

Deployment of OS X Computers

MACTECH



acmeFoo

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Deployment: Agenda

Goal:

- To open your mind to the possibilities, from a high-and-medium level, on how you can deploy Mac OS X in the modern era
 - (not to become experts in any particular subject...)

“Classic” Deployment
DeployStudio

Puppet
Packages



“Classic” Deployment

Why Organize and Automate Deployment

Per-device manual configuration to be avoided

Things that aren't automated tend to be

- tedious
- prone to error
- inconsistent



‘‘The way we were...’’

The ‘‘Golden Master Mac’’

- Not the ‘‘cool kids’’ way of doing things anymore

Cloning isn’t imaging!

- Making an exact copy of a previously existing boot volume without any other effort is NOT how you create a master image
- CarbonCopyCloner and DiskUtility are WONDERFUL at cloning
 - ...but don’t forget that pesky Recovery HD partition

Why is Deployment Difficult

- Binding to Directory Services
 - External
 - KDC (localKDC)
- Recovery HD
- Cleaning up the cruft
- Canned Application/Resource Installation
- Scripting
 - pre/postflight, etc.
- Using SystemImageUtility 10.x to create images in 10.x
- Can't deploy from a backup/archive
- AppleID
- Partitioning
- AirDrop
- Configuration Profiles / MCX
- ...



NetInstall/NetBoot

Server requires:

- DNS
- DHCP
 - Can run your own DHCP server on same device as providing NetInstall/NetBoot, or use a different one
- NFS/HTTP
- NetInstall

Create “master image” for computers to deploy

- or...

Make sure your Image is of the latest OS you can

- newer computers may not boot from older OS versions
- <http://support.apple.com/kb/HT2186>

Throw out “trash”/”cache”

- ...and deal with EVERYTHING on list of previous slide



NetRestore

... is no more

A wonderful product in the Tiger/Leopard era

Development stopped in 2008

- <http://www.tuaw.com/2008/11/17/farewell-to-a-friend-netrestore-goes-eol/>



DeployStudio

DeployStudio

Utilizes

- NetBoot/NetInstall infrastructure
 - Instead of the NetBoot .nbi image being a Master Image for deployment, it's an environment to DeployStudio
- Apple Software Restore (asr)
 - Multicasting

Documentation

- <http://deploystudio.com/Doc/Doc.html>
 - http://deploystudio.com/Doc/Entries/2012/7/7_DeployStudio_Guide_2.0.html
 - http://deploystudio.com/Doc/Entries/2012/7/7_DeployStudio_Lion_Supplement.html



DeployStudio Setup

OS X Server machine running:

- AFP
- NetInstall
- DHCP
- DNS
- Open Directory
- Server.app (Workgroup Manager.app)
- DeployStudioServer
 - DeployStudio Assistant
 - DeployStudio Admin
 - DeployStudio Runtime

DeployStudio Admin user account

- Should be different than other admin accounts



DeployStudio Server

DeployStudio Assistant

- Tool for installing and configuring the DeployStudio Server daemon and for NetBoot system creation for the DeployStudio Assistant

DeployStudio Admin

- Configure and edit workflows, computers, scripts and disk images

DeployStudio Runtime

- Engine that connects to the DeployStudio Repository and runs various, pre-configured workflows on the client system(s).



DeployStudio Workflows

Workflow Task Categories

- Computer Database Update
 - Hostname
 - Users
 - Network
 - Licenses
 - OSX Server (older versions)
 - XSan
- General
 - Run a script
 - Partition a Disk
 - Install packages
 - Copy a File or Folder
 - Shutdown



DeployStudio Workflows

Workflow Task Categories (cont.)

- Imaging
 - Image a volume
 - Restore a disk image
- Post-Restoration
 - Active Directory Binding
 - Open Directory Binding
 - Time Setup
 - Apple Software Update
 - Reconfigure system with computers database content
- Security
 - Firmware Password
- Meta
 - Workflow



DeployStudio Workflows

Four sample workflows are included

- Create a master from a volume
- Install a package (.pkg)
- Restore a master on a volume
- Triple-OS restoration

NOTE:

During preso on 6 March 2013, the reason the demos did not work: MacMini Server was NOT connected to an Ethernet switch (so hostname/DNS resolution was borked)...

Screen shots included on following slides to (kind of) show what was intended during the demo--sorry, at least all the other demos worked!!!



DeployStudio GUI

The screenshot displays the DeployStudio Admin application window. The title bar reads "DeployStudio Admin" with menu items: Server, Edit, Window, Help. The status bar indicates "DeployStudio Admin connected to mainserver.pretendco.com".

The left sidebar contains a tree view with the following items:

- ACTIVITY
- COMPUTERS
 - Lab
- WORKFLOWS (highlighted with a blue bar and a small "5" icon)
- MASTERS
- PACKAGES
- SCRIPTS (highlighted with a blue bar and a small "5" icon)

The main pane shows a table of workflow tasks:

Title	Description	Access group	Identifier
Create a master from a volume	This simple workflow enables you...	-	04062220-1111-8888-2222-000000000000
Create Master Images		-	C883578C-D528-4622-8138-87011205F82E
Install a package (pkg)	This simple workflow enables you...	-	04062220-1111-8888-2222-000000000020
Restore a master on a volume	This simple workflow enables you...	-	04062220-1111-8888-2222-000000000010
Triple-OS restoration	This workflow shows the 4 tasks...	-	04062220-1111-8888-2222-000000000030

Below the table is a "Disk image" section with a plus icon and a minus icon. The "Source:" field is empty. The "Type:" dropdown is set to "Compressed - faster restoration, small footprint". The "Format:" dropdown is set to "Auto-detect". The "Keywords:" field is empty.

At the bottom of the main pane are several checkboxes:

- ☒ Try to create intermediate files on a local volume to preserve network bandwidth
- ☒ Cleanup Mac OS X machine dependent files and caches
- ☒ Image NTFS volumes with OS X built-in tools to allow multicast deployment
- ☐ Try to shrink NTFS volume's size before imaging
- ☐ Automate

The right sidebar contains a list of workflow tasks with icons and descriptions:

- Active Directory binding**: Binds a computer to an Active Directory server.
- Alert**: Pauses the workflow by displaying an alert message.
- Automatic enrollment**: Enrolls a computer to a MDM server at first boot.
- Configure**: Applies computer's settings defined in the DeployStudio database.
- Disk image**: Creates a disk image of a volume or partition.
- File copy**: Copies files and folders to a volume.
- Firmware Security**: Enables Firmware Security at boot.
- Generic**: Runs a script or any executable file.
- Hostname form**: Updates computer's name in the DeployStudio database.
- Licenses form**: Updates computer's Server & Xsan licenses in the DeployStudio database.
- Localization**: Configures the default system language & keyboard layout.
- Network location form**: Updates computer's network locations in the DeployStudio database.
- New user form**: Updates computer's local users list in the DeployStudio database.
- Open Directory binding**: Binds a computer to an Open Directory server.
- Package install**: Installs a package to a volume.
- Partition**: Creates multiple partitions on a specific disk.
- Periodic NetBoot**: Configures the computer to NetBoot periodically.
- Restore**: Restores a disk image to a specific partition or disk.
- Shut down**: Shuts down the computer at the end of the workflow (NetBoot only).
- Software update**: Customizes the Software update client.
- Time**: Configures the default network time server & time zone.
- Workflow**: Inserts all the tasks of another workflow at runtime.

At the bottom right of the right sidebar, it says "Drag an icon to the workflow timeline".

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Left Sidebar:

- Runtime
- Control
- Logs
- ACTIVITY
- COMPUTERS
 - Lab
- WORKFLOWS (5) - **Selected**
- MASTERS
- PACKAGES
- SCRIPTS (5)

Main Content Area:

Title	Description	Access group	Identifier
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Partition Configuration:

Target volume: First disk available

OS	Size	Usage
LINUX	10GB	
MacOSX	80%	
WINDOWS	20%	

Apply layout template: Custom [Add partition]

☐ Secure erase before partitioning with the algorithm (single-pass zero-fill (~4 hours for 500GB))

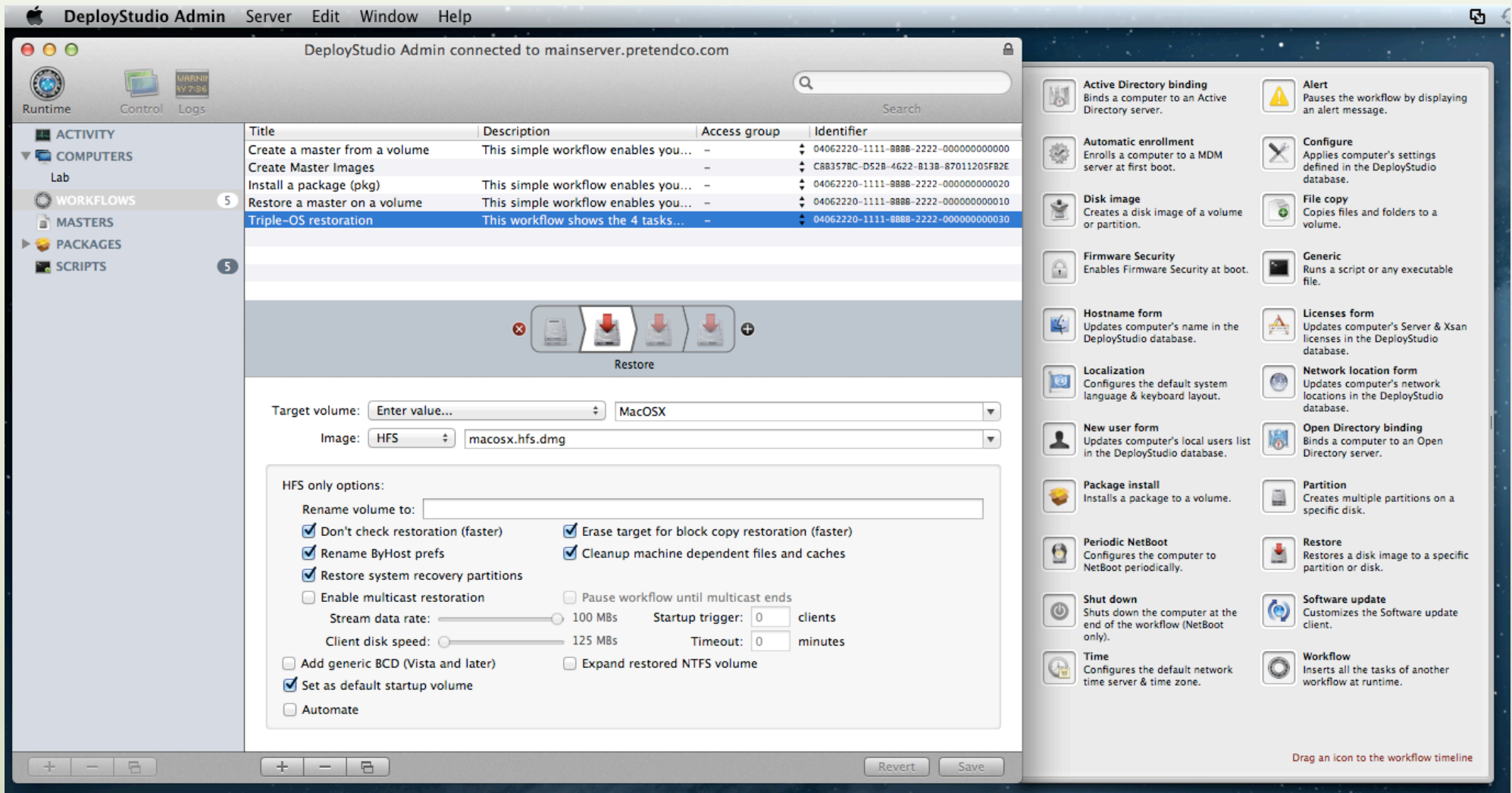
☐ Automate

Right Sidebar (Workflow Tasks):

- Active Directory binding: Binds a computer to an Active Directory server.
- Alert: Pauses the workflow by displaying an alert message.
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- Configure: Applies computer's settings defined in the DeployStudio database.
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- Runtime
- Control
- Logs
- ACTIVITY
- COMPUTERS
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- WORKFLOWS (5)
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Main Panel:

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Restore Configuration:

Target volume: Enter value... (dropdown) WINDOWS

Image: NTFS (dropdown) windows.ntfs.gz (dropdown)

HFS only options:

Rename volume to: [text field]

- ☒ Don't check restoration (faster)
- ☒ Erase target for block copy restoration (faster)
- ☒ Rename ByHost prefs
- ☒ Cleanup machine dependent files and caches
- ☒ Restore system recovery partitions
- ☐ Enable multicast restoration
- ☐ Pause workflow until multicast ends
- Stream data rate: 100 MBs
- Client disk speed: 125 MBs
- Startup trigger: 0 clients
- Timeout: 0 minutes
- ☐ Add generic BCD (Vista and later)
- ☐ Expand restored NTFS volume
- ☒ Set as default startup volume
- ☐ Automate

Right Panel (Workflow Tasks):

- Active Directory binding: Binds a computer to an Active Directory server.
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Bottom Bar: + - [icon] + - [icon] Revert Save

Footer: Drag an icon to the workflow timeline



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Below the table is a "Restore" button with a red arrow icon. Underneath are two dropdown menus: "Target volume:" (set to "Enter value...") and "Image:" (set to "DEV" with "linux.dd.gz" selected).

The "HFS only options:" section contains several checkboxes and sliders:

- ☒ Don't check restoration (faster)
- ☒ Rename ByHost prefs
- ☒ Restore system recovery partitions
- ☐ Enable multicast restoration
- ☐ Add generic BCD (Vista and later)
- ☒ Set as default startup volume
- ☐ Automate
- ☒ Erase target for block copy restoration (faster)
- ☒ Cleanup machine dependent files and caches
- ☐ Pause workflow until multicast ends
- ☐ Expand restored NTFS volume

Sliders for "Stream data rate:" (set to 100 MBs) and "Client disk speed:" (set to 125 MBs) are also present. "Startup trigger:" is set to 0 clients, and "Timeout:" is set to 0 minutes.

The right sidebar lists various tasks with icons: Active Directory binding, Alert, Automatic enrollment, Configure, Disk image, File copy, Firmware Security, Generic, Hostname form, Licenses form, Localization, Network location form, New user form, Open Directory binding, Package install, Partition, Periodic NetBoot, Restore, Shut down, Software update, Time, and Workflow. A note at the bottom right says "Drag an icon to the workflow timeline".



Preparing the Image

You could:

- Install all updates to the OS and any installed software.
- Enable AppleRemoteDesktop, if desired.
- Create any users (i.e., an admin account for remote administration and an Apple Remote Desktop user account).
- Install and run all software once to
 - verify serial numbers
 - build font lists.
- Run Disk Utility->RepairPermissions.
- Run Disk Utility -> Verify Disk.
- Install desired apps
 - Know about license keys, and alternate package formats
- Install desired Virus software



Preparing the Image

- Enable / disable various functions as desired:
 - Disable the Apple Remote functionality to avoid intentional or inadvertent IR signals effecting the systems - System Preferences -> General -> check.
Disable remote control infrared receiver.
 - Adjust Energy Saver settings - System Preferences -> Energy Saver -> Settings for: Power Adapter adjust settings accordingly.
- Unbind
 - If you bound the system for testing Active Directory or Open Directory testing, you must unbind the system prior to creating the image. DeployStudio includes Workflow Tasks for rebinding the systems to both Active Directory and/or Open Directory.

... Or you may want to script all of this



Preparing the Image

- Note: DeployStudio manages the creation of the Local Kerberos Distribution Center (LKDC) on first boot.
- Using tools other than DeployStudio to build and deploy images may sidestep the removal and recreation of the LKDC.
 - In a scenario where DeployStudio is not used, each imaged machine is using the same security certificate and hash. Deploying a single image will deploy the same LKDC to every system. This can cause problems later when binding to Active Directory and/or Open Directory.

Select the name of the deployment image

- Note:
 - If DeployStudio is set up to automate the erasure and deployment of the OS, this could potentially erase unsuspecting users systems as well. NetBoot images will appear on client systems in System Preferences > Startup Disk. Including a name that warns users not to choose this startup disk is also recommended.

DisplayStudio Resources

Documentation listed earlier

AFP548

Google will result in MANY hits

- this is a very popular tool--it's free, and it ROCKS



Puppet

Puppet

A Declarative system

- You specify how you want things to be, Puppet monitors devices and maintains your goals
- If it's wrong, puppet fixes it; if it's already right, puppet leaves it be...

Puppet runs as agent/master (aka client/server)

Free VM demo is available

- We will explore that demo here

Learn

- <http://docs.puppetlabs.com/learning/>

Cookbook (3rd party)

- <http://www.puppetcookbook.com/>



Puppet: Resources

In Puppet, all participants in an OS or on a device are called Resources

- Any resource is very similar to a class of related things
 - Similar resources can be grouped into types
 - every file has a path and an owner
 - every user has a name, a UID, and a group
- The description of a resource can be abstracted away from its implementation

The Resource Abstraction Layer (RAL) splits resources into:

- types
 - high-level models
- providers
 - platform-specific implementations

You describe resources in a way that can apply to any system



Puppet: Resources

Puppet uses the RAL to both read and modify the state of resources on a system.

- Puppet starts with an understanding of what state a resource should have.
- To sync the resource, it uses the RAL to
 - Read
 - query the current state
 - Check
 - compares that against the desired state
 - Write
 - make any necessary changes.

Puppet: Resources

Example User Resource

```
user { 'dave':  
  ensure      => present,  
  uid         => '507',  
  gid         => 'admin',  
  shell       => '/bin/zsh',  
  home        => '/home/dave',  
  managehome  => true,  
}
```

Core Resource Types

- notify
- file
- package
- service
- exec
- cron
- user
- group

Cheat Sheet

- http://docs.puppetlabs.com/puppet_core_types_cheatsheet.pdf



Puppet: Resource shell

Puppet features a shell for accessing/setting resources

- Accessing

```
$ puppet resource user
```

```
...
```

```
$ puppet resource user root
```

```
user { 'root':  
  home => '/var/root',  
  shell => '/bin/sh',  
  uid => '0',  
  ensure => 'present',  
  password => '*',  
  gid => '0',  
  comment => 'System Administrator'  
}
```

- Setting

```
$ puppet resource user dave ensure=present shell="/bin/zsh"  
home="/home/dave" managehome=true
```



Puppet: Describe

Puppet features a built-in documentation system for commands

```
$ puppet describe -s user
user
====
```

Manage users. This type is mostly built to manage system users, so it is lacking some features useful for managing normal users.

This resource type uses the prescribed native tools for creating groups and generally uses POSIX APIs for retrieving information about them. It does not directly modify `/etc/passwd` or anything.

...

Puppet: Manifests

Example manifest

```
# /root/learning-manifests/1.file.pp
```

```
file {'testfile':  
  path      => '/tmp/testfile',  
  ensure    => present,  
  mode      => 0640,  
  content   => "I'm a test file.",  
}  
  
notify {'littlenotify':  
  message => "I'm notifying you."  
}
```

Loading manifest

```
$ puppet apply 1.file.pp
```



Puppet: Metaparameters

Each resource type has its own set of attributes, but there's another set of attributes, called metaparameters, which can be used on any resource.

- They're meta because they don't describe any feature of the resource that you could observe on the system after Puppet finishes; they only describe how Puppet should act.

There are four metaparameters that let you arrange resources in order

- before
- require
- notify
- subscribe

```
$ puppet describe -s user
```



Puppet

We've only just begun...

The power of Puppet is staggering

- especially from an automation perspective



Packages

Creating .pkg Packages

Focus here on creating packages for deployment

- Not necessarily GUltastic, or meant for users

Issues

- Gatekeeper

Apple

- PackageMaker GUI/CLI tools deprecated since 10.6
 - Don't even launch on Mtn Lion
- Replacement tools are CLI based

3rd Party

- The Luggage
 - <http://luggage.apesseekingknowledge.net/>
- Packages
 - <http://s.sudre.free.fr/Software/Packages/about.html>
- Iceberg
 - <http://s.sudre.free.fr/Software/Iceberg.html>



Creating Packages: Apple

CLI only (so far)

- Located in /Developer/usr/bin
 - pkgbuild
 - productbuild
 - pkgutil

Installed with Xcode tools

- Also used for preparing applications for submission to App Store

Only generates “flat” packages

- Format introduced in 10.5

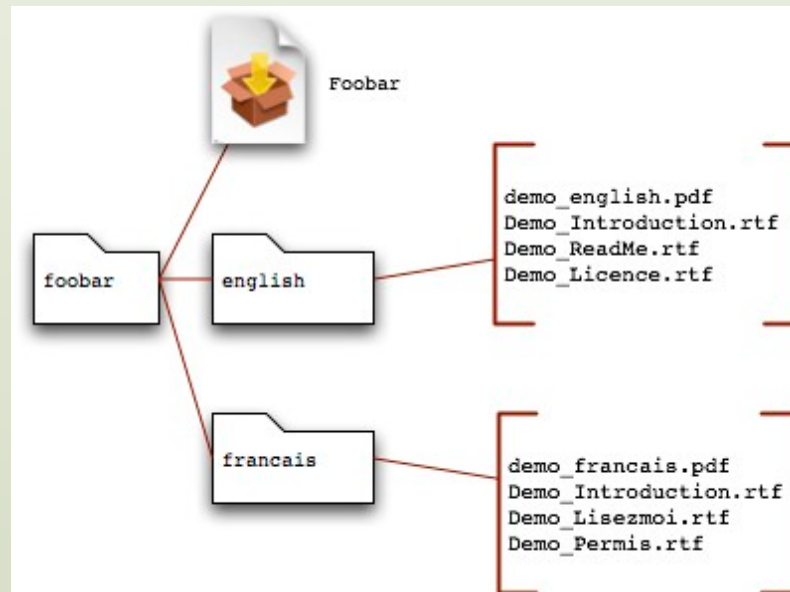
Can sign your packages

- Makes Gatekeeper happy
- Requires you be a registered developer with Apple and obtain a Developer certificate



Creating Packages: Apple

Arrange your payload the way you want it installed



Creating Packages: Apple

More than Payload: you can provide Scripting / Automation

There are 7 types of scripts than can be launched during the Installation Process of a package:

- InstallationCheck
 - Launched at the beginning of the installation process (even before the Authentication step). It can be used to check that the package can be installed on this computer.
- VolumeCheck
 - Launched in the "Select Destination" step. It is used to determine on which volume the package can be installed.
- preflight
 - Launched just after the user clicked on the "Install" button.



Creating Packages: Apple

- preinstall / preupgrade
 - Launched after the preflight script if there's one (in the case of a single package installation); otherwise just after the user clicked on the "Install" button.
 - preinstall is launched when the package has never been installed (from an Installer.app point of view)
 - preupgrade is launched when the package has already been installed.
 - To determine whether a package has already been installed or not, Installer.app is having a look at the content of the following directory: /Library/Receipts. If there's a file named PackageName.pkg within it, then the package has already been installed, otherwise it's the first install.
- postinstall / postupgrade
 - Launched after the files in the package have been installed. See (preinstall / preupgrade) to see which one is launched.



Creating Packages: Apple

- postflight
 - Launched after the postinstall / postupgrade script or when the package has been installed.

Automation you might want to consider

- systemsetup
- networksetup
- pmset
- defaults/PlistBuddy



Creating Packages: Apple

Controlling the installation

- <http://developer.apple.com/library/mac/#documentation/DeveloperTools/Reference/DistributionDefinitionRef/Chapters/Introduction.html>
- Distribution
 - XMLfile
- Can utilize javascript
 - limited but useful
- Take a look at other installers to see what is possible
 - Example: iTunes

```
pkgutil --expand "Install iTunes.pkg" "Install iTunes"
```

Can create empty-payload packages

- scripts-only
- <http://derflounder.wordpress.com/2012/08/15/creating-payload-free-packages-with-pkgbuild/>



Creating Packages: Apple

Documentation is scarce

- man pages
- References to some new, and some old (but still valid for mindset) documents
 - <http://managingosx.wordpress.com/2012/07/05/stupid-tricks-with-pkgbuild/>
 - http://s.sudre.free.fr/Stuff/PackageMaker_Howto.html
 - <http://s.sudre.free.fr/Stuff/Ivanhoe/FLAT.html>
 - <http://stackoverflow.com/questions/11487596/making-os-x-installer-packages-like-a-pro-xcode4-developer-id-mountain-lion-re>



Other Package Formats

Don't even TRY to support VISE, etc. (unless you absolutely have to, or are incredibly masochistic...)

Adobe has its own package formats

- <http://www.adobe.com/content/dam/Adobe/en/devnet/creativesuite/pdfs/AdobeApplicationManagerEnterpriseEditionDeployGuide.pdf>

Microsoft doesn't have a custom package format, but needs some post-install love

- <http://coxmanagement.wordpress.com/2011/03/14/deploying-ms-office-2011/>

Others?



Summary

Other Tools

ASR Multicasting

- Integrates with DeployStudio or can be run standalone from command line
- Distinct from NetInstall/NetBoot

InstaDMG

- <http://afp548.com/forums/forum/software/instadmg/>

Munki

- “munki is a set of tools that, used together with a webserver-based repository of packages and package metadata, can be used by OS X administrators to manage software installs (and in many cases removals) on OS X client machines.”
- <http://code.google.com/p/munki/wiki/InstallingOSX>

Other Tools

Casper tools (and others built on top of it like RobotCloud)

- “The Casper Suite simplifies the life of system administrators with a comprehensive platform to manage Mac OS X computers and iOS mobile devices.”
- <http://www.jamfsoftware.com/products/casper-suite/>

Absolute Software

- “Absolute Software specializes in technology and services for the management and security of mobile computers, netbooks, and smartphones.”
- <http://www.absolute.com>

Deep Freeze

- “When you want to preserve a computer’s desired configuration, Faronics Deep Freeze is the answer.”
- <http://www.faronics.com/products/deep-freeze/>



Other Mindset

Lion and Mtn Lion have changed the game

- Recovery HD

There is new coolness

- Thin Imaging:
 - http://dl.dropbox.com/u/46593175/IT8103_M_Boylan_R_Trouton.pdf
 - <http://chris-gerke.blogspot.com.au/2012/04/mac-osx-soe-master-image-day-7.html>
- No-Image Deployment: Greg Neagle
 - <http://managingosx.wordpress.com/2012/08/01/installing-lion-and-mountain-lion-instead-of-imaging/>
- Can run scripts to enabled ARD, create users, trigger .AppleSetupDone, etc.
 - as though the computer was configured by a real live human



Other Mindset

Pre-populate User Template folders

- /System/Library/User Template/English.lproj/Library/Preferences/

Audience suggestions:

-

Resources

http://images.apple.com/education/docs/I521219a_osx_deployment_guide_jan2013.pdf

MacTech magazine

AFP548.com

Tech2000 Apple Training

- OS X Deployment 10.7 or 10.8 (OS X 302)
<http://www.t2000inc.com/training/osx302.html>
- Offered in Seattle, Portland, and all over the world

Google



Summary

Break your “image” into:

- Base OS
- Software
- Settings

Use the tools/mindset that makes you most comfortable at each stage

PRACTICE ON UNIMPORTANT MACHINES

- remember that these tools can erase an entire disk (not just volume) without ANY warning
 - because you ASKED it to do that!



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A co-op of developers, trainers, & consultants

- “We beat our heads against the wall so you don’t have to!”

Goal is to empower you, not merely “can” solutions

Current focuses include:

- Command Line
- Sysadmin Automation
 - Local & Remote (ARD)
- Cocoa (Mac OS X & iOS)
- Mac OS X and iOS Deployment & MDM
- Package Creation
- Publishing Automation
- Life Automation
- Work Automation
- Pro Photo Automation
- Pro Video Automation
- Pro Audio Automation
- Home/Business Automation
- Multimedia Automation
- ... (programming, automation, etc.)



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Please send email to info@acmefoo.org for:

- Ideas on Automations you'd like to see created
- Courseware you are interested in
 - attending
 - delivering
 - developing
- The Automation Mindset book
 - Designed specifically for non-programmers
 - Be able to read and use every page of MacTech (and others)
 - Coming soon!
- Training sessions offered in Seattle and Portland
 - and across the country (and the world!)



Deployment of OS X Computers

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