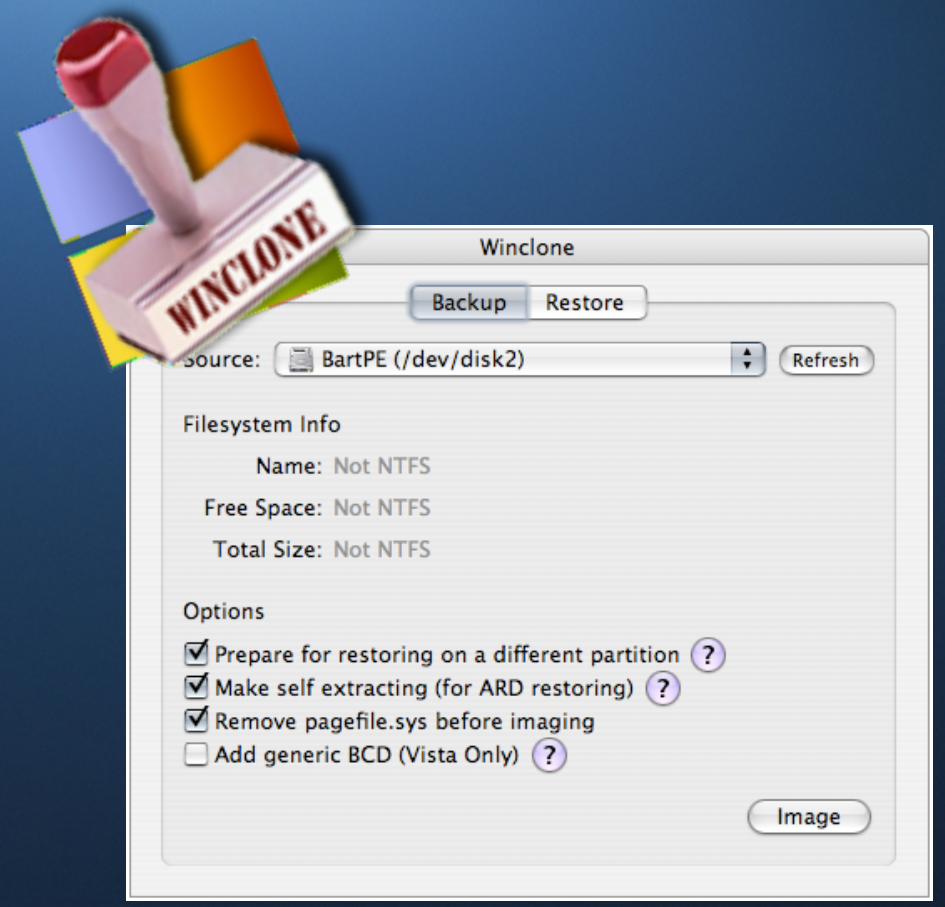
## Windows pains

- Sysprep Windows systems before imaging
- Makes master system “generic”
  - Computer names
  - Unique SIDs
- Custom driver cache databases
- Manage hardware difference
- Driver hunting (Apple unsupported operating systems)

# Multi-OS Systems

## Winclone

- Compresses image (~25-50%)
- Self-extracting (for ARD deployment)
- Support for Vista
- Support for multiple drives
- Can resize filesystem
- Based on NTFSProgs
- Post-install action proof
- Free



# Multi-OS Systems

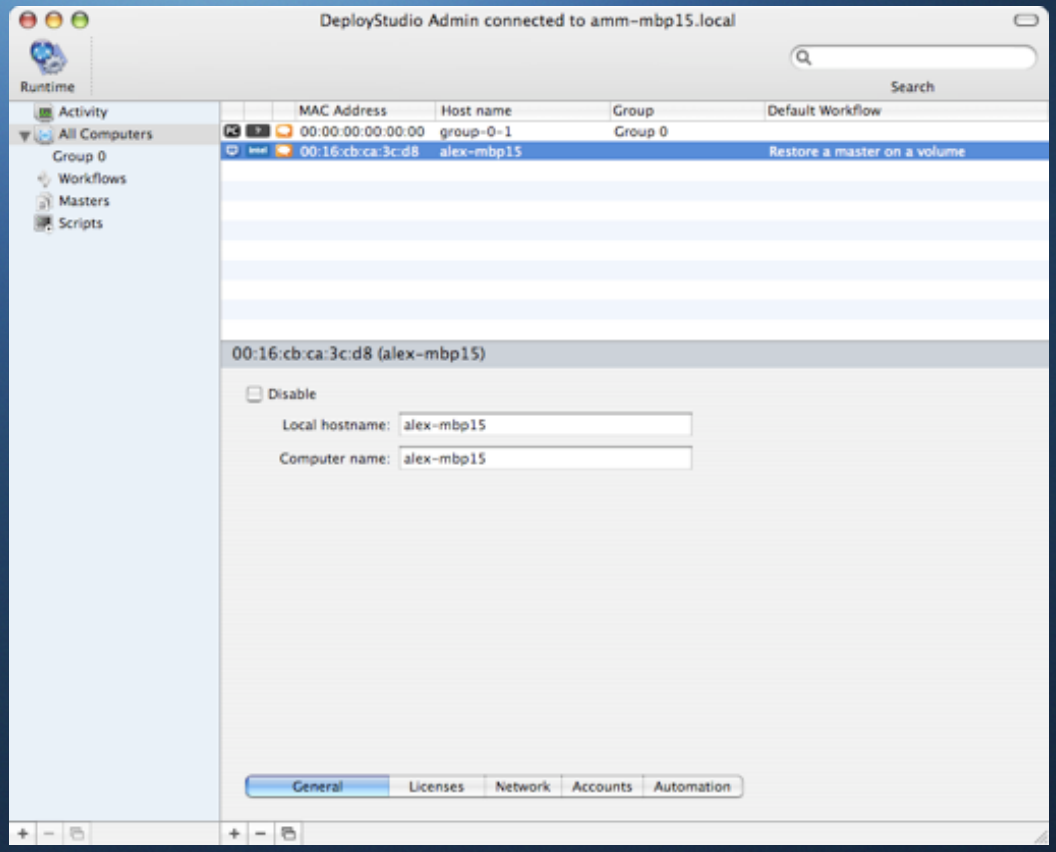
## Triple boot best practices

| Mac OS X | Linux | Windows |
| --- | --- | --- |
| Install on first partition<br><br>Install and configure rEFIt boot loader | Create partitions specifying sizes in bytes<br><br>Use swap file instead of partition<br><br>Install LILO/GRUB on Linux partition | Install on last partition<br><br>Use SysPrep<br><br>But there is more … |

# Multi-OS Systems

## DeployStudio Server

- Workflow based imaging tool
- Triple boot systems support
  - HFS, NTFS, EXT filesystems
- ASR multicast for Mac OS X images
- Live deployment monitoring
- Leopard-ready
- Free!



# Multi-OS Systems

- No Apple support for any OS other than Mac OS X
- Managing more hardware dependencies
- Windows licenses
- Monolithic images
- Requires third party tools to customize and maintain

# Break

# Three Concepts

01 Package Making

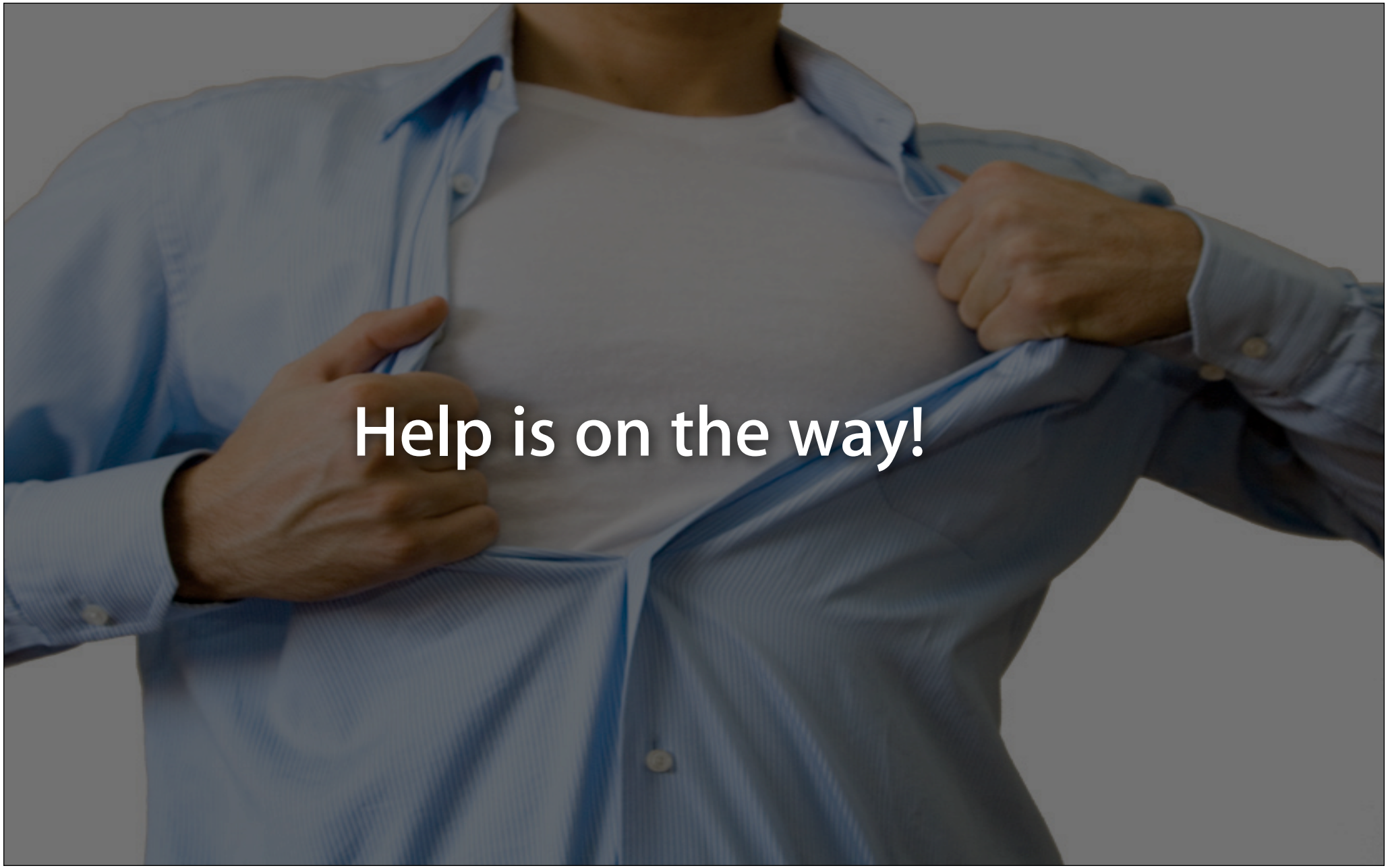
02 InstaDMG

03 DeployStudio


Deployment


Bombich Software: NetRestore
NetRestore
© 2003, Mike Bombich
Download version 3.4 [retired] (Leopard, Universal)
NetRestore End of Life -- November 17, 200
Around December of 2002 I was at Johnson Co Community Co ith cowork We were manning
an information booth at the student union ducati people ou Mac pa f st ents pproached us
and I gave my pitch for Macs. Afte t a moment, one o m sa in a fairly shotty te ), "We like
Dells". A little taken aback, I grouped and ed a erent itch. A r i a mo nt, the student clarified
her stance, "Well, the M s in the labs suc t this int, as nearly sp chless. Not about the Macs
"sucking", rather t at thes student ld es ntially it in he fac of a vendor. I replied "Well, the
Macs in the la s a probab mis anag "
I thought to my lf fo m nt. T Mac n the la probably did suck. Mac OS X was a fairly new
platform (10.1 w s the rrent rsion). Many ople were still deploying Mac OS 9 and there really weren't
*any* good mass ana ment t ls for ac OS X. There was Carbon Copy Cloner for cloning Mac to
Mac, but there wer no ss dep yment toolsets. I suspected that the Mac lab managers, who were
probably dedicated ac fa oys (had to be at that time for Mac labs to really exist at all), had spent every
working hour simply getting the Macs deployed, that they had no time left to polish the end-user
experience. They probably spent most of their time running around to individual machines in break-fix
mode, struggling to keep things working. As a result, the user experience probably wasn't far off from using
a Windows machine.
The student patted me on the shoulder and condescendingly commented "Well, good luck today." You can
imagine how red I turned and make a guess about how the rest of my day went. As it turns out, though, this
was one of the most important days in my career. I remember that day so well because that is the day and
moment that ignited my passion for developing the best Mac OS X mass deployment toolset within my
capabilities. On that day I became a Mac OS X Deployment Technologies Evangelist. Since then I have
developed a commendable suite of tools -- NetRestore, NetRestore Helper, NetRestore PHP Services,
NetBoot Across Subnets, Loginwindow Manager, DeLocalizer, ShadowClassic, NetBoot Machines Manager,
SessionLimiter, ADAM, and numerous others that were never publicly released. In addition to software, I
have published several articles relating to mass deployment and fielded thousands of related emails from
Retired


DIESEL

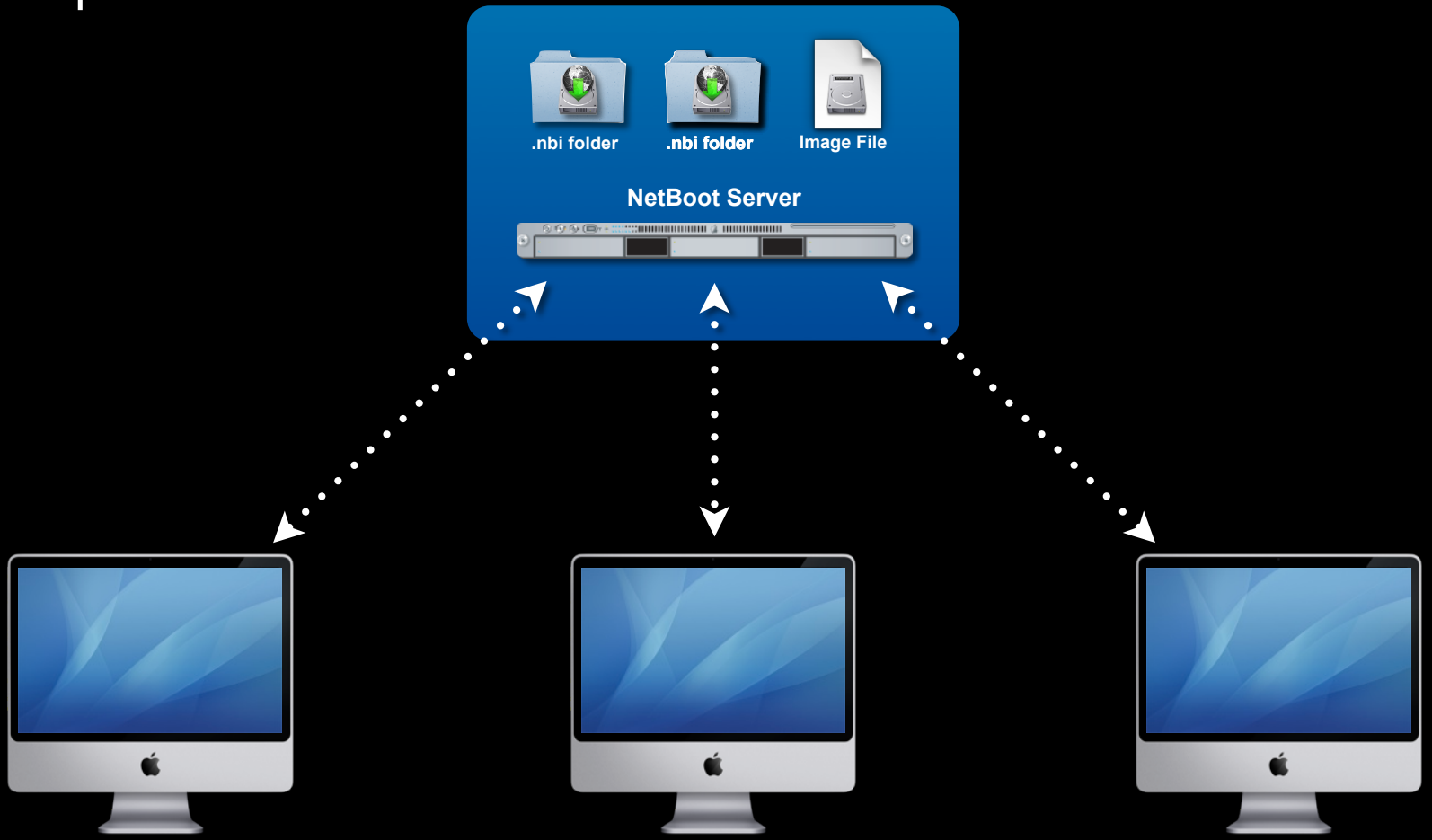

Help is on the way!

# Definitions

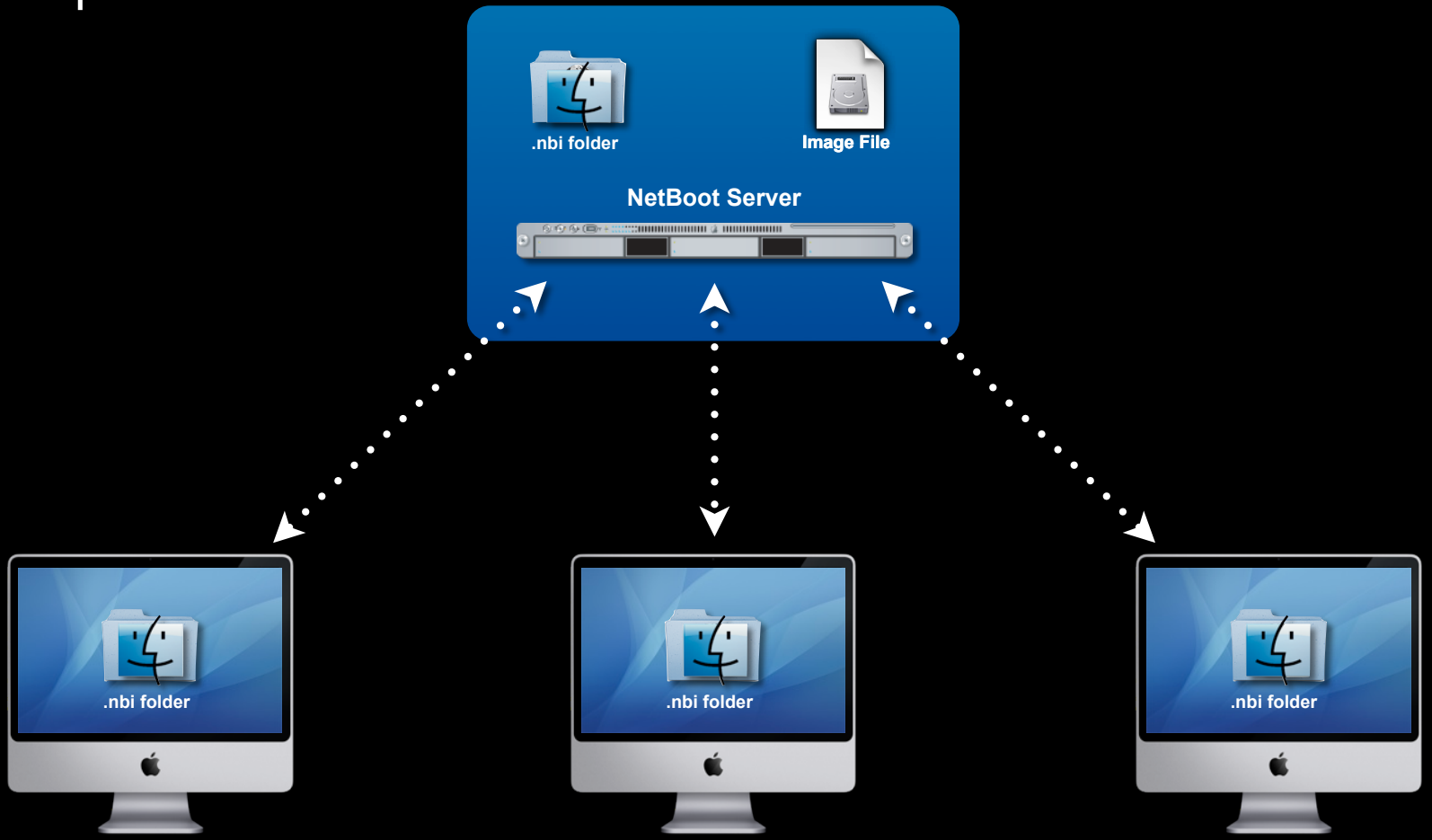
**u•ni•cast** |ˈyo͞oniˌkast| noun

the sending of information packets to a single destination

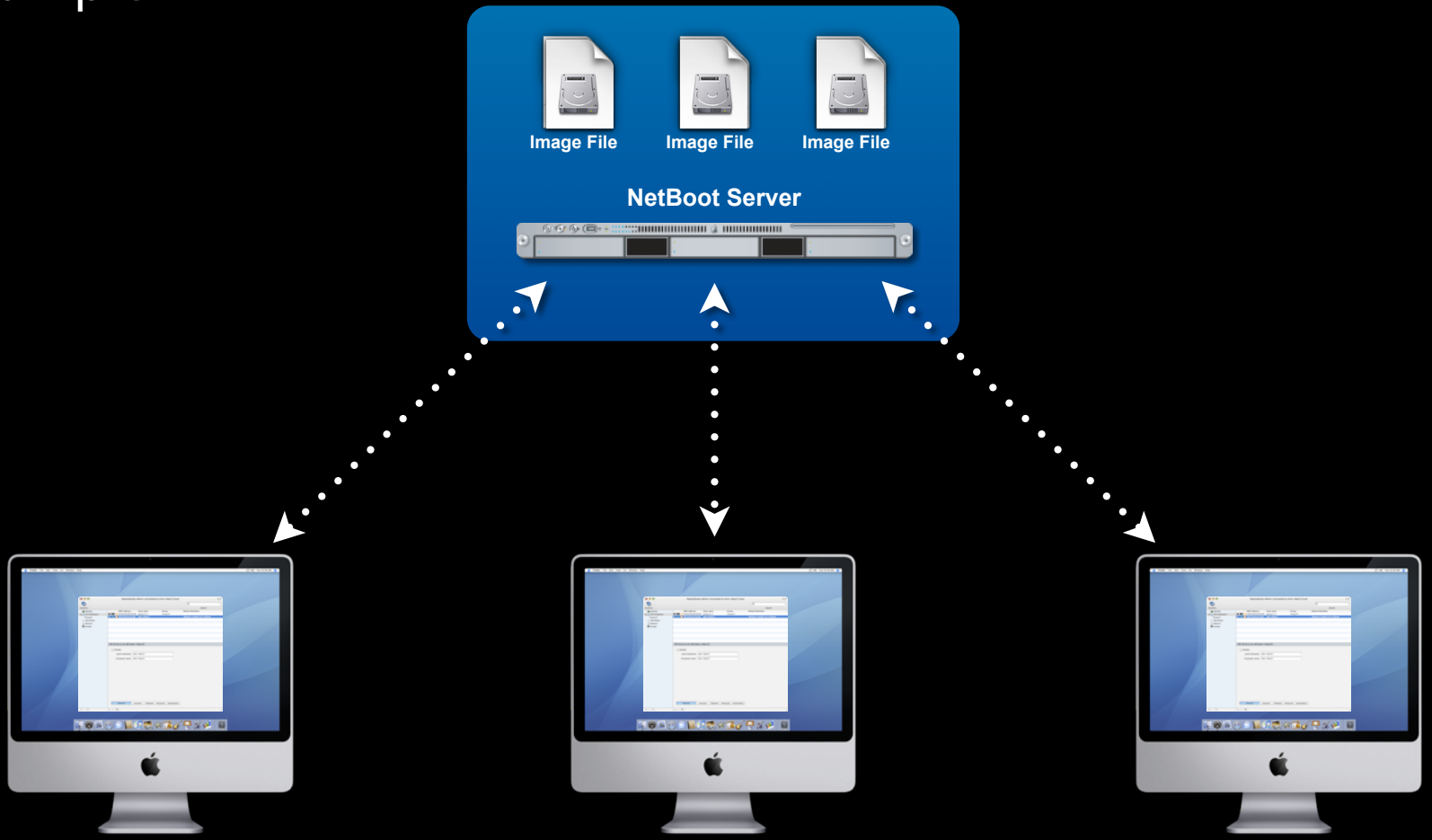
# Unicast
## Example



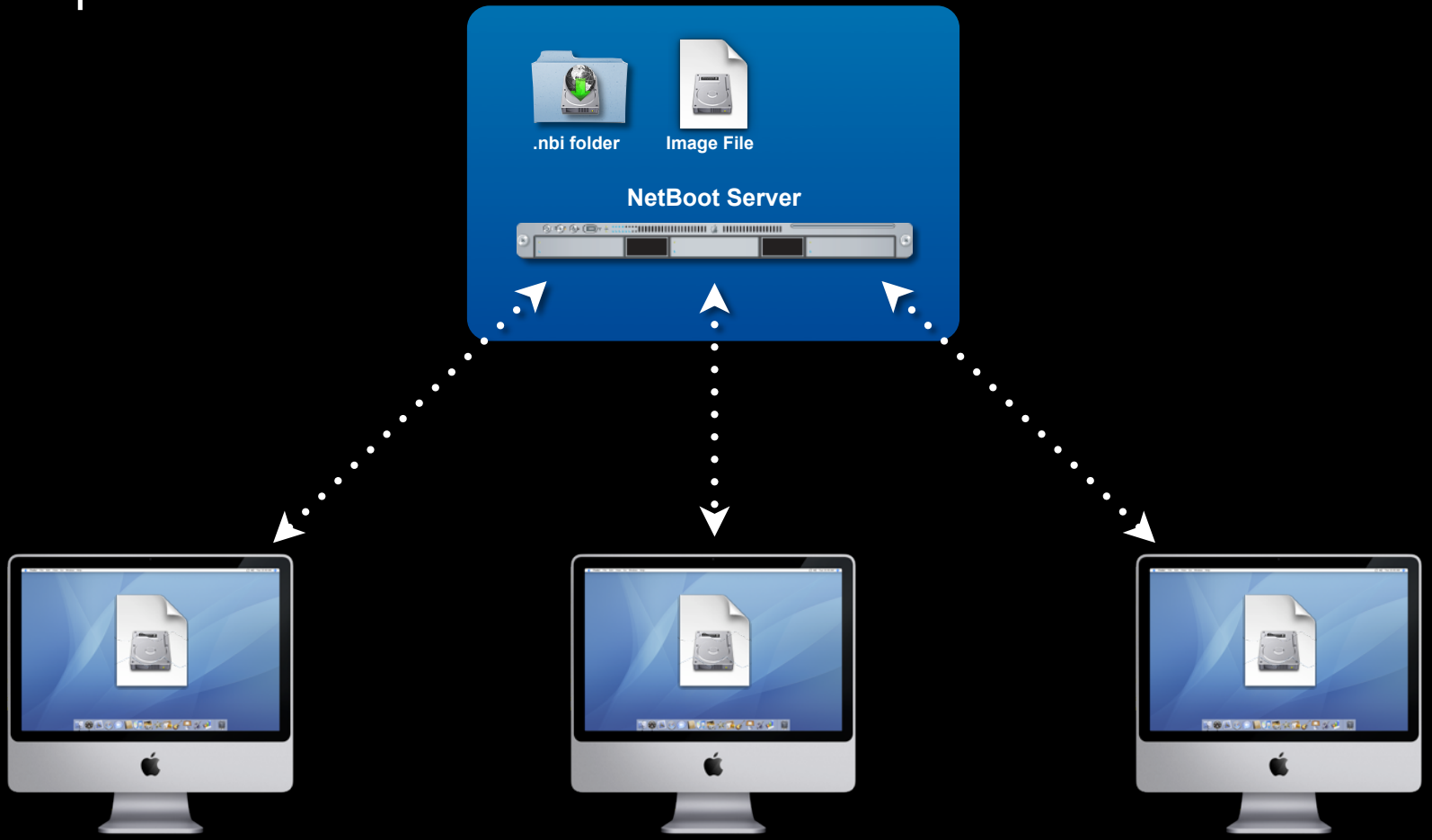
# Unicast
## Example



# Unicast
## Example



# Unicast
## Example

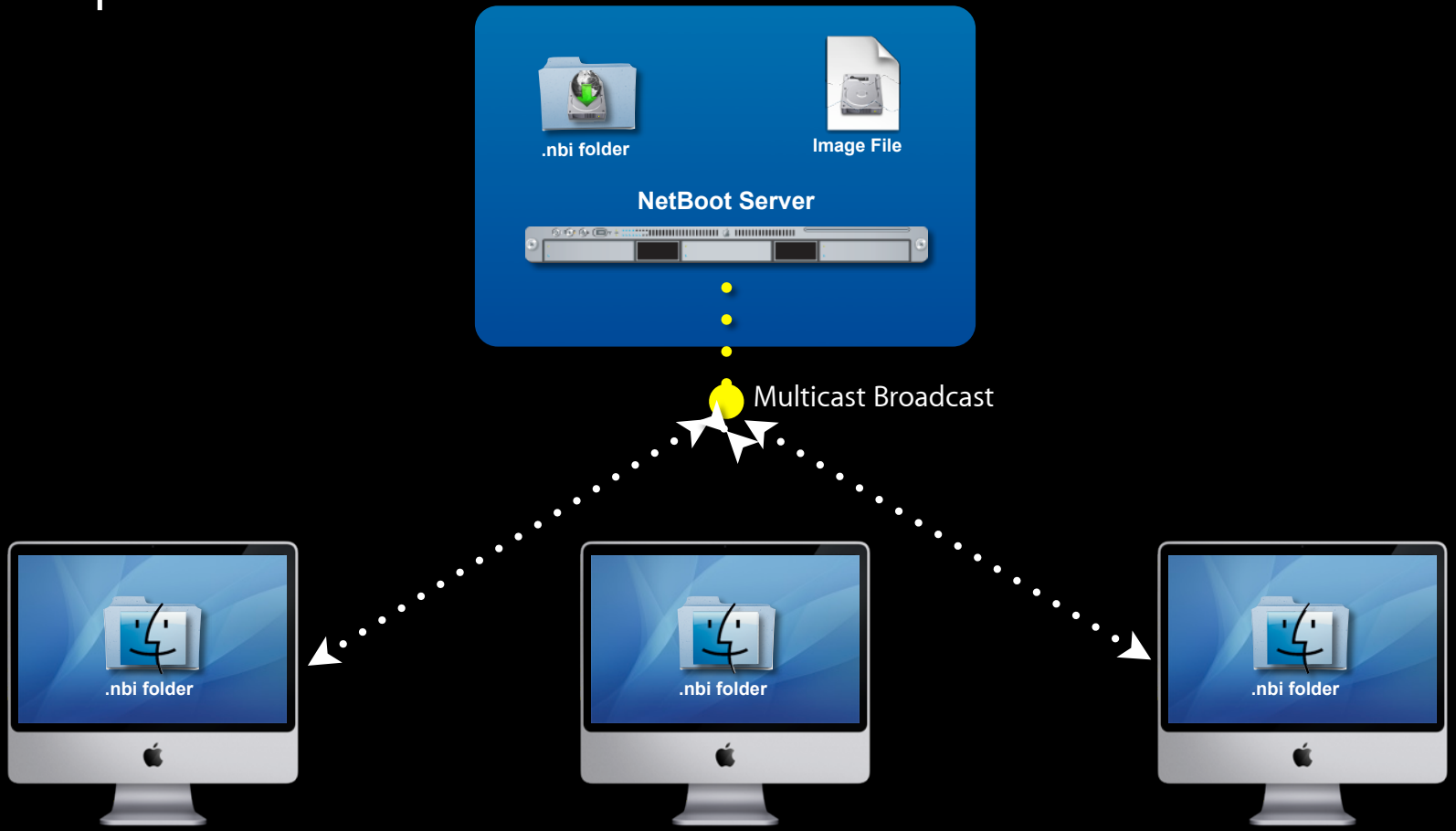


# Definitions

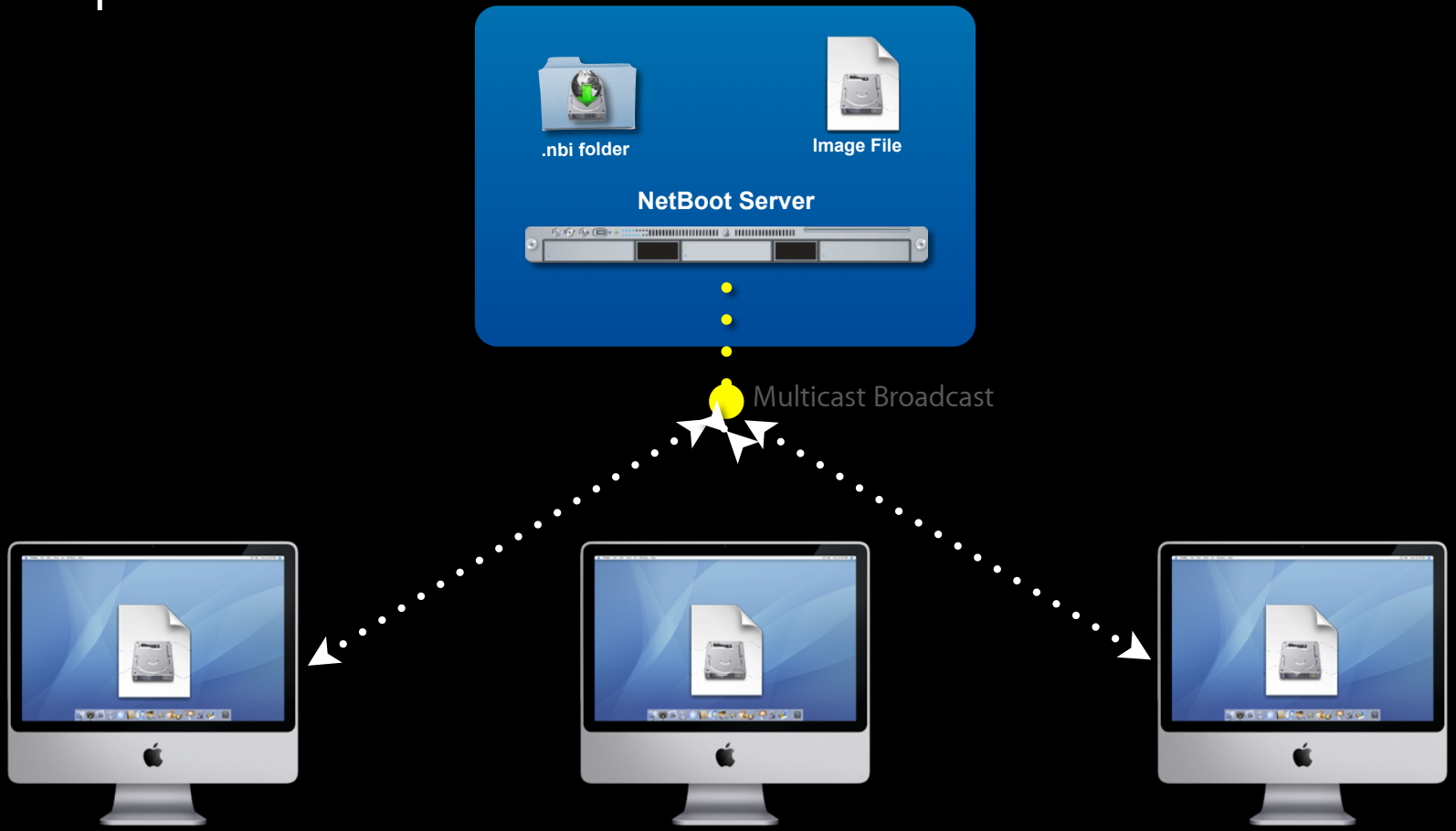
**mul•ti•cast** |ˈməltiˌkast; ˌməltiˈkast| *verb*

send (data) across a computer network to several users at the same time

# Multicast
## Example



# Multicast
## Example

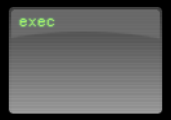


# DeployStudio

www.deploystudio.com

- Flexible Deployment Ecosystem
- Scalable Deployment Model
- Multi–OS Deployment
- NetBoot Set Creation
- Cloned System Image Creation
- Directory Services Integration
- Multicast

# Structure




DeployStudio Server Daemon

DeployStudio Server Repository

DeployStudio Assistant

DeployStudio Admin

DeployStudio Runtime

# Comparison

DeployStudio Server Repository = Images Folder

DeployStudio Assistant = NetRestore Helper

DeployStudio Runtime = NetRestore

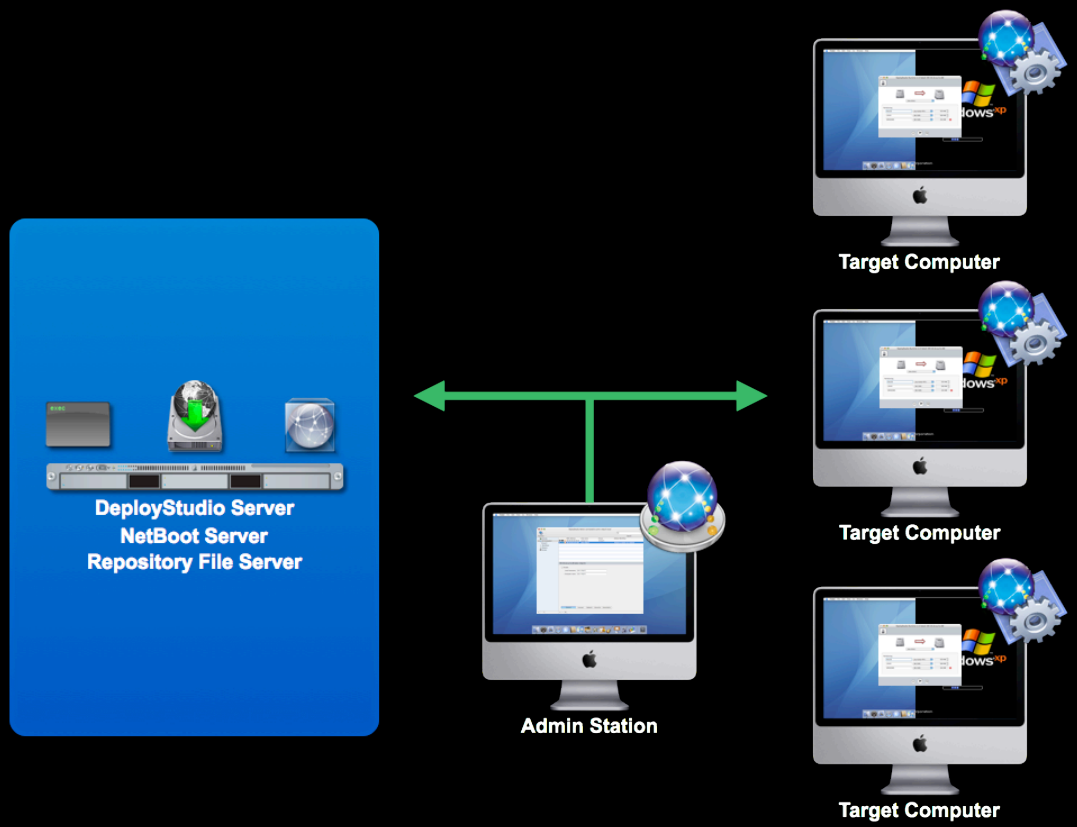
# Usage

Local Boot + Local Repository

Local Boot + Network Repository

Network Boot + Network Repository

# Scalable


DeployStudio Server
NetBoot Server
Repository File Server
Admin Station
Target Computer
Target Computer
Target Computer
Network Link

Demo

# Review

## DeployStudio

- Flexible Deployment Ecosystem
- Scalable
- Multi–OS Deployment
- NetBoot Set Creation
- Cloned System Image Creation
- Directory Services Integration
- Multicast


Architecture

**Simple** **Complex**

| Install DVDs | External Drive | Image from server | NetBoot/ NetInstall | mASR |
|---|---|---|---|---|
| Low Cost<br>Quick and Easy<br>Can be done by the end user | Fast<br>Simple | Host image on anything<br>Always up to date | Fully automated<br>No local boot | Many at once |
| Annoying<br>Lots of DVDs<br>Updates are hard | Expensive<br>Lots of HDDs<br>Not very scaleable | Still need local boot | Server<br>Networking needs | Server<br>Network! |
| 1-15 | 1-25 | 1-50 | 1-50 | 20-2000+ |

# Architecture

## Networking Scenarios

- Multicast environments
- Computer lab
- Building-wide implementation
- WAN
- WLAN

# Architecture Considerations

## Infrastructure examples

- Server Sizing/Balancing
- NetBoot Infrastructure
- NetInstall Infrastructure
- ARD Infrastructure
- Virtualization Infrastructure

# Architecture

## Capacity Planning

- Airport/Wireless for NetBoot? No...
- Ethernet speed
- Hard disk capacity and number of images
- Hard disk capacity and number of users
- Number of ethernet ports on the switch
- NetBoot across subnets?

# Architecture

## NetBoot capacity planning

- < 10 clients, usable with 100-Mbit Ethernet
- 10 - 50 clients, usable with 100-Mbit switched Ethernet
- > 50 clients, use Gbit Ethernet

- Need more — think about segmentation

# Architecture

## Servers

- Any currently shipping server supported hardware
- More RAM is better
- Networking connections are most important
  - Right cables
  - Right switches
- Load balancing techniques can be leveraged

# Architecture

## Required Services

| Service provided by NetBoot server | For booting Mac OS X computers with hard disks | For booting Mac OS X computers without hard disks |
|---|---|---|
| DHCP | Optional | Optional |
| NFS | Required if no HTTP | Required if no HTTP |
| AFP | Not required | Required |
| HTTP | Required if no NFS | Required if no NFS |
| TFTP | Required | Required |

# Architecture

## Clients (NetBoot & NetInstall)

- Any G4 or G5 PowerPC-based Macintosh computer
- Any Intel-based Macintosh computer
- 512 MB RAM (minimum)
- Built-In 100-Mbit Ethernet (or higher)
- All shipping Macs have these specs
- Check MacTracker to see if your older client computers meet these requirements
- Check KB 25517

# Architecture Considerations

## Other considerations

- Licensing
  - Obtain site licenses for images you will serve
  - For imaged servers, site licenses are required
- Pre-preparation
  - Generate a setup file to add to the Network Install image so the server knows how to configure itself automagically

# A quest for perfection

# Choices in Tools

## Improving your workflow

| Packaging | Testing | Deployment | Post Installation |
| --- | --- | --- | --- |
| PackageMaker | Eggplant | Software Image Utility | Open Directory Client Management |
| Iceberg | | instaDMG | ARD |
| Doppelganger | | Deploy Studio | Deep Freeze |
| DeployStudio | | Casper Suite | Casper Suite |
| Casper Suite | | FileWave | FileWave |
| | | radmind | radmind |