

DEPLOYMENT

A New Dawn

Agenda

- Classic Deployment
- Casper
- Deploy Studio
- Puppet
- Apple

Classic Deployment

- Build and Build Again
Very tedious and prone to errors,
inconsistent
- Monolithic, The Golden Master
- Early tools
 - NetRestore
 - Carbon Copy Cloner
 - Disk Utility

Mike Bombich

- NetRestore
- Carbon Copy Cloner



The Golden Master Mac

- Master Mac (newest model you have)
- Install all software
- Test, Test, Test again
- Image Cleanup (If you aren't using automated tools, stuff you **MUST** remove)

Image Cleanup



- Terminal cleanup of the following files
 - > sudo su - (logs you in as root, be careful)
 - rm -rf /Library/Caches/
 - rm -rf /System/Library/Caches/
 - rm -rf /System/Library/Extensions/Caches/
 - rm -rf /etc/ssh_host
 - rm -rf /var/db/Spotlight/
 - rm -rf /var/db/.com.apple.iokit.graphics
 - rm -rf /Library/logs
 - rm -rf /.Trashes/

The Golden Image

- The end of an era





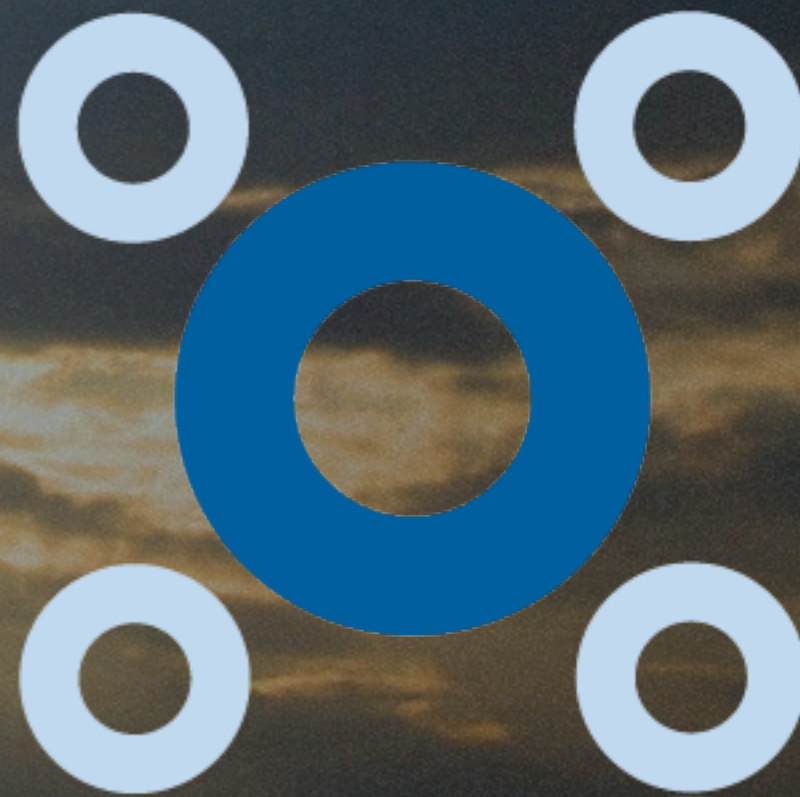
CASPER

JAMF
software

MACTECH

Casper Deployment

- Modular approach
- Packages are king
- Casper Tools
 - Casper Admin
 - Casper Imaging
 - Composer



Casper Admin

Casper Admin 8.64

New Config New Category Add Printers Add Dock Items New Adobe Install Info Delete Empty Trash

REPOSITORY
All Items

CONFIGURATIONS
Broad 2.1 (deprecated)
B2-Desktop (10.6.8)
B2-Laptop (10.6.8)
B2-Loaner (10.6.8)
B2-MacBook Air (10.6.8)
Broad 3.0 (deprecated)
B3-Desktop (10.7.4)
B3-MacBook Air (10.7.4)
B3-MacBook Pro (10.7.4)
B3-MBP Retina (10.7.4)
Broad 4.0
B4-Desktop (10.8.3)
B4-MacBook Air (10.8.3)
B4-MacBook Pro (10.8.3)
B4-MacBook Retina (10.8.3)
Classroom Macs (10.7.5)
Mac Loaner - Do Not Use, development only

DISTRIBUTION POINTS
* Casper AFP

View Type
All
Packages
Scripts
Printers
Directory Bindings
Dock Items
Adobe Installer Images

Stages
Deployable
All Stages
Non-Deployable
Testing
Deleted

Categories
All Categories
190 Printers
301B Printers
320C Printers
5CC Printers
7CC Printers
Adobe
Adobe Uninstallers
Adobe_Communications Only
Apple
Apple Updates
Base Software
Chemistry
Classroom
CrashPlan
DNA Analysis

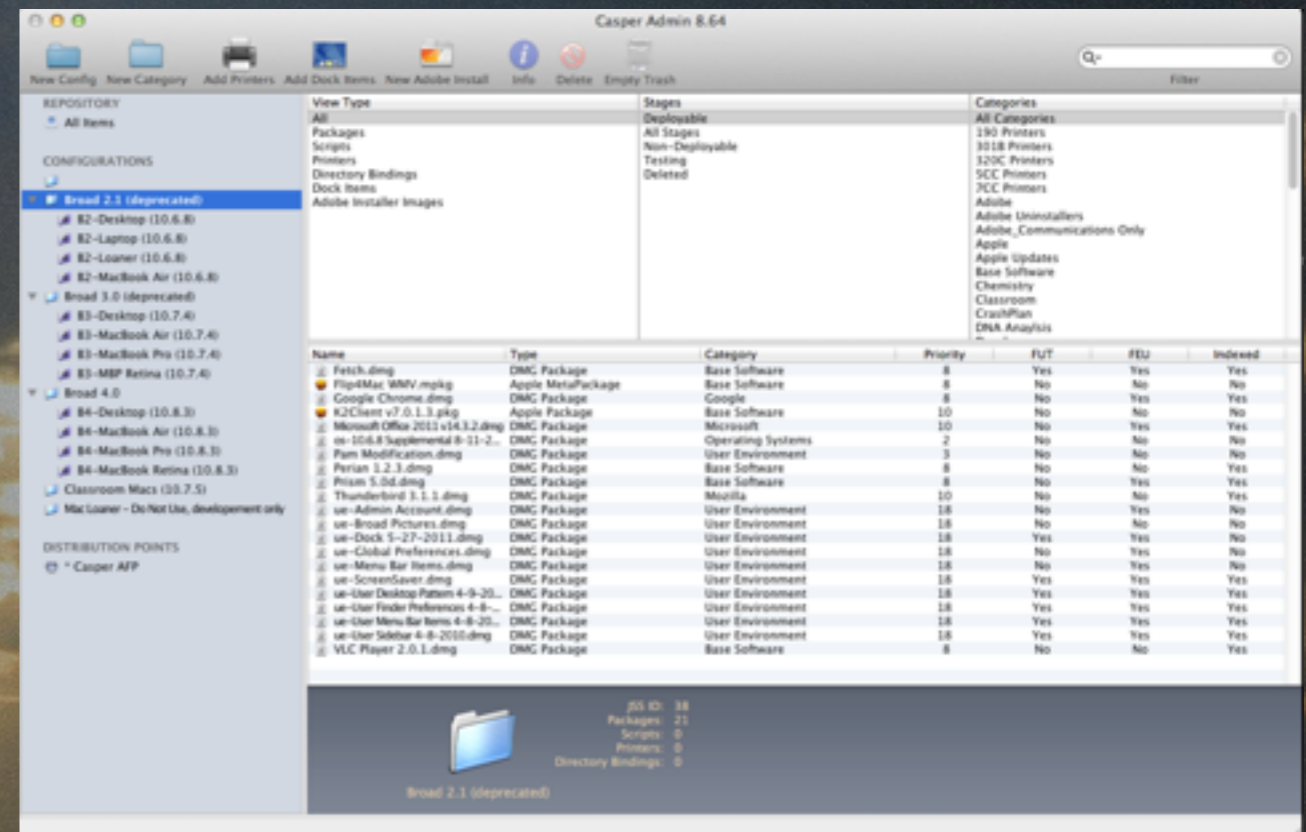
| Name | Type | Category | Priority | FUT | FEU | Indexed |
|------------------------------------|-------------------|-------------------|----------|-----|-----|---------|
| Fetch.dmg | DMG Package | Base Software | 8 | Yes | Yes | Yes |
| Flip4Mac WMV.mpkg | Apple MetaPackage | Base Software | 8 | No | No | No |
| Google Chrome.dmg | DMG Package | Google | 8 | No | Yes | Yes |
| K2Client v7.0.1.3.pkg | Apple Package | Base Software | 10 | No | No | No |
| Microsoft Office 2011 v14.3.2.dmg | DMG Package | Microsoft | 10 | No | Yes | Yes |
| os-10.6.8 Supplemental 8-11-2... | DMG Package | Operating Systems | 2 | No | No | No |
| Pam Modification.dmg | DMG Package | User Environment | 3 | No | No | No |
| Perian 1.2.3.dmg | DMG Package | Base Software | 8 | No | No | Yes |
| Prism 5.0d.dmg | DMG Package | Base Software | 8 | No | Yes | Yes |
| Thunderbird 3.1.1.dmg | DMG Package | Mozilla | 10 | No | No | Yes |
| ue-Admin Account.dmg | DMG Package | User Environment | 18 | No | Yes | No |
| ue-Broad Pictures.dmg | DMG Package | User Environment | 18 | No | No | No |
| ue-Dock 5-27-2011.dmg | DMG Package | User Environment | 18 | Yes | Yes | No |
| ue-Global Preferences.dmg | DMG Package | User Environment | 18 | No | Yes | No |
| ue-Menu Bar Items.dmg | DMG Package | User Environment | 18 | No | Yes | No |
| ue-ScreenSaver.dmg | DMG Package | User Environment | 18 | Yes | Yes | Yes |
| ue-User Desktop Pattern 4-9-20... | DMG Package | User Environment | 18 | Yes | Yes | Yes |
| ue-User Finder Preferences 4-8-... | DMG Package | User Environment | 18 | Yes | Yes | Yes |
| ue-User Menu Bar Items 4-8-20... | DMG Package | User Environment | 18 | Yes | Yes | Yes |
| ue-User Sidebar 4-8-2010.dmg | DMG Package | User Environment | 18 | Yes | Yes | Yes |
| VLC Player 2.0.1.dmg | DMG Package | Base Software | 8 | No | No | Yes |

JSS ID: 38
Packages: 21
Scripts: 0
Printers: 0
Directory Bindings: 0

Broad 2.1 (deprecated)

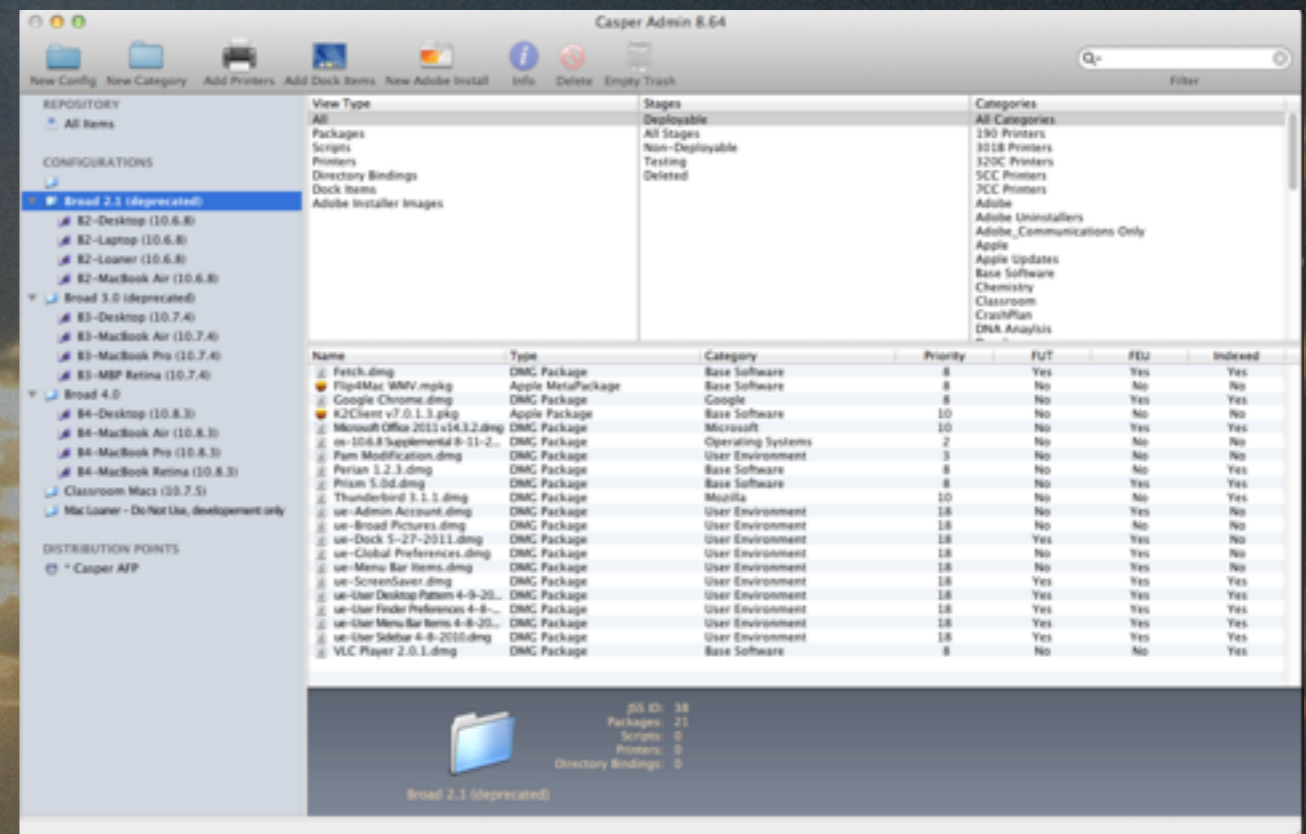
Casper Admin

- OS Image separate from all software packages
- Parent and Child relationships
- Create partitions on the drive for different configurations (i.e. BootCamp)
- Allows you to choose a WinClone image for windows deployment

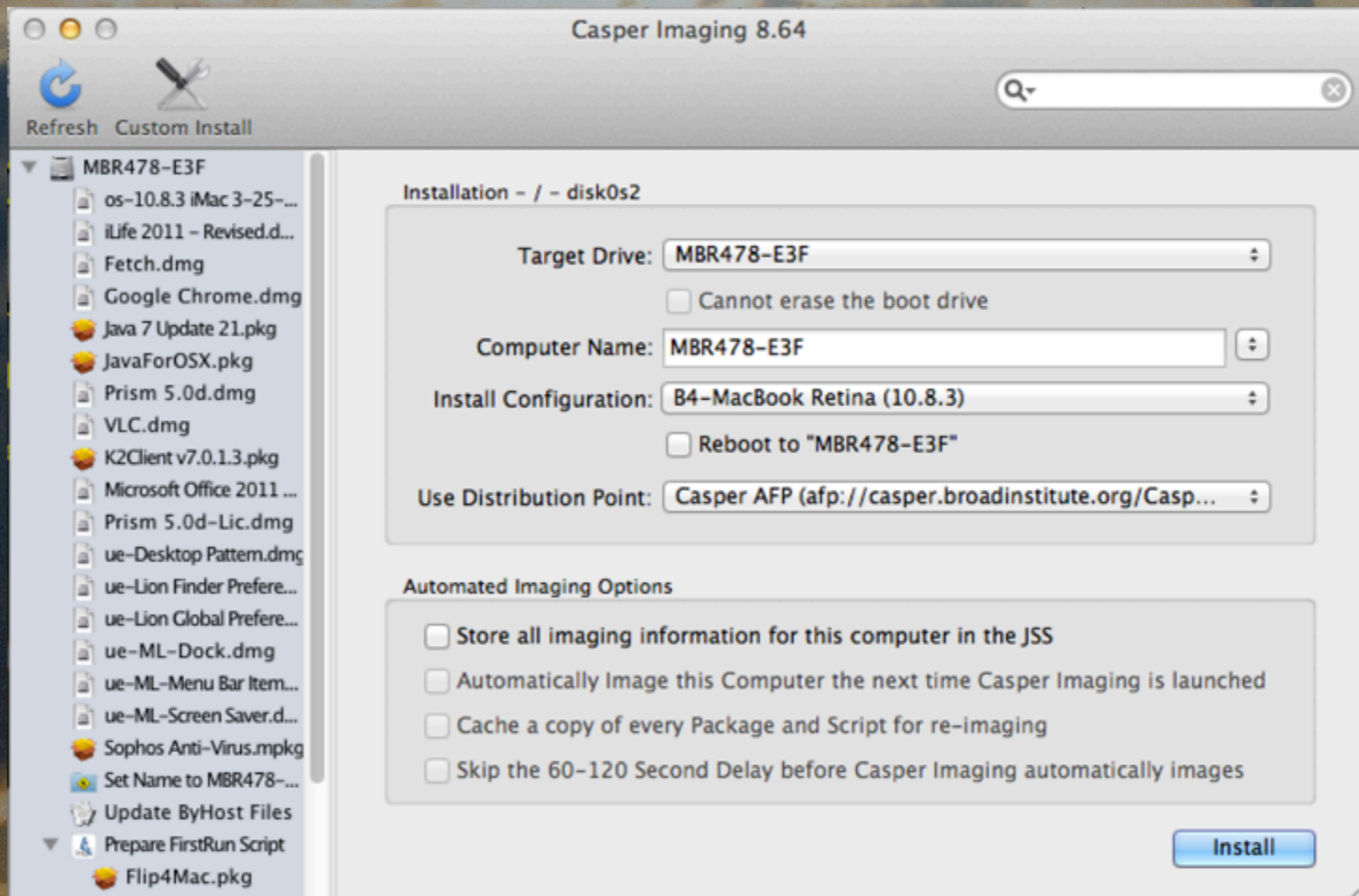


Casper Admin

- Accepts Composer built .dmg or .pkg formats
- Accepts commercial .pkg files
- Ability to create compiled images
- Local or Cloud based

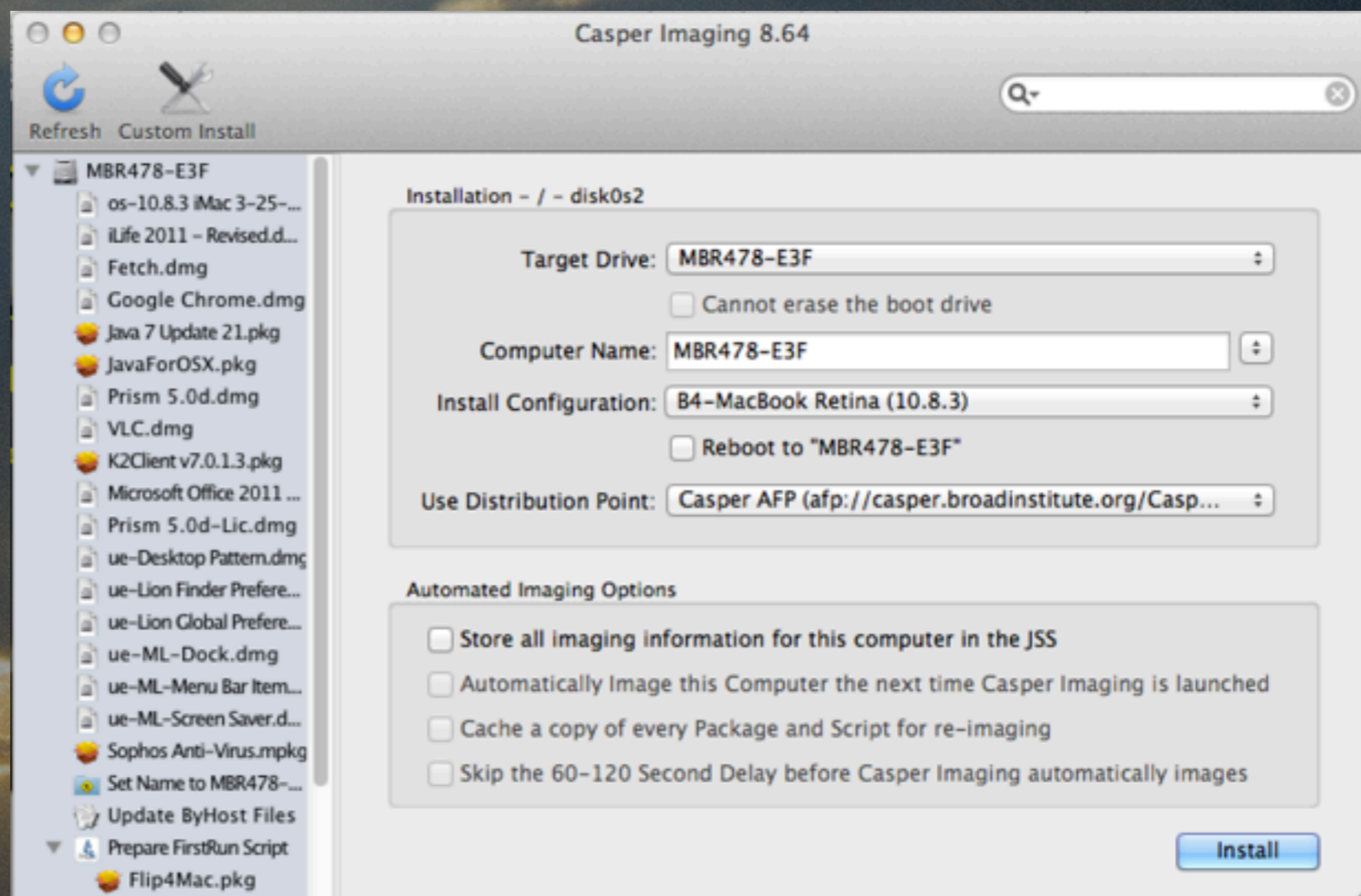


Casper Imaging



Casper Imaging

- Can be run from another partition
- External Drive
- NetBooted



DeployStudio

- Open Source Deployment
 - 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



DeployStudio

- 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:
 - NetInstall
 - DHCP
 - DNS
 - Server.app
 - DeployStudioServer
 - DeployStudio Assistant
 - DeployStudio Admin
 - DeployStudio Runtime

DeployStudio Setup

- DeployStudio Admin user account
 - Should be different than other admin accounts
- DeployStudio Assistant
 - Tool for installing and configuring the DeployStudio Server daemon and for NetBoot system creation for the DeployStudio Assistant

DeployStudio Server

- 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

DeployStudio Workflows

- Workflow Task Categories
 - General
 - Run a script
 - Partition a Disk
 - Install packages
 - Copy a File or Folder
 - Shutdown

DeployStudio Workflows

- Workflow Task Categories
 - Imaging
 - Image a volume
 - Restore a disk image

DeployStudio Workflows

- Workflow Task Categories
 - Post-Restoration
 - Active Directory Binding
 - Open Directory Bindig
 - Time Setup
 - Apple Software Update
 - Reconfigure system with computers database content

DeployStudio Workflows

- Workflow Task Categories
 - Firmware Password
- Four sample workflows are included
 - Create a master from a volume
 - Install a package (.pkg)
 - Restore a master on a volume
 - Triple-OS restoration

DeployStudio GUI

The screenshot shows the DeployStudio Admin interface. The top menu bar includes 'DeployStudio Admin', 'Server', 'Edit', 'Window', and 'Help'. Below the menu, a status bar indicates 'DeployStudio Admin connected to mainserver.pretendco.com'. The left sidebar contains a navigation tree with 'ACTIVITY', 'COMPUTERS', 'Lab', 'WORKFLOWS' (selected), 'MASTERS', 'PACKAGES', and 'SCRIPTS'. The main pane displays a table of workflows:

| 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-D52B-4622-813B-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, there is a 'Disk image' section with a 'Source' field, a 'Type' dropdown set to 'Compressed - faster restoration, small footprint', a 'Format' dropdown set to 'Auto-detect', and a 'Keywords' field. At the bottom, there are several checkboxes for workflow options:

- ☒ 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

On the right side of the interface, there is a list of 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 on a computer.
- Partition: Creates multiple partitions on a 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.
- Software update: Customizes the Software update workflow.
- Time: Configures the default network & time zone.
- Workflow: Inserts all the tasks of another workflow at runtime.

Four sample workflows are included

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

DeployStudio GUI

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

Left Sidebar:

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

Main Content Area:

| 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-D52B-4622-B138-87011205F82E |
| 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 "Partition" section with a visual representation of a disk layout. The "Target volume:" dropdown is set to "First disk available". The layout shows three partitions: LINUX (10GB), MacOSX (80%), and WINDOWS (20%). The "Apply layout template:" dropdown is set to "Custom". An "Add partition" button is visible.

At the bottom, there are checkboxes for "Secure erase before partitioning with the algorithm" (set to "single-pass zero-fill (~4 hours for 500GB)") and "Automate".

Right Sidebar:

- 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, a note says: "Drag an icon to the workflow timeline".

DeployStudio GUI

The screenshot displays the DeployStudio Admin application window, which is connected to a server named 'mainserver.pretendco.com'. The interface is divided into several sections:

- Top Bar:** Contains the application name 'DeployStudio Admin' and menu items: 'Server', 'Edit', 'Window', and 'Help'.
- Left Sidebar:** A navigation pane with icons and labels for 'Runtime', 'Control', and 'Logs'. Below these are expandable sections: 'ACTIVITY', 'COMPUTERS' (with a sub-item 'Lab'), 'WORKFLOWS' (highlighted with a '5' badge), 'MASTERS', 'PACKAGES', and 'SCRIPTS' (with a '5' badge).
- Main Content Area:**
 - Workflow List:** A table with columns 'Title', 'Description', 'Access group', and 'Identifier'. It lists several workflows, with 'Triple-OS restoration' selected and highlighted in blue.
 - Restore Section:** Features a 'Restore' button with a red arrow icon and a plus sign.
 - Configuration Fields:**
 - 'Target volume:' with a dropdown menu set to 'MacOSX'.
 - 'Image:' with a dropdown menu set to 'HFS' and a text field containing 'macosx.hfs.dmg'.
 - HFS only options:** A group of checkboxes and sliders for advanced configuration, including:
 - ☒ Don't check restoration (faster)
 - ☒ Rename ByHost prefs
 - ☒ Restore system recovery partitions
 - ☐ Enable multicast restoration
 - ☐ Add generic BCD (Vista and later)
 - ☐ Automate
 - ☒ Erase target for block copy restoration (faster)
 - ☒ Cleanup machine dependent files and caches
 - ☐ Pause workflow until multicast ends
 - ☐ Expand restored NTFS volume
 - Stream data rate: 100 MBs
 - Client disk speed: 125 MBs
 - Startup trigger: 0 clients
 - Timeout: 0 minutes

- Right Panel:** A collection of task icons and descriptions, including:
- 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
- Workflow

At the bottom right, a note states: 'Drag an icon to the workflow timeline'.

DeployStudio GUI

The screenshot displays the DeployStudio Admin application window, titled "DeployStudio Admin connected to mainserver.pretendco.com". The interface includes a menu bar (DeployStudio Admin, Server, Edit, Window, Help) and a toolbar with icons for Runtime, Control, and Logs. A left sidebar contains a tree view with categories: ACTIVITY, COMPUTERS (Lab), WORKFLOWS (5), MASTERS, PACKAGES, and SCRIPTS (5). The main pane shows a table of workflows:

| 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 "Restore" button with a red arrow icon. The configuration section includes:

- Target volume: Enter value... (dropdown menu showing "WINDOWS")
- Image: NTFS (dropdown menu) windows.ntfs.gz (dropdown menu)
- 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: [slider] 100 MBs
 - Startup trigger: 0 clients
 - Client disk speed: [slider] 125 MBs
 - Timeout: 0 minutes
 - ☐ Add generic BCD (Vista and later)
 - ☐ Expand restored NTFS volume
 - ☒ Set as default startup volume
 - ☐ Automate

At the bottom are buttons for "+", "-", and "Revert", "Save".

On the right, a panel lists various 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.
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- 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, a note says: "Drag an icon to the workflow timeline".

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 shows a tree view with 'WORKFLOWS' selected, containing 'Create Master Images', 'Install a package (pkg)', 'Restore a master on a volume', and 'Triple-OS restoration' (highlighted). The main pane shows a table of workflows:

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|-------------------------------|-------------------------------------|--------------|--------------------------------------|
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| 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 'Restore' button with a red arrow icon. The configuration section includes:

- Target volume: Enter value... (dropdown menu showing 'LINUX')
- Image: DEV (dropdown menu showing 'linux.dd.gz')
- HFS only options:
 - Rename volume to: [text field]
 - ☒ 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
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 - ☐ Expand restored NTFS volume
- Stream data rate: 100 MBs
- Client disk speed: 125 MBs
- Startup trigger: 0 clients
- Timeout: 0 minutes

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

- Active Directory binding: Binds a computer to an Active Directory server.
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- Partition: Creates multiple partitions on a specific disk.
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- 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, a note says 'Drag an icon to the workflow timeline'. The bottom of the window has 'Revert' and 'Save' buttons.

Preparing the Image

- 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
- verify serial numbers
- build font lists.

Preparing the Image

- Run Disk Utility->RepairPermissions.
- Run Disk Utility -> Verify Disk.
- Install desired apps
- Know about license keys, and alternate package formats

Preparing the Image

- Enable / disable various functions as desired:
 - Disable the Apple Remote functionality
 - Adjust Energy Saver settings
 - Unbind (AD or OD)
- ... Or you may want to script all of this

Preparing the Image

- 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.

Preparing the Image

- If DeployStudio is not used, each imaged machine may be 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.

Preparing the Image

- Select the name of the deployment image
- 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.
- Recomend you run imaging on a separate network that normal users do not live on

DisplayStudio Resources

- DeployStudio.com
- AFP548
- Google

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

Puppet

- 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

Puppet: Resources

- 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: 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.

Puppet: Metaparameters

- There are four metaparameters that let you arrange resources in order
 - before
 - require
 - notify
 - subscribe
- The power of Puppet is staggering
 - especially from an automation perspective

Apple

- Apple Server is app that is placed on top of any base system to provide server functions
- NetBoot
- NetRestore
- NetInstall

No-image deployment

- What packages do you need?
- Benefit: Fastest method of deployment
- Benefit: Doesn't require system-specific images
- Benefit: Ability to use Internet-restore.

Third-party tools

- **InstaDMG**
 - creates clean, never-booted ASR images for deploying MacOS X. It uses Apple's native installers, package formats, and disk image frameworks.
- **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.

Using the best tools

- Free and easy, DeployStudio
- Full Management and deployment, Jamf Casper
- Unix type management, Puppet
- Apple, NetBoot, the foundation

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