

# Modular Image Creation

(Yes, it's still a Thing)



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# Session Overview

- Why image? Why modularly?
- Techniques needed for modular
- Modular image creation tools
- Advanced AutoDMG

Know your stuff,  
know who you're stuffing,  
then stuff 'em!

*- attributed to John P. Paynter*

# Why image?



# Why image?

Why automate?

Why use images  
(to deploy)?

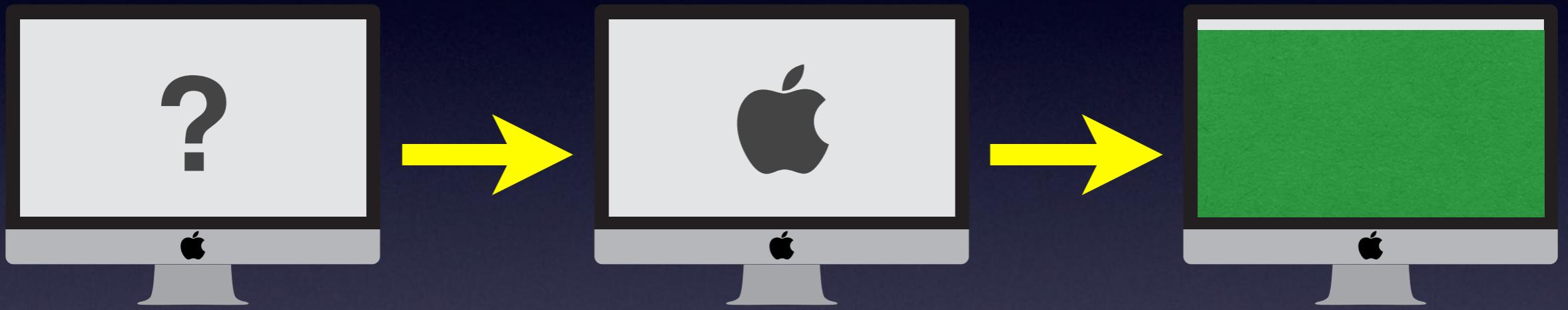


Unknown

Known

Desired

# Imaging



Unknown

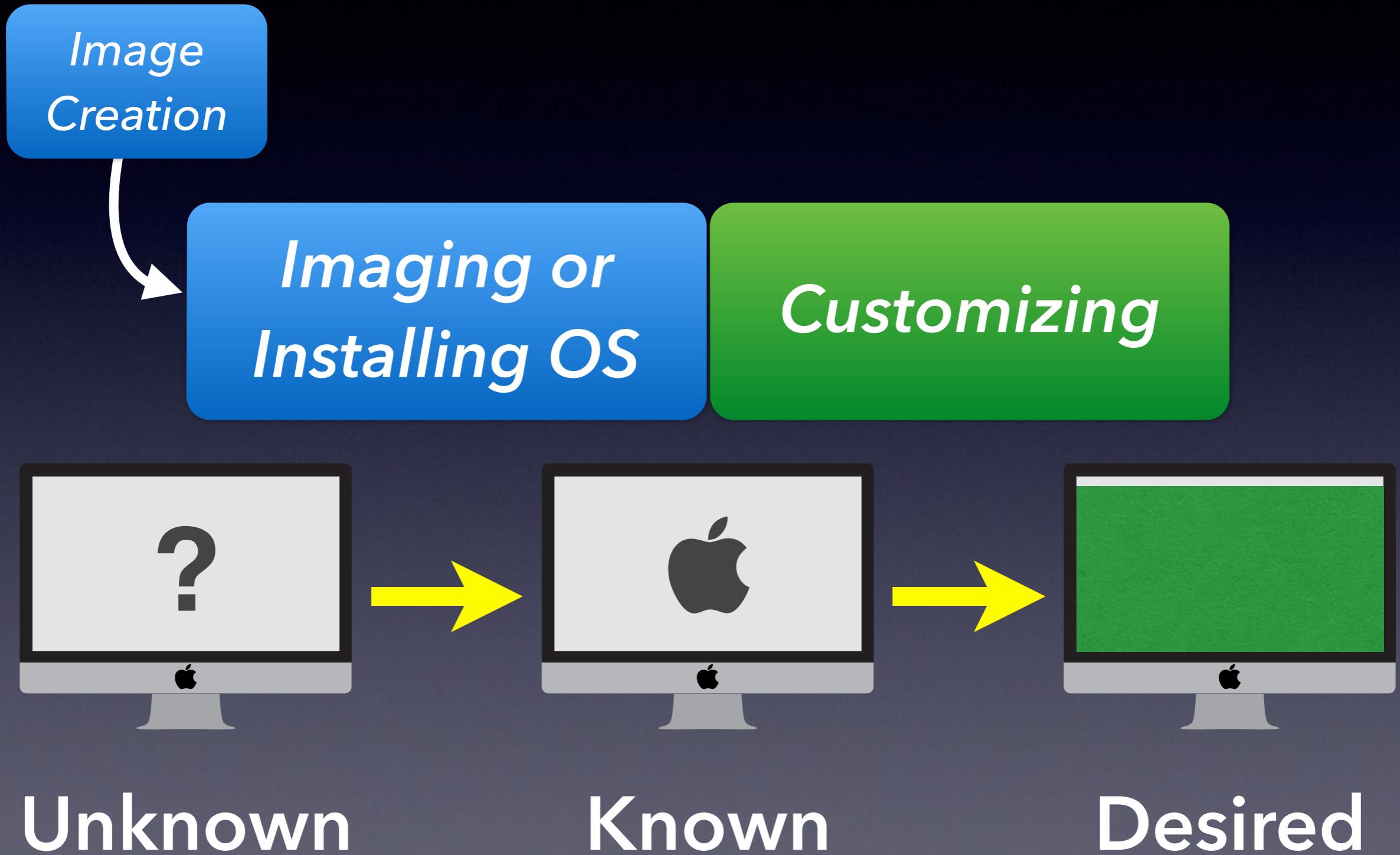
Known

Desired

# Deployment



# Deployment



# Why image?

Why automate?

Why use images  
(to deploy)?

Create a base system image for recovery

Create a base system image for testing

# When does imaging make sense?

When does any methodology make sense? When it's the best solution.

Environments that are often reset

Environments that are truly homogenous

Kevin M. White @ MacSysAdmin 2013  
“Modern Trends in Apple Management”



# Why image?

- Create a base system image
- Environments that are often reset
- Truly homogenous environments



# Why image?

- Create a base system image
- Environments that are often reset
- Truly homogenous environments

*More  
important  
as payload  
grows*

- When speed or bandwidth of (re)deployment matters
- Large (local) static elements

# Why image ***modularly?***



*SEPT*

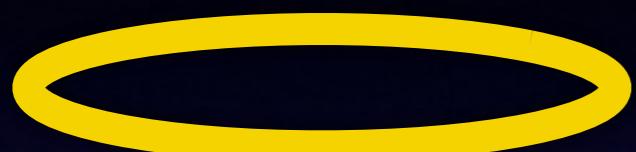
12



OS X 10.8.5

SEPT

24



OS X 10.8.5



OS X 10.8.5  
Custom Build

SEPT

24



OS X 10.8.5



OS X 10.8.5  
Custom Build



# Non-modular way

1. Download OS installer for model via Internet Recovery
2. Erase drive and reinstall OS
3. Install existing image onto an external drive
4. Connect that external drive to the target Mac
5. Boot into newly installed OS and use Migration Assistant to bring over content from existing image
6. Make an image of the new machine for other Macs with the same OS build



# Modular way

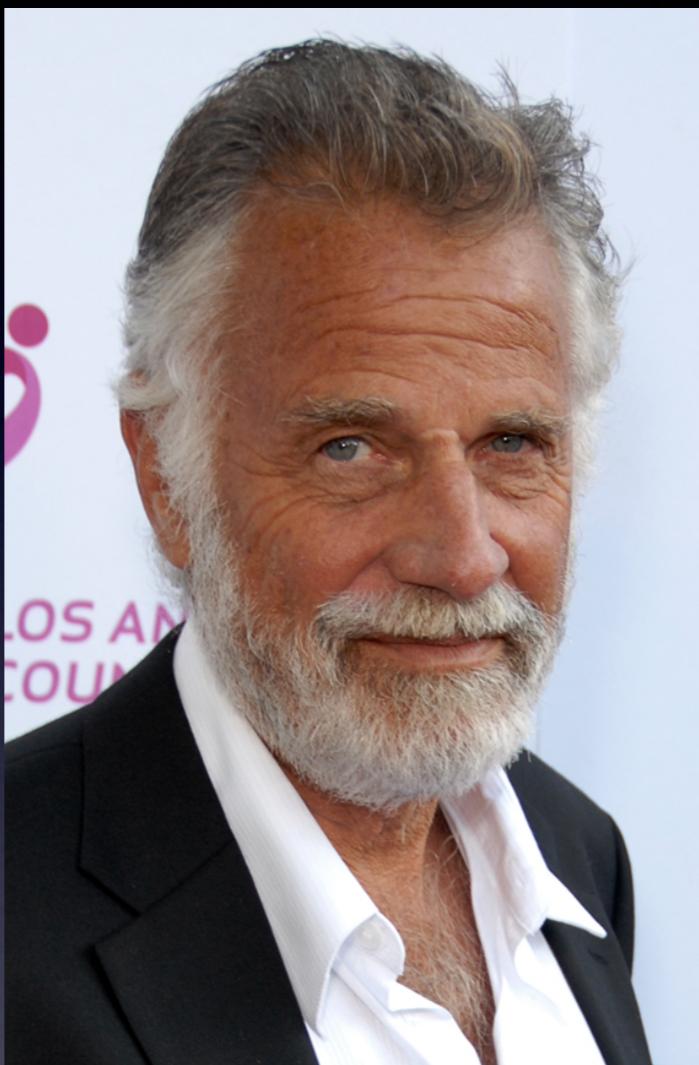
1. Download OS installer for model  
(or make a backup of never-booted drive)
2. Swap OS installer in your modular build workflow and generate new image
3. Deploy image as usual



# “Install Only” Way

1. Install software load as usual using automated tool (e.g., Munki)

# I DON'T ALWAYS CREATE IMAGES



## BUT WHEN I DO, I CREATE THEM MODULARLY!



# Another Case

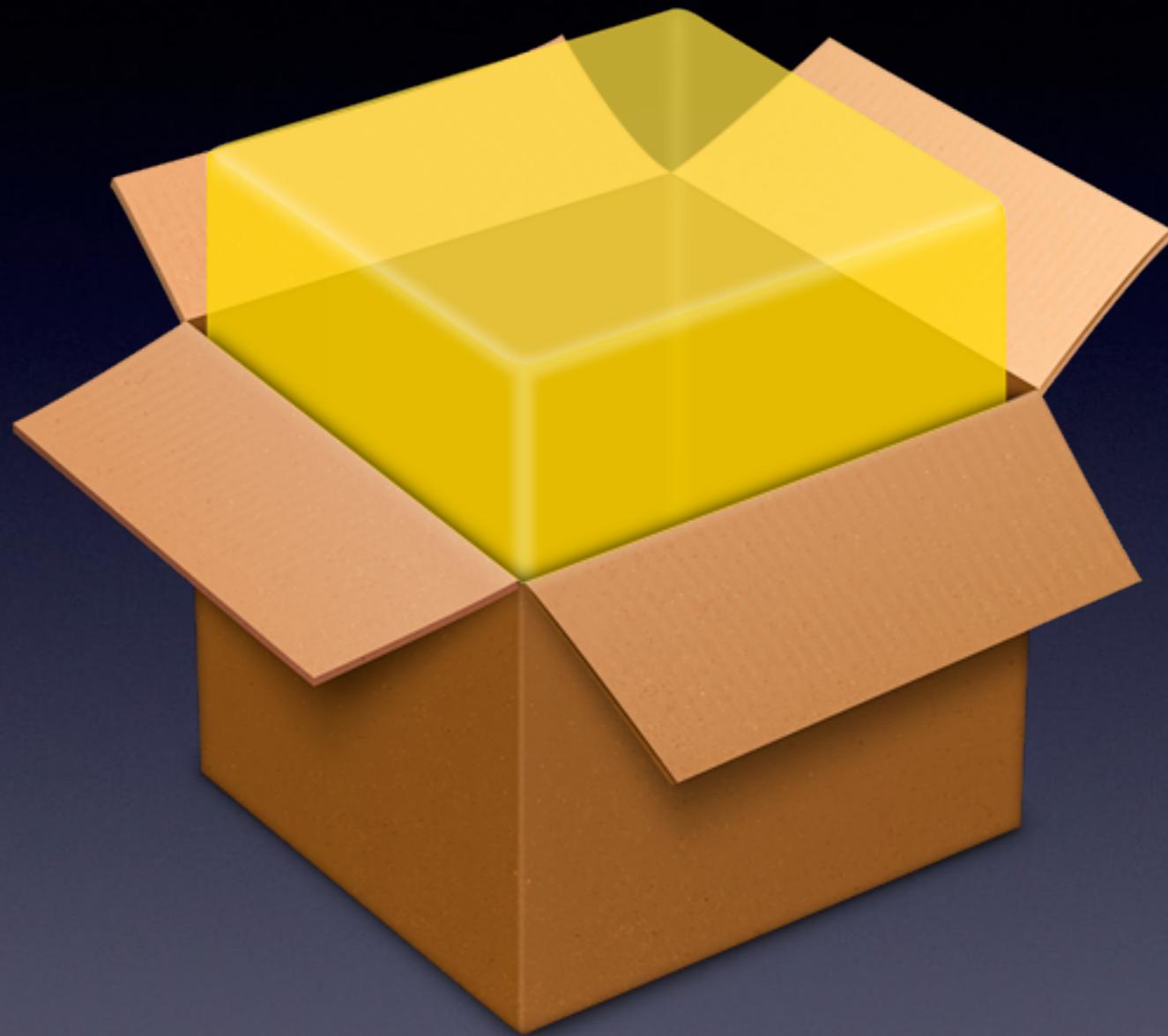
	Before	After
OS	10.6.8	10.8.2 (12C60) 10.8.2 (12C2034)
Key Apps	Final Cut Pro 7 Motion 4	Final Cut Pro X Motion 5
Existing/New Macs		16/5
Staff		1 skilled
Notes	Reported that FCP 7 and FCP X conflict when installed on same boot volume	

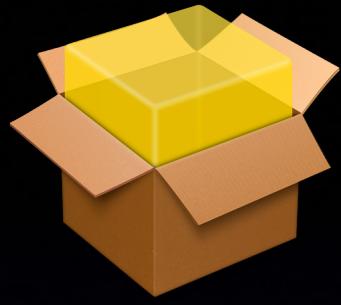


# Modular Advantages

- Never booted, cruft-free
- Easy to change OS / software
- Self-documenting
- Packages are useful elsewhere
- Multiple payload variations can be managed

# Techniques for Modular

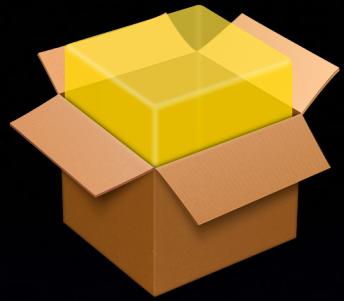




# When Packages Fail

## Assume

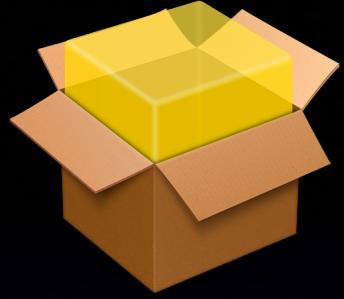
- Being installed on a booted volume
- Being run from the GUI
- A user is currently logged in



# When Packages Fail

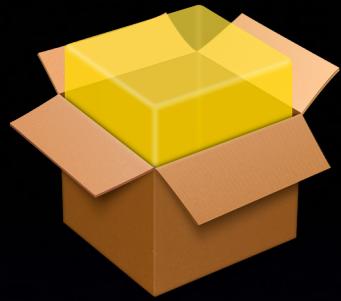
Solution:

- Repackage
- Modify Original Package
- Deploy somewhere else  
in the workflow



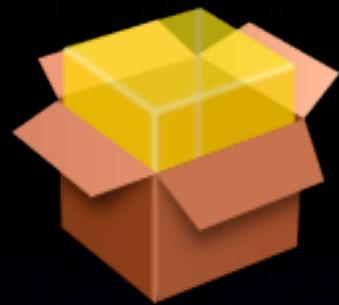
# Packages that Fail in Images

- Adobe CS/CC (w/AAMEE, CCP)
- Microsoft Office 2011/365
- iLife '11



# Packaging Tips

- Build using same users & permissions
- Segregate user-based and system-based files
- Use for serialization (volume / site licences)



# Packaging Tools



- **pkgsbuild, pkgutil (CLI)**
  - ▶ *Apple, included with OS X 10.7 and later*



- **Packages**
  - ▶ *WhiteBox ([s.sudre.free.fr/Packaging.html](http://s.sudre.free.fr/Packaging.html)), free*



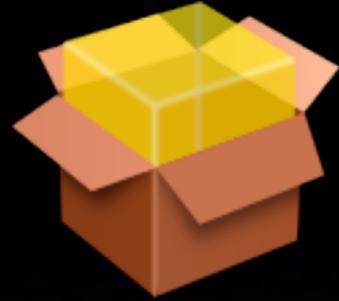
- **Composer**
  - ▶ *[www.JAMFSoftware.com](http://www.JAMFSoftware.com), \$100 (\$80 Edu.)*



# Packaging Tools



- Adobe-specific tools
  - ▶ *Adobe Application Manager Enterprise Edition (AAMEE)* – CS only
    - [adobe.com/products/creativesuite/it.html](http://adobe.com/products/creativesuite/it.html)
  - ▶ *Creative Cloud Packager (CCP)* – CC only
    - [helpx.adobe.com/creative-cloud/packager.html](http://helpx.adobe.com/creative-cloud/packager.html)



# Package Inspection



- Pacifist
  - ▶ [www.charlessoft.com](http://www.charlessoft.com), \$20
- Suspicious Package
  - ▶ [www.mothersruin.com/software/\*SuspiciousPackage\*](http://www.mothersruin.com/software/SuspiciousPackage), free
  - ▶ *QuickLook Plugin*

# More Modular Techniques

- Scripting
  - ▶ *Thursday @ 09:00 (Poucher)*
  - ▶ *Friday @ 09:00 (Reichman & Trouton)*
- Profiles
  - ▶ *Thursday @ 13:30 (Gilbert)*
  - ▶ *Thursday @ 15:15 (Smith)*
- LaunchAgents



# Modular Image Creation Tools



# Modular Image Creation Tools

Boot OS = Build OS  
(major release)



# Modular Image Creation Tools



- InstaDMG (+ InstaUp2Date)
  - ▶ *Kuehn, Wisenbaker, Banks et al*
  - ▶ [afp548.com/category/instadmg/](http://afp548.com/category/instadmg/)
  - ▶ OS X 10.5 - 10.8 only
  - ▶ CLI
- InstaDMG 10.9 fork
  - ▶ *Yoann Gini*
  - ▶ <https://github.com/ygini/InstaDMG>



# Modular Image Creation Tools



- System Image Utility/NetRestore
  - ▶ Apple
    - ▶ *in /System/Library/CoreServices/  
(or Server Admin Tools in 10.7 and earlier)*
    - ▶ GUI
    - ▶ *Extract .dmg from .nbi generated (mount  
SetName.nbi/NetInstall.dmg,  
then grab /Packages/System.dmg)*



# Modular Image Creation Tools

- can haz image
  - ▶ Google
  - ▶ [https://code.google.com/p/google-macops/wiki/can\\_haz\\_image\\_manual](https://code.google.com/p/google-macops/wiki/can_haz_image_manual)
  - ▶ CLI



# Modular Image Creation Tools

- System Image Creator
  - ▶ *Mondada (Duncan McCracken)*
  - ▶ [\*https://github.com/mondada/SIC\*](https://github.com/mondada/SIC)
  - ▶ *Terminal-based UI*
  - ▶ *"I designed it not so much for creating a monolithic image but for creating a modular baseline." (AFP548 podcast, ep. 9)*



# Modular Image Creation Tools

- **stew**
  - ▶ *Joseph Chilcote*
  - ▶ <https://github.com/chilcote/stew>
  - ▶ *CLI*
  - ▶ *“...stew is useful to myself and anyone with my particular automation needs. I would definitely recommend AutoDMG first.”*



# Modular Image Creation Tools



- AutoDMG
  - ▶ *Per Olofsson*
  - ▶ <https://github.com/MagerValp/AutoDMG>
  - ▶ *GUI, CLI*

Messages

Per Olofsson



Per, what is your preferred pronunciation for AutoDMG? (I presume “Auto Damage” was a joke.) Auto D-M-G? Auto D’image? Auto Image?



2014-05-29, 8:48 PM



It was a joke, but it kinda stuck :)

2014-05-29, 11:12 PM



## InstaDMG   SIU/NR   SIC   can haz image stew   AutoDMG

Admin UI

CLI  
+ text files

GUI

Terminal

CLI

CLI  
+ text file

GUI,  
CLI + plist

Payload

pkg  
dmg w/app  
dmg w/pkg

pkg  
sh  
user accounts

pkg

pkg  
dmg w/app

pkg  
dmg w/pkg

pkg  
dmg w/app  
dmg w/pkg  
app

Automate

Catalogs  
(+Nested)

Automator  
Workflow

Config.

Folder  
Structure

Catalogs  
(flat)

Templates  
(+Nested)

Requires

10.5+,  
Python

extracting  
the dmg

sh

Webserver,  
Python 2.7

10.9+,  
Python 2.7

10.7+



# AutoDMG In Action!



# Demo Ingredients

- AutoDMG
  - ▶ *github.com/MagerValp/AutoDMG*
- OS Installer (*same as booted OS*)
- CreateUserPkg
  - ▶ *github.com/MagerValp/CreateUserPkg*
- Anything else you'd like to add
  - ▶ *pkg, dmg with app or pkg, app*



# CreateUserPkg

Untitled

Full Name: Local Admin

Account name: tech

Password: ••••••

Verify: ••••••

User ID: 499 Account type: Administrator

Home directory: /Users/tech

UUID: A435DC3D-081D-49BA-91F0-71A0F6148AB2

Automatic login

Package ID: ca.ucalgary.ffa.iaml.create\_tech.pkg Version: 1.0

Save Package



# CreateUserPkg

Untitled

Full Name: Local Admin

Account name: tech

Password: ••••••

Verify: ••••••

User ID: 499 Account type: Administrator

Home directory: /Users/tech

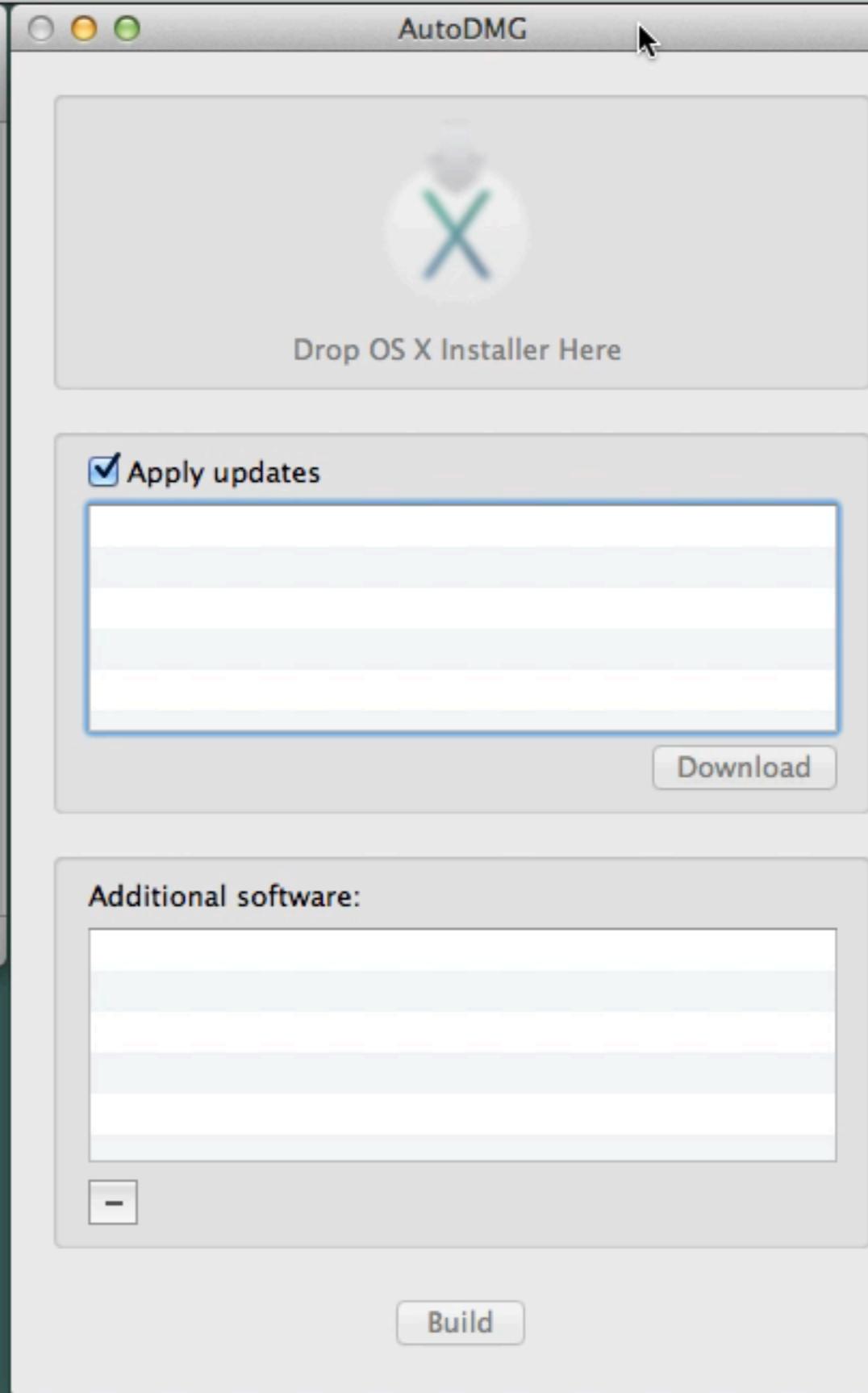
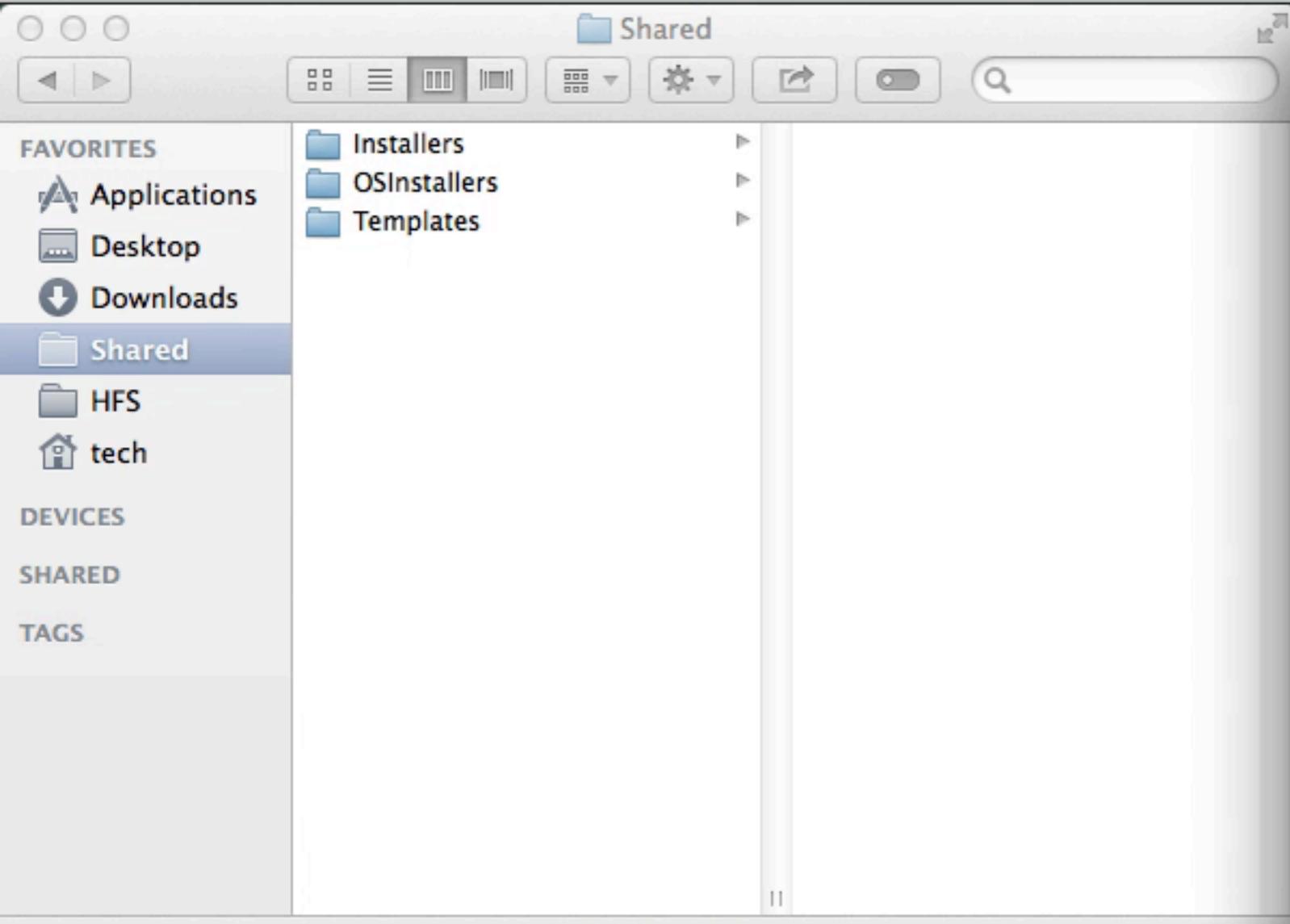
UUID: A435DC3D-081D-49BA-91F0-71A0F6148AB2

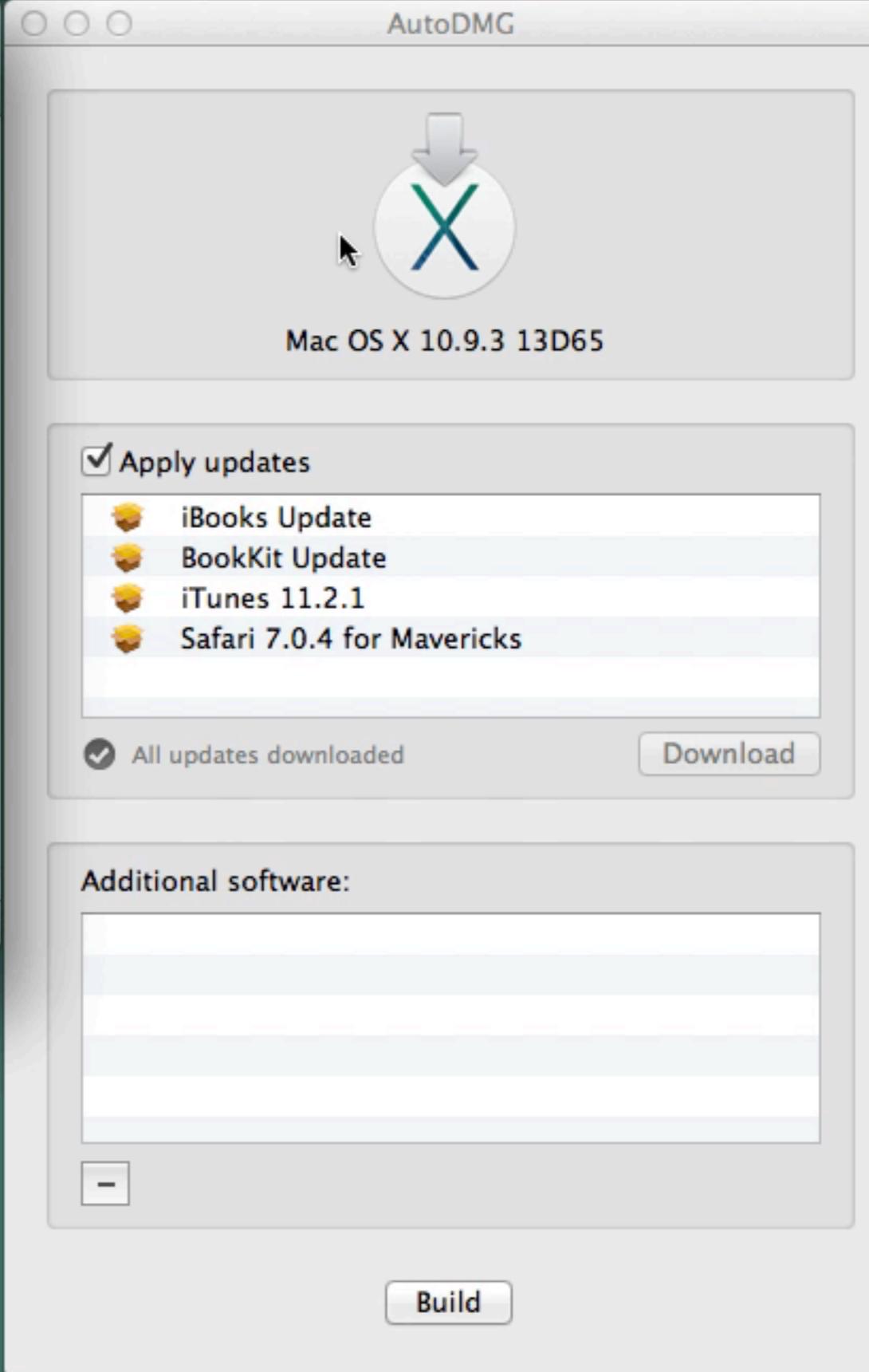
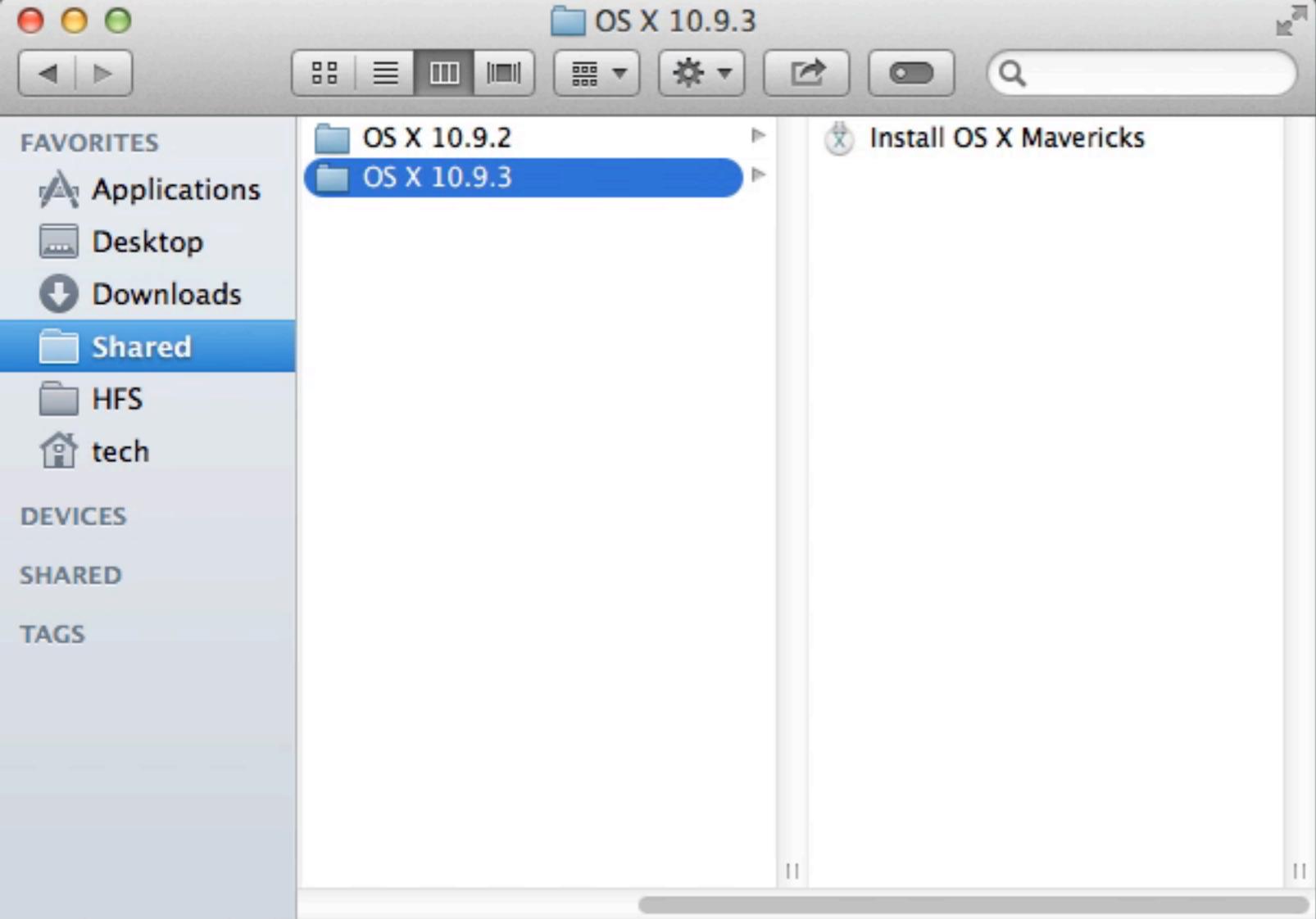
Automatic login

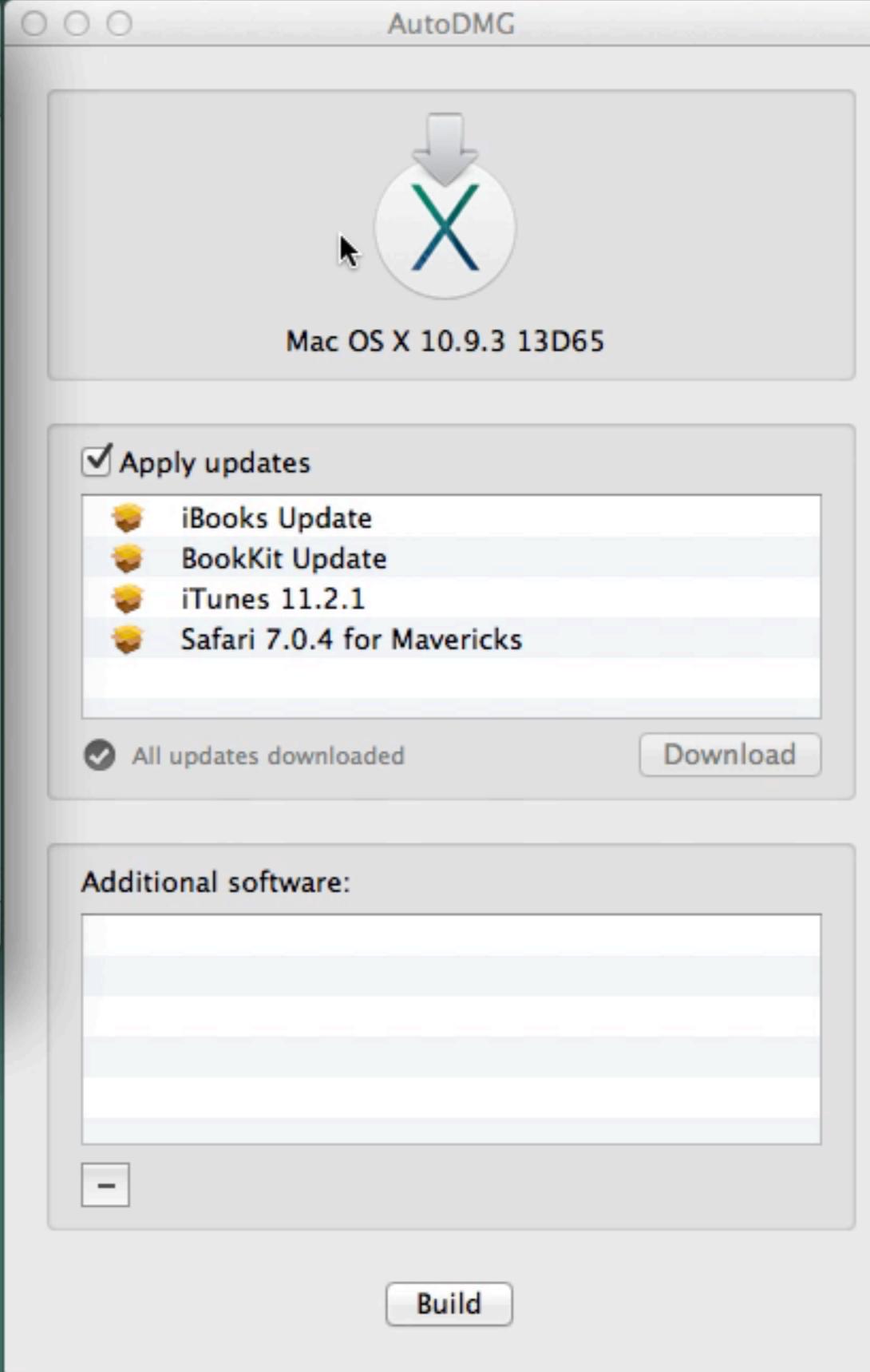
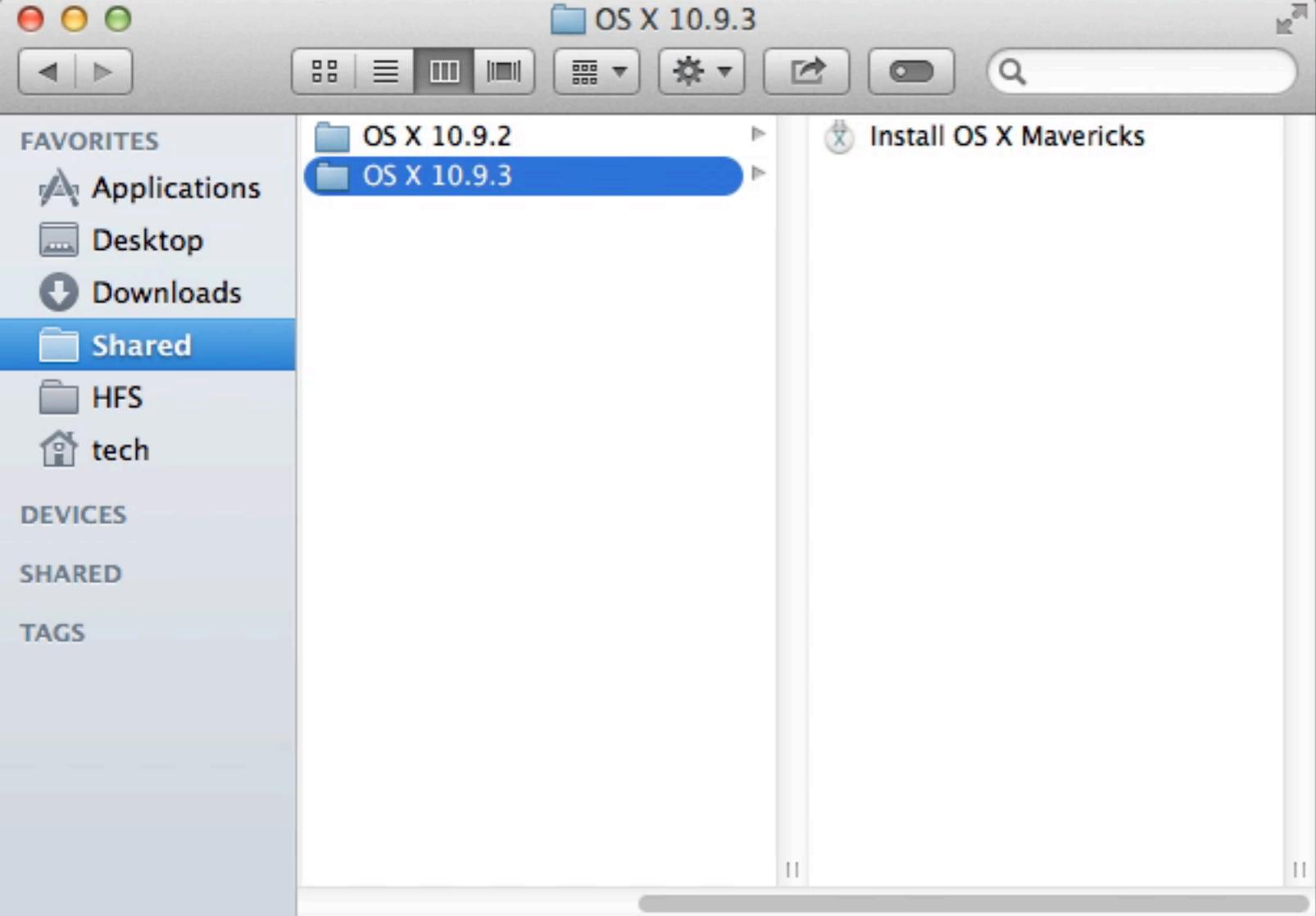
Package ID: ca.ucalgary.ffa.iaml.create\_tech.pkg Version: 1.0

Save Package

/Library/User Pictures







AutoDMG File Edit Window Help

Installers

FAVORITES Applications Desktop Downloads Shared HFS tech

DEVICES

SHARED

TAGS

Installers

OSInstallers

Templates

MuseScore-1.5.dmg  
Office 2011 14.4.1.pkg  
Office2Templ.pkg  
OSCforMax61.pkg  
ProAppsQTCodecs.dmg  
ProAudioC...ff07765.pkg  
QT7\_serial.pkg  
QuickTime...Leopard.pkg  
RAWCamer...te5.05.dmg  
Sibelius 7.1...erDisc.dmg  
SpectraVie...English.dmg  
SpectraVie...English.dmg  
TextWrangler\_4.5.8.dmg  
TouchOSC Editor.pkg  
Vectorworks2012Help.pkg  
vlc-2.1.4.dmg  
VW2012 M...s Patch.pkg  
VW2012.pkg  
Wacom Tab...amboo.pkg  
Wacom Tablet Intuos.pkg  
XeroxPrinterDrivers.pkg

55 items, 885.11 GB available

AutoDMG

Mac OS X 10.9.3 13D65

Apply updates

iBooks Update  
BookKit Update  
iTunes 11.2.1  
Safari 7.0.4 for Mavericks

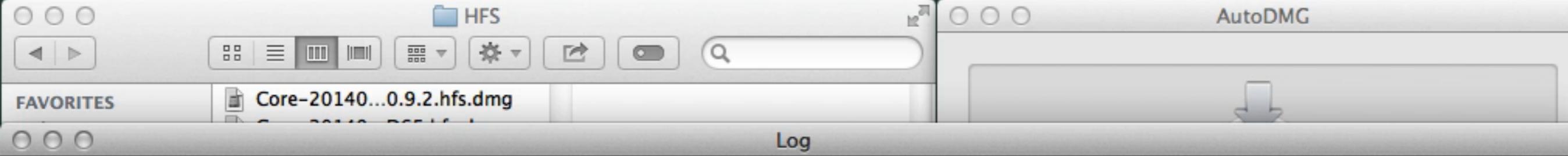
All updates downloaded Download

Additional software:

clearReg.pkg  
create\_tech\_2014.pkg  
TextWrangler\_4.5.8.dmg

Build





Timestamp	Level	Message
2014-05-22, 10:32:...	Notice	Starting task
2014-05-22, 10:32:...	Info	Phase Convert
2014-05-22, 10:32:...	Notice	Starting phas
2014-05-22, 10:32:...	Notice	Finalize task
2014-05-22, 10:32:...	Info	Launching fin
2014-05-22, 10:32:...	Info	'/Aplica
2014-05-22, 10:32:...	Info	'--socket
2014-05-22, 10:32:...	Info	'/tmp/se.
2014-05-22, 10:32:...	Info	'imagescan'
2014-05-22, 10:32:...	Info	'/Volumes/IAML-DSServer/Users/Shared/Deploy/Masters/HFS/Tech-20140522-10.9.3-13D65.hfs.dmg'
2014-05-22, 10:32:...	Notice	Script phase: asr1
2014-05-22, 10:32:...	Info	Phase Scanning disk image with weight 2097152 finished after 3.283 seconds
2014-05-22, 10:32:...	Notice	Starting phase: Scanning disk image
2014-05-22, 10:32:...	Notice	Script phase: asr2
2014-05-22, 10:32:...	Info	Phase Scanning disk image with weight 1048576 finished after 0.211 seconds
2014-05-22, 10:32:...	Notice	Starting phase: Scanning disk image
2014-05-22, 10:33:...	Notice	Script phase: asr3
2014-05-22, 10:33:...	Info	Phase Scanning disk image with weight 157286400 finished after 77.762 seconds
2014-05-22, 10:33:...	Notice	Starting phase: Scanning disk image
2014-05-22, 10:34:...	Info	asr output: asr: successfully scanned image "/Volumes/IAML-DSServer/Users/Shared/Deploy/Masters/HFS/Tech-20140522-...
2014-05-22, 10:34:...	Notice	Starting task with 1 phases
2014-05-22, 10:34:...	Info	Phase Scanning disk image with weight 17825792 finished after 6.716 seconds
2014-05-22, 10:34:...	Notice	Starting phase: Finishing
2014-05-22, 10:34:...	Notice	Finish
2014-05-22, 10:34:...	Notice	Build finished successfully, image saved to /Volumes/IAML-DSServer/Users/Shared/Deploy/Masters/HFS/Tech-20140522-1...

Log level: Info

Save As...



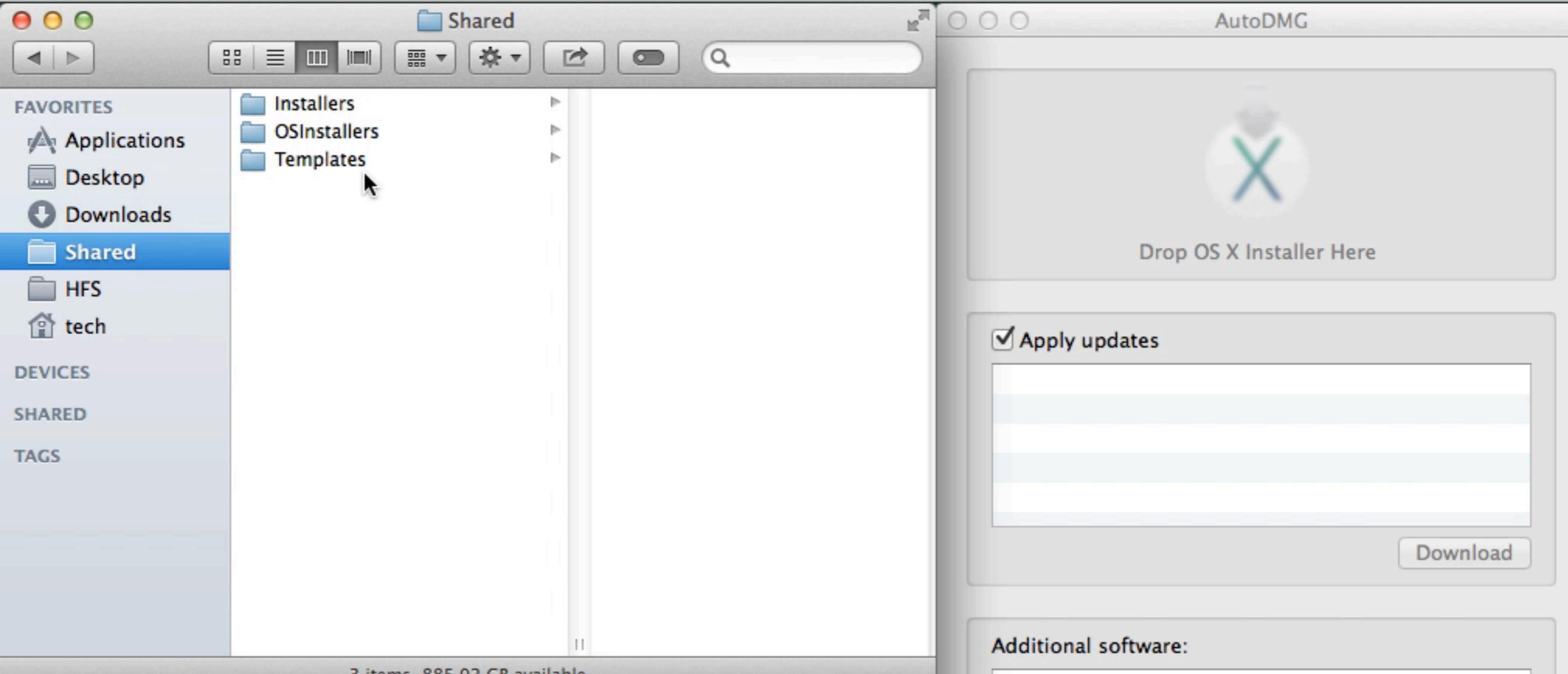


# Advanced AutoDMG



# Cached OS Install

- Replicates a popular feature in InstaDMG (only better)
- A demo is worth a thousand words...



AutoDMG

Drop OS X Installer Here

Apply updates

Download

Additional software:

-

Build

This window is for creating a bootable OS X installer. It features a large circular icon with a green 'X' in the top right corner. Below it is a placeholder text 'Drop OS X Installer Here'. A checkbox labeled 'Apply updates' is checked. A 'Download' button is located to the right of the update section. Below that is a section titled 'Additional software:' with a minus sign '-' at the bottom left. A 'Build' button is located at the bottom right of this panel.





# Cached OS Install

- Great for testing
  - ▶ *Saves ~20 min*
  - ▶ *Build final from scratch (best practice)*



# Templates

- Save from GUI
- Make/modify your own



# Templates

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://
www.apple.com/DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <key>AdditionalPackages</key>
    <array>
        <string>/Users/Shared/Installers/clearReg.pkg</string>
        <string>/Users/Shared/Installers/create_tech_2014.pkg</string>
        <string>/Users/Shared/Installers/TextWrangler_4.5.8.dmg</string>
    </array>
    <key>ApplyUpdates</key>
    <true/>
    <key>SourcePath</key>
    <string>/Users/Shared/OSInstallers/OS X 10.9.3/Install OS X
Mavericks.app</string>
    <key>TemplateFormat</key>
    <string>1.0</string>
    <key>VolumeName</key>
    <string>Macintosh HD</string>
</dict>
</plist>
```



# IncludeTemplates

- Added by editing .adtmpl file
- No limit to nesting
- Run from CLI or GUI

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/
DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <key>IncludeTemplates</key>
    <array>
        <string>/Users/Shared/Templates/iaml_payload.adtmpl</string>
    </array>
    <key>ApplyUpdates</key>
    <true/>
    <key>SourcePath</key>
    <string>/Users/Shared/OSInstallers/OS X 10.9.3/Install OS X Mavericks.app</
string>
    <key>TemplateFormat</key>
    <string>1.0</string>
    <key>VolumeName</key>
    <string>IAML-Mav</string>
</dict>
</plist>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/
DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <key>IncludeTemplates</key>
    <array>
        <string>/Users/Shared/Templates/tech-labs.adtmpl</string>
        <string>/Users/Shared/Templates/fau-labs.adtmpl</string>
        <string>/Users/Shared/Templates/Office2011_no_Outlook.adtmpl</string>
        <string>/Users/Shared/Templates/internet.adtmpl</string>
        <string>/Users/Shared/Templates/iLife.adtmpl</string>
        <string>/Users/Shared/Templates/iWork.adtmpl</string>
        <string>/Users/Shared/Templates/notation.adtmpl</string>
        <string>/Users/Shared/Templates/modelling.adtmpl</string>
        <string>/Users/Shared/Templates/audio.adtmpl</string>
        <string>/Users/Shared/Templates/video-animation.adtmpl</string>
        <string>/Users/Shared/Templates/printers-iaml.adtmpl</string>
    </array>
    <key>TemplateFormat</key>
    <string>1.0</string>
</dict>
</plist>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/
DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <b><key>AdditionalPackages</key></b>
    <array>
        <string>/Users/Shared/Installers/iDVD final.pkg</string>
        <string>/Users/Shared/Installers/iDVDEExtraContent.pkg</string>
        <string>/Applications/iMovie.app</string>
        <string>/Applications/iPhoto.app</string>
        <string>/Users/Shared/Installers/RawCameraUpdate5.05.dmg</string>
    </array>
    <b><key>IncludeTemplates</key></b>
    <array>
        <string>/Users/Shared/Templates/GarageBand2013.adtmpl</string>
    </array>
    <b><key>TemplateFormat</key></b>
    <string>1.0</string>
</dict>
</plist>
```



# IncludeTemplates

- Parses `IncludeTemplates` before `AdditionalPackages` within the same template

Template 0:



Template 1:



Template 2:



Template 3:



Template 0:



Template 1:



Template 2:



Template 3:





Drop OS X Installer Here

Apply updates

Download

Additional software:

-  vlc-2.1.4.dmg
-  MPEG\_Streamclip\_1.9.2.dmg
-  Keynote.app



Build

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/
DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <key>AdditionalPackages</key>
    <array>
        <string>/Users/Shared/Installers/vlc-2.1.4.dmg</string>
        <string>/Users/Shared/Installers/MPEG_Streamclip_1.9.2.dmg</string>
        <string>/Applications/Keynote.app</string>
    </array>
    <key>ApplyUpdates</key>
    <false/>
    <key>TemplateFormat</key>
    <string>1.0</string>
    <key>VolumeName</key>
    <string>Macintosh HD</string>
</dict>
</plist>
```

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/
DTDs/PropertyList-1.0.dtd">
<plist version="1.0">
<dict>
    <key>AdditionalPackages</key>
    <array>
        <string>/Users/Shared/Installers/vlc-2.1.4.dmg</string>
        <string>/Users/Shared/Installers/MPEG_Streamclip_1.9.2.dmg</string>
        <string>/Applications/Keynote.app</string>
    </array>
    <key>TemplateFormat</key>
    <string>1.0</string>
</dict>
</plist>
```



# AutoDMG Miscellany

- Updates catalogue
  - ▶ *Deprecates all but the latest version of the OS (10.7.5, 10.8.5, 10.9.4)*
  - ▶ *Per does the updating, but you can fork your own (for faster or slower service)*
    - 10.9.4: [github.com/rmanly/AutoDMG/blob/master/AutoDMG/UpdateProfiles.plist](https://github.com/rmanly/AutoDMG/blob/master/AutoDMG/UpdateProfiles.plist)
  - ▶ *~/Library/Application Support/AutoDMG/UpdateProfiles.plist*



# AutoDMG Miscellany

- Designed for “Thin” or smaller common images
- Build supporting Yosemite already available
  - ▶ *NDA forums*
  - ▶ *GitHub fork*

# Slides:

[www.ucalgary.ca/iaml/help/pro](http://www.ucalgary.ca/iaml/help/pro)

# Feedback:

[j.mp/psumac29](http://j.mp/psumac29)

Anthony Reimer

*@AnthonyReimer*



UNIVERSITY OF  
CALGARY