Extreme NetBooting

by Brandon Turner

NetBoot

What is NetBoot?

⦿ NetBoot

A technology that allows you to boot a machine from a "system" that is kept on a disk image on a NetBoot server.

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Why NetBoot?

● Classrooms and Labs
- Allows use of machine, changes discarded on restart

● Kiosks and Libraries
- Allows use of machine, changes discarded on restart

● Diskless NetBoot
- Kiosks, testing centers etc.
- Does not require read and write to the local hard drive

● System Troubleshooting and Repairs
- No CD's
- Repair utilities, diagnostics
- Running diskless allows repair of local hard drive

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Configure the Server

DHCP

- Required!
- Setup your DHCP range
- Enable it

Enable	Interface	Starting Address	Ending Address	Name
✓	en0	192.168.0.2	192.168.0.15	Test Range

Editing: Test Range

General | DNS | LDAP | WINS

Subnet Name: Test Range

Starting IP Address: 192.168.0.2

Ending IP Address: 192.168.0.15

Subnet Mask: 255.255.255.0

Network Interface: en0

Router: 192.168.0.1

Lease Time: 1   hours

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Configure the Server

NetBoot

- General Tab

  - Enable the ethernet port

Enable	Port
☑	Built-in Ethernet

- Enable Volume for:

  - Images

  - Client Data

Volume	Images	Client Data
Mac OS X	☑	☑
Radmind Ignores	☐	☐

Configure the Server

NetBoot Continued...

- Images Tab
    - Enable the image(s)
- Default: image that boots using the "N" Key or Boot Menu
    - Use Startup Disk to select other images.
- Diskless: Great for Terminals, Kiosks, and Utility Images

Image Name	Default	Enable	Diskless	Index	Protocol
http_image	●	☑	☐	5000	HTTP
SCL NetInstall	○	☐	☐	4998	NFS
SCL Utilities	○	☑	☑	4999	NFS

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Configure the Server

NetBoot Continued...

- Index: Use any number
    - For Load Balancing use 4096-65535
        - Across servers and or server hard disks
        - Not partitions - Has reverse effect reduces performance
- Protocol:
    - HTTP - Serve images without re-configuring firewall
    - NFS - Default method, Apple's preferred method

Image Name	Default	Enable	Diskless	Index	Protocol
http_image	●	☑	☐	5000	HTTP
SCL NetInstall	○	☐	☐	4998	NFS
SCL Utilities	○	☑	☑	4999	NFS

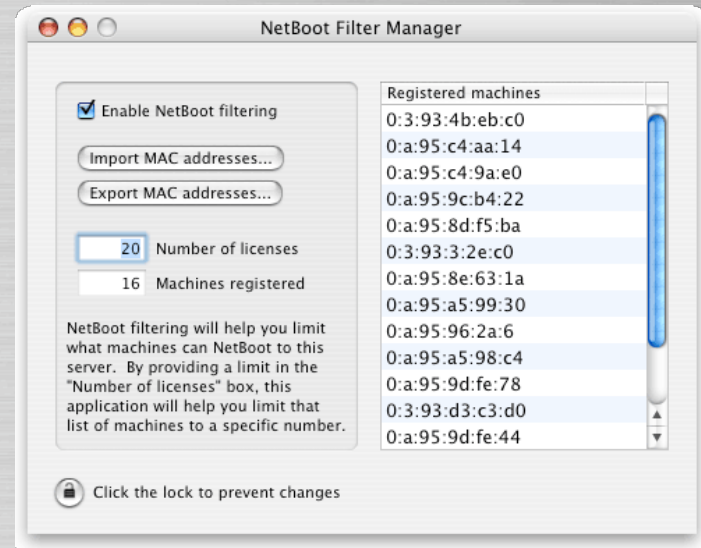# Configure the Server

NetBoot Continued...

- Server Admin - Filters Tab

- Allow or Deny Clients via MAC Address

  - Browse, Import, or Add machines

    Or use...

- NetBoot Filter Manager

  - Created by Mike Bombich

  - Easily import multiple machines

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A NetBoot Set?

A set of five files maintained on the NetBoot server that allow client machines to boot.

- booter
- mach.macosx
- mach.macosx.mkext
- Imagename.dmg
- NBImageInfo.plist
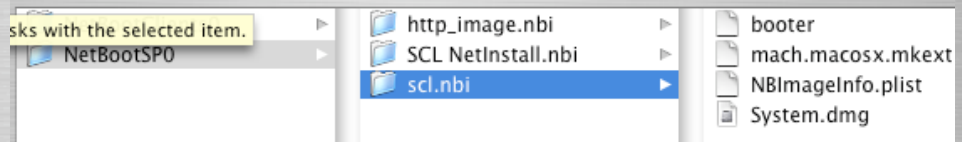
These files are stored in
/Library/NetBoot/NetBootSP0/<name.nbi>

Create A NetBoot Set

Setup a "Master" computer

- Setup machine, like accounts and software updates
- Install utilities such as DiskWarrior etc.
- Boot into target disk mode

Use System Image Utility

- Located in Applications/Server folder on your server
- Can be copied to another machine for use
- Choose the "New Boot" button
- "Contents" tab, choose your target disk, language, packages

Upload <name.nbi> to Server

- /NetBootSP0 (Is the default Share Point)
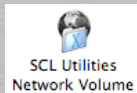- Configure "Images Tab" on NetBoot section on the server

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NetBoot Process...

① BSDP DISCOVER , DHCP Request

Startup Disk

SCL Utilities Network Volume

② Downloads the "booter" file

- Startup disk is set, or "N" key is used

- BSDP Discover & Offer

- DHCP Discover, Offer, Request, ACK

- Client has DHCP address

- Downloads booter file via TFTP

Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: BSDP DISCOVER [en0] 1, HW Address NetBoot001 arch=ppc sysid=PowerMac3,4
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: BSDP OFFER sent [1, HW Address] pktsize 423
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: DHCP DISCOVER [en0]: 1, HW Address
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: OFFER sent brandon-tech-mac-3 IP Address pktsize 300
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: DHCP REQUEST [en0]: 1, HW Address
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: ACK sent brandon-tech-mac-3 IP Address pktsize 300

/var/log/system.log   Filter: Q▾

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NetBoot Process...

Downloads Kernel & Kernel Cache

❸

- Loads boot file

- Downloads the Kernel and Kernel Extension Cache

    - mach.macosx

    - mach.macosx.mkext

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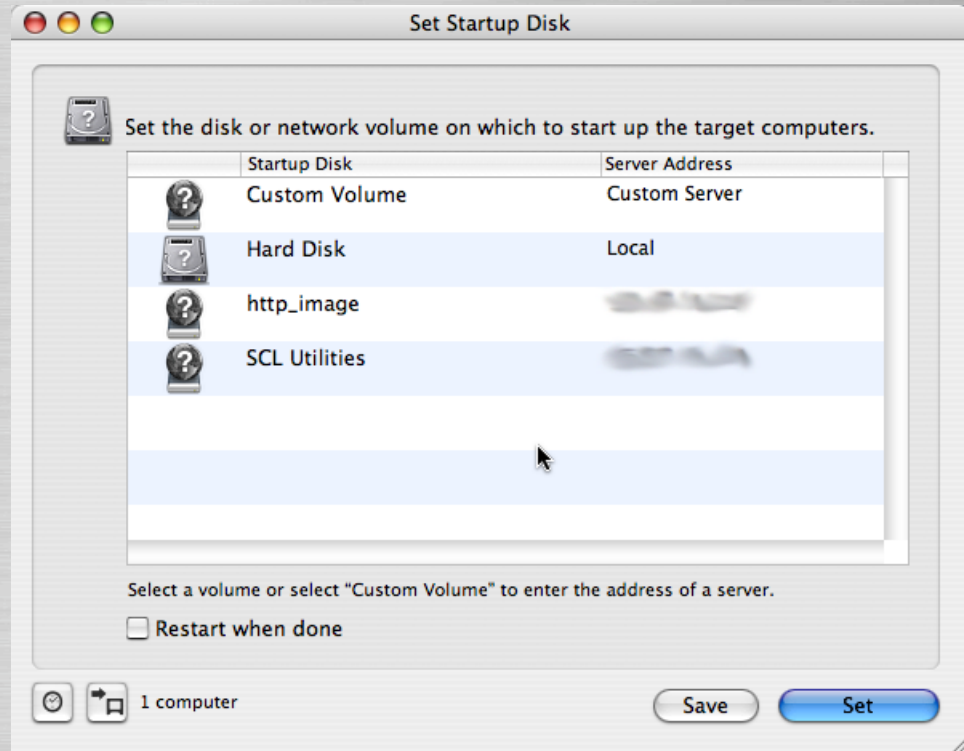STUDENT COMPUTING LABS

NetBoot Process...

④

- Kernel mounts NetBoot disk image via NFS
- Loads the Kernel Extension Cache
- Client booted from image on server

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Using ARD to NetBoot

- Open Remote Desktop
- "Manage" menu item
- Set Startup Disk
- Choose and Image
- Select Restart when done

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NetInstall Using NetRestore

# NetInstall What is it?

NetInstall

The difference between NetInstall and NetBoot is that its sole purpose is to provide an environment in which you can install software onto the local drive.

- Like booting from an installation CD!

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A NetInstall Set?

A set of five files maintained on the NetBoot server that allow client machines to boot.

- booter
- mach.macosx
- mach.macosx.mkext
- Imagename.dmg
- NBImageInfo.plist
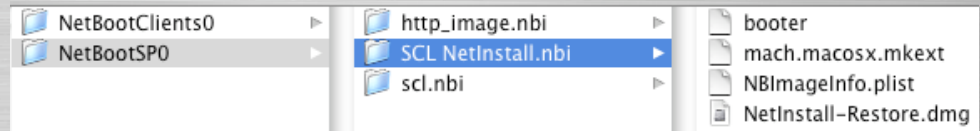
These files are stored in
/Library/NetBoot/NetBootSP0/name.nbi

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Create A NetInstall Set

Download NetRestore from Mike Bombich's site

Open NetRestore Helper
- Click "Create NetInstall Set" tab
- Fill in the fields
- Choose a Protocol - NFS or HTTP

Upload <name.nbi> to server
- /NetBootSP0 (Is the default Share Point)
- Configure "Images Tab" on
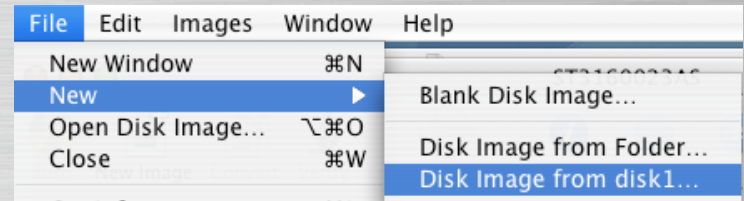 - NetBoot section in Server Admin application

Create An Image

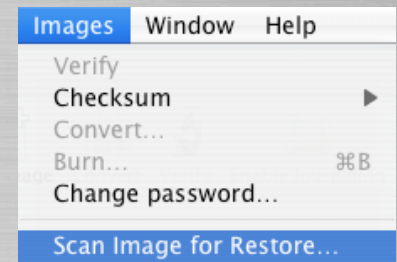Tools to create and ASR Ready Disk Images:

- Disk Utility
- SuperDuper
- NetRestore Helper

** Disk Utility is an excellent solution

Setup the "Master" machine (Updates, Tools, Software)

- Target Disk Mode the "Master" computer to another computer
- Create the disk image
- Scan image for ASR
    - SuperDuper and NRH do this automatically

Upload & Configure

- Mount the NetInstall-Restore.dmg from /NetBootSP0/<name.nbi>/NetInstall-Restore.dmg
  - Upload your ASR Disk Image
    - **Option 1**: /NetBootSP0/<name.nbi>/NetInstall-Restore/Applications/Utilities/Resources/Disk Images/
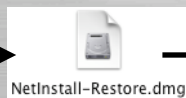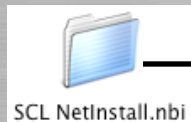   - **Option 2**: Open NetRestore.app and edit the Configurations to use an AFP share point
- Open NetInstall-Restore/Applications/Utilities/NetRestore.app
- Configure the Preferences and Configurations
- Enable Full Automation etc..
- Eject Image and Volume when finished

Resources Folder

- Resources folder
  - Store ASR images in "Disk Images" folder
  - Set "pre" and "post" action scripts (optional)
  - Preferences Folder
    - Configure "machine_specific_data.csv"
      (force settings to machines via MAC address)

NetRestore	About This Folder.html
NetRestore Helper	Disk Images ▷
NetRestore PHPServices ▷	Documentation ▷
Resources ▷	Example Scripts ▷
	NRH ▷
	Post-actions ▷
	Pre-actions ▷
	Preferences ▷

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NetBoot Process...

BSDP DISCOVER , DHCP Request

❶

Startup
Disk

**SCL Utilities
Network Volume**

Downloads the "booter" file

❷

- Startup disk is set, or "N" key is used

- BSDP Discover & Offer

- DHCP Discover, Offer, Request, ACK

- Client has DHCP address

- Downloads booter file via TFTP

Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: BSDP DISCOVER [en0] 1, HW Address
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Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: DHCP DISCOVER [en0]: 1, HW Address
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: OFFER sent brandon-tech-mac-3 IP Address
pktsize 300
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: DHCP REQUEST [en0]: 1, HW Address
Jan 12 14:37:14 Brandon-Test-Server bootpd[280]: ACK sent brandon-tech-mac-3 IP Address
pktsize 300

/var/log/system.log

Filter: Q

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NetBoot Process...

❸ Downloads Kernel & Kernel Cache

- Loads boot file
- Downloads the Kernel and Kernel Extension Cache
    - mach.macosx
    - mach.macosx.mkext

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NetBoot Process...

④

- Kernel mounts NetBoot Disk image via NFS

- Loads the Kernel Extension Cache

- Client booted from image on server

- But there's more!!!...

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S T U D E N T   C O M P U T I N G   L A B S

NetInstall Process...

❺ NetInstall-Restore.dmg
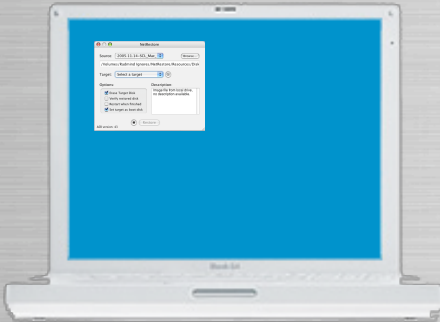
- Instead of "Finder" or "Login Window" it boots into NetRestore
  - If set to "Automate" it will run automatically

NetInstall Process...

❻ NetRestore requests image based on preferences you set
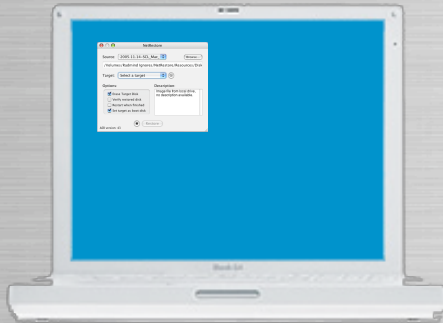
NetInstall Process...
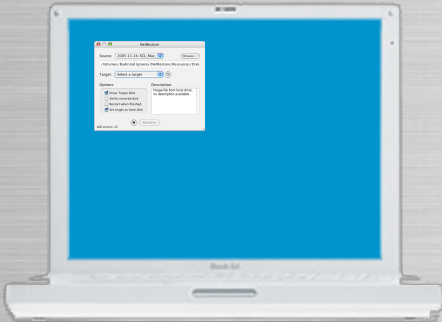
- NetRestore
  - Runs pre-action scripts
  - Erases and images the hard disk
  - Runs post-action scripts
- Preferences that can be set:
  - Verify hard disk
  - Set target as boot disk
  - Reboot when finished
  - Others..

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NetRestore PHP Services

What is PHP Services?

- NetRestore PHP Services

A technology that allows you to image a machine using a PHP website and a MySQL database that contains specific information about a client by it's hardware address.

Why Use PHP Services?

- Everything is stored in a database

- Changes can be made to the settings from a web page
  - No longer have to update the preference file in the application

- Machines can be imported from a Remote Desktop database
  - Use ADAM, a program created by Mike Bombich

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Prepare for the Image

Create a user on the server

- Imaging User
  - Short Name "Image"
  - Create a password

Create a share point

- Images

- This setup information can be found in the "Resources/Documentation" folder in the NetRestore download

Upload the image(s) to the share point

Share Points	All
Images	2005.10.20–
	2005.11.01–

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S T U D E N T   C O M P U T I N G   L A B S
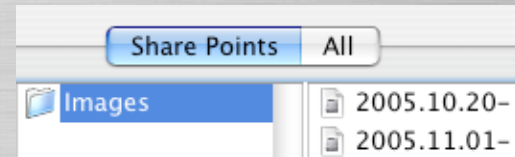
Enable PHP Module

- "Web" under Computers and Services list
  - Settings Tab
    - Modules
      - Enable php4_module

☑ php4_module   mod_php4.c   libexec/httpd/libphp4.so

- Start web services

▶ Start Service

Configure MySQL

⬤ Download the latest version of MySQL
- www.dev.mysql.com
    - The default Apple install has errors
        - Supposed to be fixed in 10.4.4 update
- Install Package, Startup Item, and Preference Pane
- Reboot server

⬤ MySQL Administrator
- GUI application to edit MySQL users and settings

⬤ Cocoa MySQL
- GUI application to edit MySQL databases

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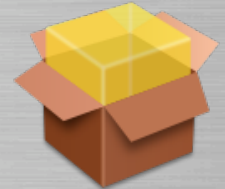
Configure MySQL

Open MySQL Administrator
- Server Host Name: 127.0.0.1
- Port: 3306 (Check firewall to allow this connection if on remote box)
- Username: root (This is not the local root)
- Password: <blank> (Change later..)

Click Options button
- Click "Create" on "Config my.cnf" popup (Important file!)

Click "Security" pulldown menu
- Check "Use Old Passwords" check box
  - 10.4.4 server update no longer needs this option checked

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Configure MySQL

Click Accounts button

- Click "root" <arrow to reveal others>
- Click localhost
- Change password
  - Instead of "root" you can create other MySQL users for security
  - This username and password is what you would use for your .php config files to connect to the databases

Accounts
- ▶ 👤
- ▼ 👤 root
  - localhost
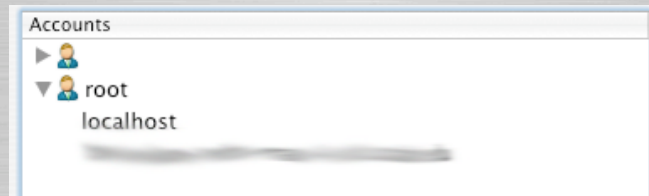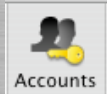
Configure MySQL

Use your favorite text editor
- edit /etc/my.cnf
- Configure my.cnf to use the "mysql.sock" socket

In server OS's before 10.4.4 change to..

[mysqld]
socket=/tmp/mysql.sock
# Use old password encryption method (needed for 4.0 and older clients)
old-passwords

[client]
socket=/tmp/mysql.sock

Configure MySQL

In Mac OS X Server 10.4.4, change to..

[mysqld]

socket=/var/mysql/mysql.sock

Use old password encryption method (needed for 4.0 and older clients)

old-passwords

[client]

socket= /var/mysql/mysql.sock

Configure PHP Services

Upload NetRestore PHP Services folder to your web server

- Rename to something simple like "nr"
- Edit config.php with your settings
- Open http://yourdomain.com/nr/install.php
- Follow on screen instructions

Write down the nr_admin password

- This user is to edit database settings only
- Create a new admin user once logged in
    - This user is used for adding machines and making changes

HELP!

<your renamed "nr" folder>/docs/

Use this documentation for help configuring NetRestore PHP Services

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Configure PHP Services

Login to http://www.yourdomain.com/nr/

Login as: nr_admin

- Manage Admin Groups
  - Create admins group
  - Set group password
- Manage Users
  - Create your "admin" user
  - Select "admins" group to administer
  - Check "Allow user to administer groups"
- Configure your other settings as well
- Logout of nr_admin

NetRestore

Data Management

Administrative Tasks

Manage Admin Groups

Manage Users

Manage Machine Groups

Import/Export Records

Database Administration

My Scripts

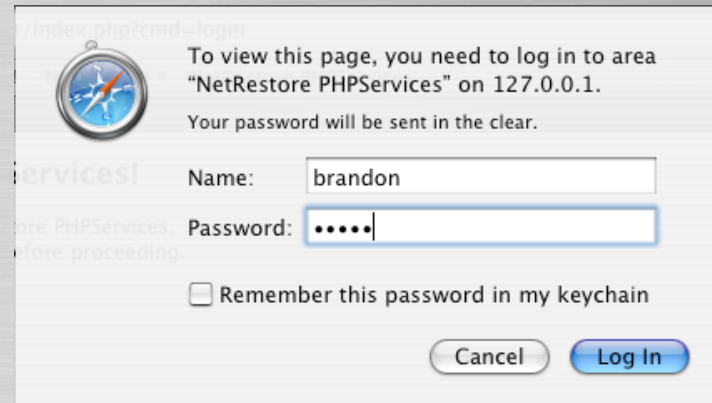**Documentation**

Hello **nr_admin!**

Logout

Version: 1.00

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Configure PHP Services

Login to http://www.yourdomain.com/nr/

Login as: <your admin user>

- Manage Machine Groups
    - Upload Mac Addresses
        - Comma delimited file!
- Manage NetRestore Configurations
    - Link images to your share point.
- Manage NetRestore Preferences
    - Choose a machine group
    - Set the preferences
- With a few tweaks you should be ready to image
- Logout of <your admin user>

To view this page, you need to log in to area "NetRestore PHPServices" on 127.0.0.1.
Your password will be sent in the clear.

Name: brandon
Password: •••••

☐ Remember this password in my keychain

Cancel   Log In

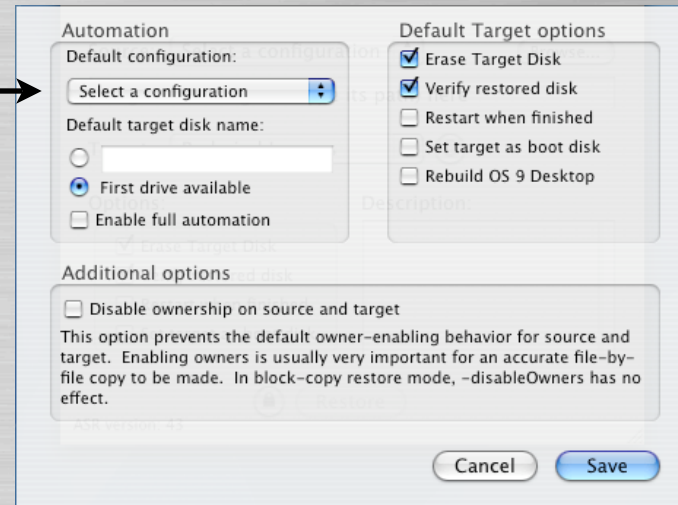**UNIVERSITY OF UTAH**
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Configure for Imaging

Mount the NetInstall-Restore.dmg from /NetBootSP0/<name.nbi>/ NetInstall-Restore.dmg

Open NetInstall-Restore/Applications/Utilities/NetRestore.app

Configure Remote Settings

Configure for Imaging

Fill in the fields..

- Type in path to your netrestore.php
- Administrative Group:
    - admins (login to web page to set)
- Group Password:
    - This is also set online as nr_admin

Save and unmount NetInstall-Restore image

Remote Database Integration

If you have NetRestore PHPServices installed on Mac OS X Server, NetRestore can retrieve machine settings from the server and automatically populate the preferences, configuration, and post-action settings.

URL to the web page used to retrieve system information:

http://_____/nr/netrestore.php

Example: https://xserve.example.com/nr/netrestore.php

Administrative Group: Group Password:

admins   •••••

Remote Preferences

URL or local path to NetRestore preferences (parameters.plist)

URL or local path to NetRestore configurations (configurations.plist)

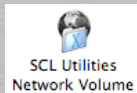Cancel   Save

NetBoot Process...

BSDP DISCOVER , DHCP Request

Downloads the "booter" file

❶

❷

Startup Disk

SCL Utilities Network Volume

- Startup disk is set, or "N" key is used
- BSDP Discover & Offer
- DHCP Discover, Offer, Request, ACK
- Client has DHCP address
- Downloads booter file via TFTP

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pktsize 300

/var/log/system.log   Filter:

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NetBoot Process...

Downloads Kernel & Kernel Cache

❸

- Loads boot file
- Downloads the Kernel and Kernel Extension Cache
  - mach.macosx
  - mach.macosx.mkext

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NetBoot Process...

④

- Kernel mounts NetBoot Disk image via NFS
- Loads the Kernel Extension Cache
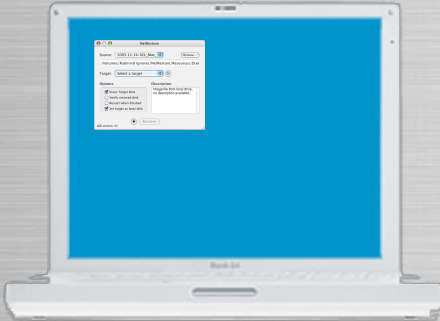- Client booted from image on server
- But there's more!!!...

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NetInstall Process...

❺ NetInstall–Restore.dmg

- Instead of "Finder" or "Login Window" it boots into NetRestore

NetInstall Process...

netrestore.php

❻

- NetRestore requests **netrestore.php**

- Downloads a .plist of settings

  - Settings are based on MAC address

    - Authorized to restore => "yes" ,"no"

      - If "no", error: machine not auth. to restore

    - Erases and images hard disk

    - Sets IP address

    - Sets computer name

    - Sets other settings you specify

    - Reboots if you set the preference

Troubleshooting

Q: Why after enabling a DHCP Subnet the server not handing out addresses?

A: Check DHCP subnet settings, Reboot server, Check system.log

Q: Clients cannot see the NetBoot Images?

A: Check firewall, Disable and try again, If it works troubleshoot the firewall

Q: NetBoot Filter Manager gives me an AppleScript error on import?

A: Filename has spaces (I submitted this bug to Mike Bombich)

Q: How do I use multiple NetBoot/NetInstall images?

A: Set Startup Disk, Use ARD, The "N" key only boots default image

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Troubleshooting

Q: Getting mysql.sock errors?

A: Check and update etc/php.ini and etc/my.cnf

Q: Fatal error: Call to undefined function: pg_connect()... on line 72?

A: Check config.php, set ARD to "no" or check ARD database

Q: Error: Upgrade Client?

A: Set root password using MySQL Administrator

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Hot Tips!

Fat Pipe! = Fast Restores

- Connect Xserve to **GIGABIT** backbone
- Connect clients to 100mb switches.

   Note:

   Gigabit switches will increase restore times even if clients have 100mb ethernet cards

My Personal Stats: (your stats my vary)

30 Clients on 10/100 Switches = approx. 6 hrs.

30 Clients on 1000mb Switches = approx. 2-3 hrs.

DHCP & NetRestore Troubleshooting:

Check /var/log/system.log using any of these tools: Server Admin, Console, or Terminal

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Useful Resources

Mike Bombich Software - http://www.bombich.com

• Troubleshooting: http://www.bombich.com/mactips/netboot.html

• (New Intel) EFI NetBoot: http://www.bombich.com/mactips/netboot.html

• Video: http://homepage.mac.com/bombich/intel_iMac.mp4

Apple Server Manuals - "Managing NetBoot Service"

   • http://www.apple.com/support/manuals/

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Useful Resources

Apple Docs:

How to setup NetBoot to use existing DHCP Server

- http://docs.info.apple.com/article.html?artnum=106459

How to create NetBoot image from existing system

- http://docs.info.apple.com/article.html?artnum=107354

How to create a customized NetBoot image

- http://docs.info.apple.com/article.html?artnum=107353

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Special Thanks To

Mike Bombich - http://www.bombich.com

Apple Computers - http://www.apple.com

Anyone else I borrowed information from.

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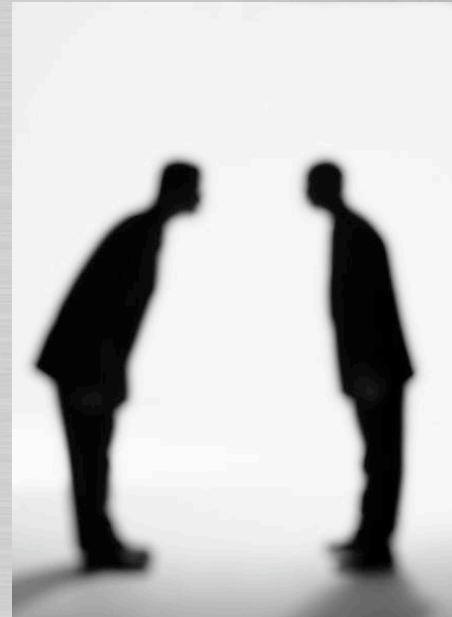
Questions & Answers

Any questions or answers?