NetBoot, LDAP and HomeLinks in Math MacOSX Labs

Jeff Kopmanis
Manager, MathIT

UM UNIX Admins, June 16, 2005

A Little History...

- Previously, all Solaris 8 Labs (103 machines)
- LSA AFS Home Directories
- Fully managed
- Access only for Math Course Students
- Maple, MATLAB, Netscape 4.78, etc...

Solaris 8 Problems

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- Printing through lp/lpr was difficult
- StarOffice 6 was not 100% compatible with Microsoft Office
- Sparse numbers of applications and application availablility for 64-bit Solaris 8

Solaris 8 Problems

SLOW

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  - Netboot + Workgroup Manager
  - Radmind as fallback option

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WINNER!!

- Radmind as fallback option

May, 2003

- 24 iMac G4 800MHz 512MB RAM
- Xserve G4 1GHz 512MB RAM
- 100Mbps to each iMac, 1Gbps to Xserve
- First image: MacOS 10.2.3 (Jaguar) <3GB
- 2 minute or less boot time!!
- Online by mid-June!

2003-2004

- June-July, 2003 & 2004: Michigan Math & Science Scholars Camp (”Math Camp”)
- F03, W04, F04: Math 216 - EXCLUSIVE, Math 215 - *REQUESTED*
- 3 LSA-IT Training Sessions
- 2 Apple Certification Courses
- Lots of misc. Math Dept orientations and

Evaluation: 1 Year Later...

A *Very* Successful Project

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Thank You, John, Sheri
and all of Apple Computer!

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But, we also learned some things...

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- A Volitile Desktop: erased on logout
- Image bloat: 6+ GB (still 2 minute boot times!)
- Cross-realm K5 trusts not supported in Jaguar
- Jaguar getting very long in tooth, both on server and client

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- Server Settings app is hopelessly broken under Jaguar
- 512MB RAM in Xserve is inadequate for anything over 50 netboot clients
- **UPGRADE TIME!!!**

Summer, 2004

- Panther Load (MacOSX 10.3.5)
- Easy to reproduce image: LSA SNI-based
- OpenAFS 1.2.10a
- Layered LDAP: UMOD & Math
- LSA LabHomeDirs.pkg (Sites-based)
- “Roaming Profiles” via **HomeLinks**

LDAP: UMOD + Math = Layered LDAP

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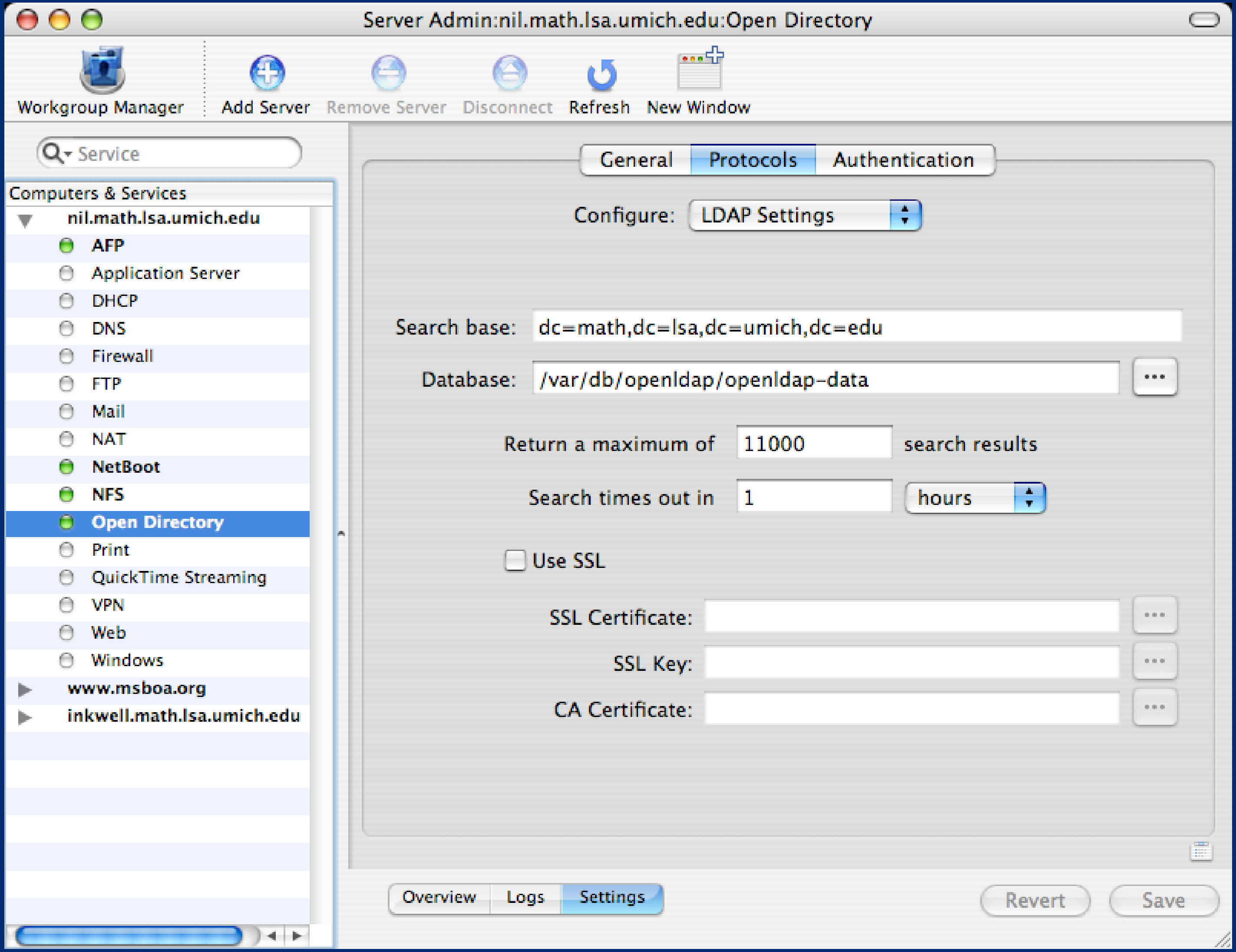
- Used UMOD for the bulk of our directory information (IFS home, shell, Full Name, etc)
- Workgroup Manager and NetBoot both require and use an LDAP database.
- OpenDirectory on NetBoot server holds above data, and...
- lists of uniqnames of those permitted in our labs!

LDAP: OpenDirectory settings



Server Admin:nil.math.lsa.umich.edu:Open Directory

Configure: LDAP Settings

Search base: dc=math,dc=lsa,dc=umich,dc=edu

Database: /var/db/openldap/openldap-data

Return a maximum of 11000 search results

Search times out in 1 hours

□ Use SSL

SSL Certificate:

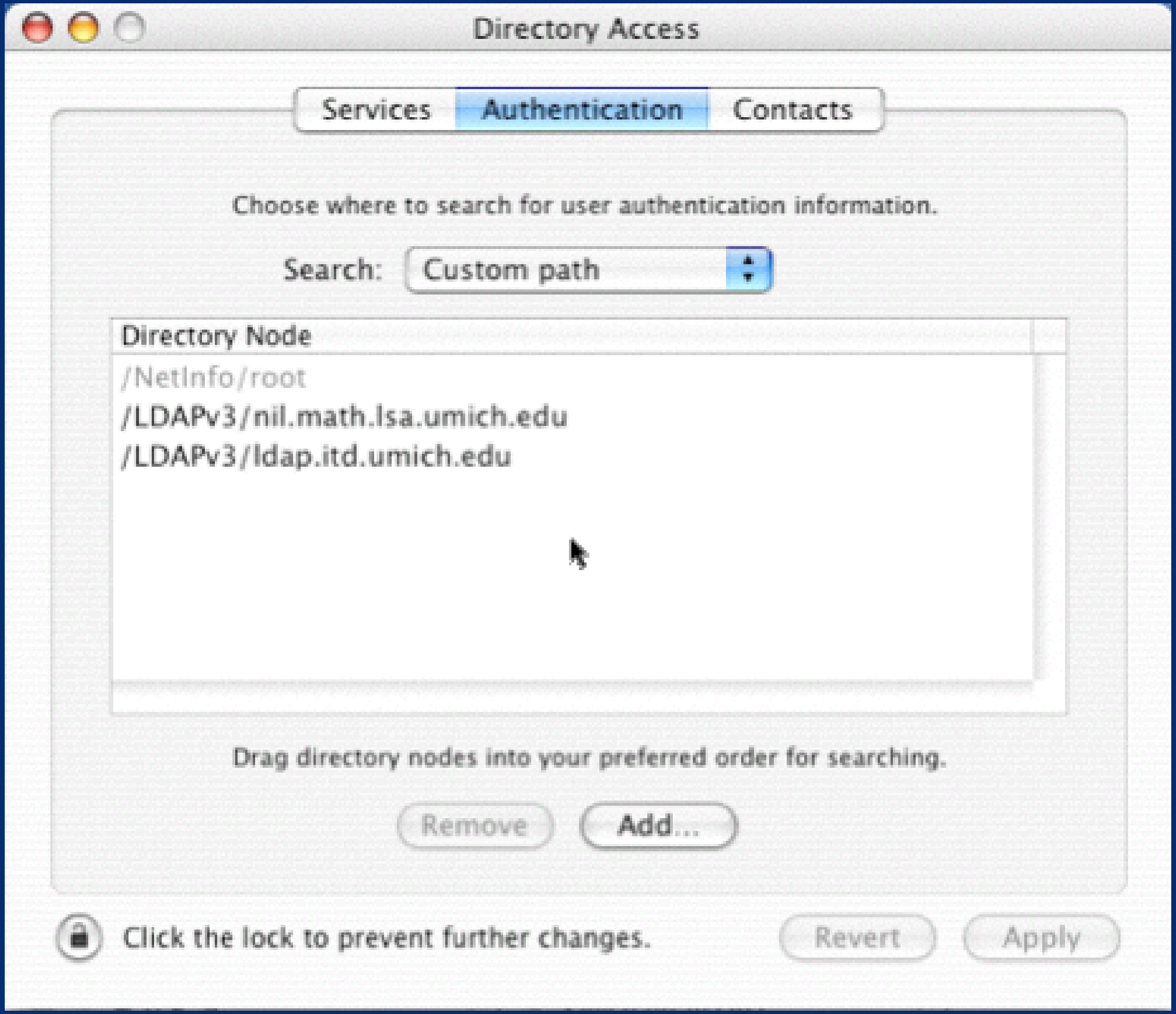
SSL Key:

CA Certificate:

LDAP: Client LDAP

- Clients point to both UMOD and Math LDAP servers.
- Order of servers is IMPORTANT!
- Math LDAP maps groups and machines (MCX records) so that only those groups and machines present are *authorized* to use the labs.

LDAP: Authentication



Choose where to search for user authentication information.

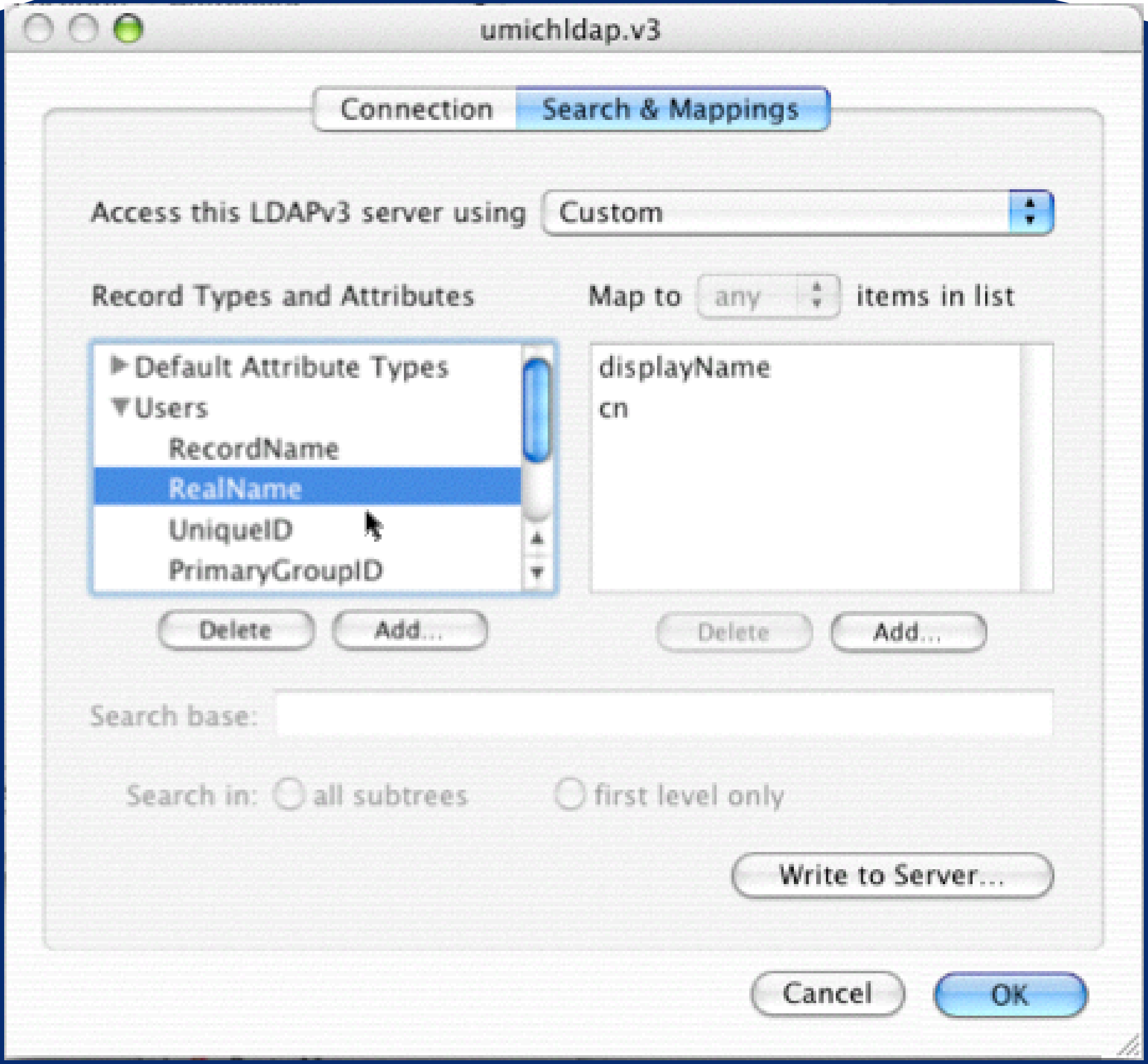
Search: Custom path

Directory Node
/NetInfo/root
/LDAPv3/nil.math.lsa.umich.edu
/LDAPv3/ldap.itd.umich.edu

Drag directory nodes into your preferred order for searching.

Click the lock to prevent further changes.

LDAP: UMOD mappings



umichldap.v3

Access this LDAPv3 server using: Custom

Record Types and Attributes

- ▶ Default Attribute Types
- ▼ Users
  - RecordName
  - RealName
  - UniqueID
  - PrimaryGroupID

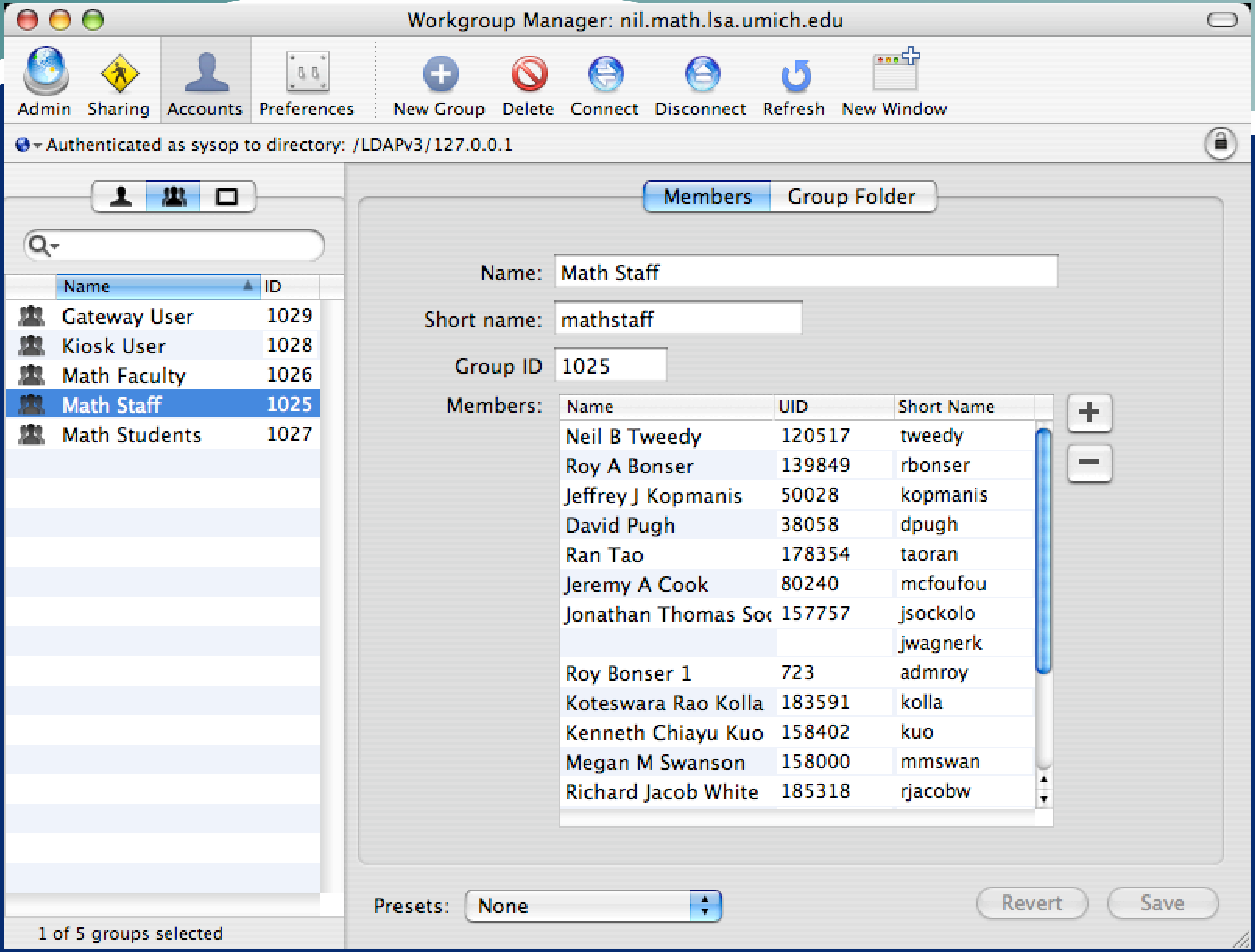
Map to any items in list

displayName
cn

Search base:

Search in: ○ all subtrees ○ first level only

Workgroup Manager: User Groups



Workgroup Manager: nil.math.lsa.umich.edu

Authenticated as sysop to directory: /LDAPv3/127.0.0.1

Name	ID
Gateway User	1029
Kiosk User	1028
Math Faculty	1026
Math Staff	1025
Math Students	1027

1 of 5 groups selected

Name: Math Staff

Short name: mathstaff

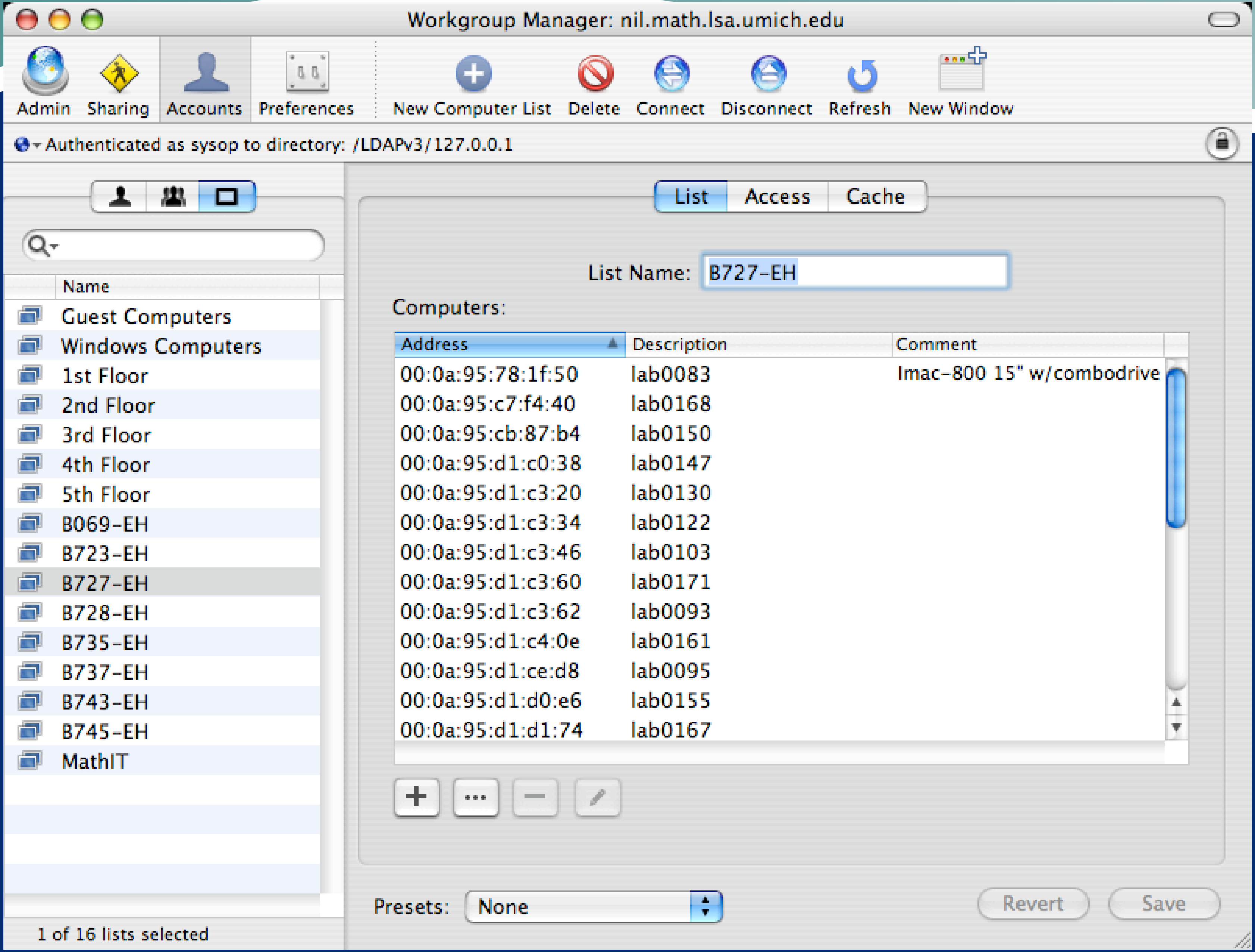
Group ID 1025

Members:

Name	UID	Short Name
Neil B Tweedy	120517	tweedy
Roy A Bonser	139849	rbonser
Jeffrey J Kopmanis	50028	kopmanis
David Pugh	38058	dpugh
Ran Tao	178354	taoran
Jeremy A Cook	80240	mcfoufou
Jonathan Thomas Soc	157757	jsockolo
		jwagnerk
Roy Bonser 1	723	admroy
Koteswara Rao Kolla	183591	kolla
Kenneth Chiayu Kuo	158402	kuo
Megan M Swanson	158000	mmswan
Richard Jacob White	185318	rjacobw

Presets: None

Workgroup Manager: Machine Groups



Authenticated as sysop to directory: /LDAPv3/127.0.0.1

Name
Guest Computers
Windows Computers
1st Floor
2nd Floor
3rd Floor
4th Floor
5th Floor
B069-EH
B723-EH
B727-EH
B728-EH
B735-EH
B737-EH
B743-EH
B745-EH
MathIT

1 of 16 lists selected

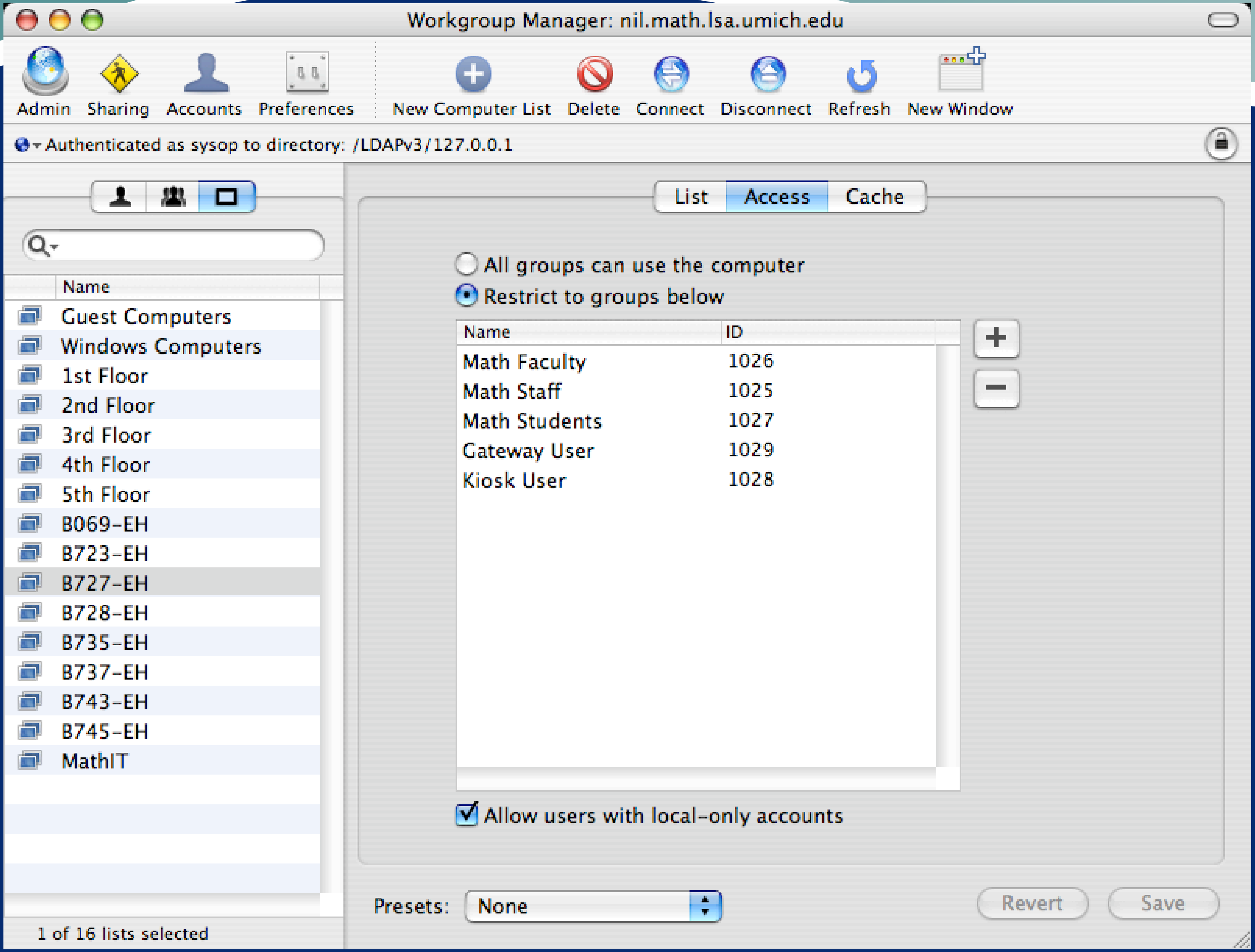
List Name: B727-EH

Computers:

Address	Description	Comment
00:0a:95:78:1f:50	lab0083	Imac-800 15" w/combodrive
00:0a:95:c7:f4:40	lab0168	
00:0a:95:cb:87:b4	lab0150	
00:0a:95:d1:c0:38	lab0147	
00:0a:95:d1:c3:20	lab0130	
00:0a:95:d1:c3:34	lab0122	
00:0a:95:d1:c3:46	lab0103	
00:0a:95:d1:c3:60	lab0171	
00:0a:95:d1:c3:62	lab0093	
00:0a:95:d1:c4:0e	lab0161	
00:0a:95:d1:ce:d8	lab0095	
00:0a:95:d1:d0:e6	lab0155	
00:0a:95:d1:d1:74	lab0167	

Presets: None

Workgroup Manager: Intersection



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B727-EH
B728-EH
B735-EH
B737-EH
B743-EH
B745-EH
MathIT

1 of 16 lists selected

○ All groups can use the computer
● Restrict to groups below

Name	ID
Math Faculty	1026
Math Staff	1025
Math Students	1027
Gateway User	1029
Kiosk User	1028

☑ Allow users with local-only accounts

Presets: None

Lab Home Directories

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- Configurable aging and quotas
- LabHomeDirs.pkg

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- Everything was local

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Enter HomeLinks!

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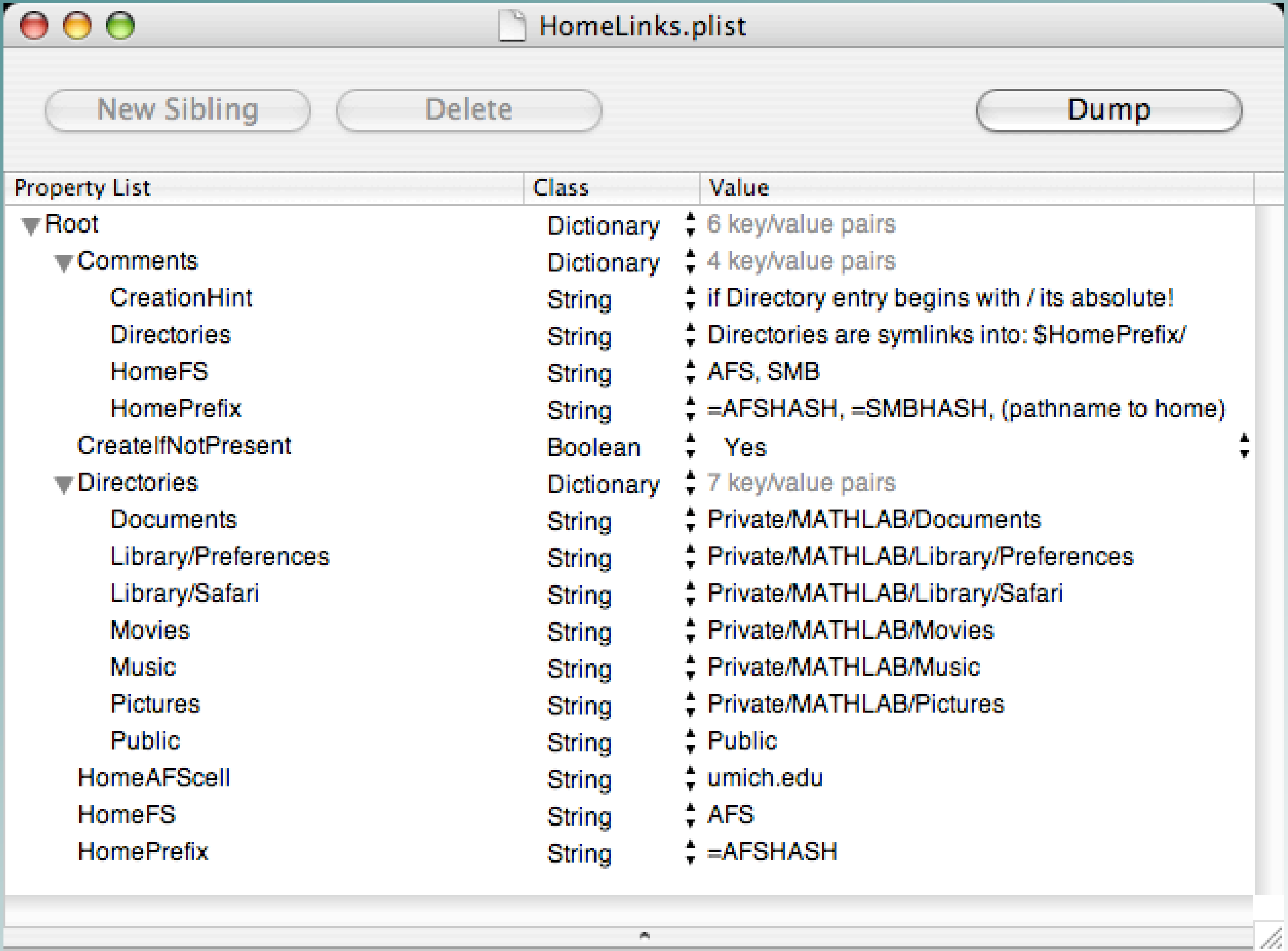
- Can create network locations, if not present
- XML (plist) files used for configuration
- PropertyList Editor becomes an easy-to-use configuration tool
- Needs **plistbuddy**, a utility that Apple

HomeLinks: Overview

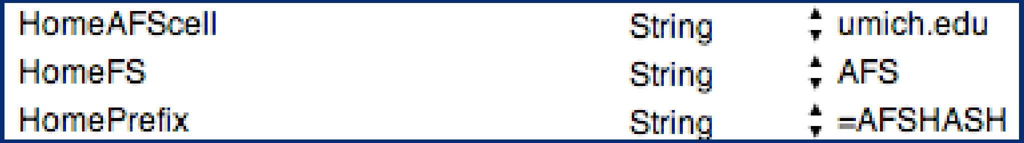
- Build a network path prefix ($PREFIX) for the user logging in
- For each of the Directories in the Dictionary...
- use **ditto** to copy from /Users/username/key to $PREFIX/value

Sample HomeLinks.plist file



Property List	Class	Value
▼ Root	Dictionary	6 key/value pairs
▼ Comments	Dictionary	4 key/value pairs
CreationHint	String	if Directory entry begins with / its absolute!
Directories	String	Directories are symlinks into: $HomePrefix/
HomeFS	String	AFS, SMB
HomePrefix	String	=AFSHASH, =SMBHASH, (pathname to home)
CreateIfNotPresent	Boolean	Yes
▼ Directories	Dictionary	7 key/value pairs
Documents	String	Private/MATHLAB/Documents
Library/Preferences	String	Private/MATHLAB/Library/Preferences
Library/Safari	String	Private/MATHLAB/Library/Safari
Movies	String	Private/MATHLAB/Movies
Music	String	Private/MATHLAB/Music
Pictures	String	Private/MATHLAB/Pictures
Public	String	Public
HomeAFScell	String	umich.edu
HomeFS	String	AFS
HomePrefix	String	=AFSHASH

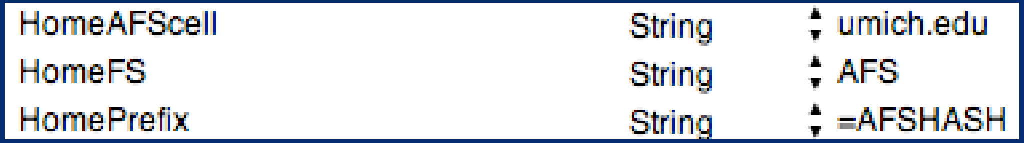
Constructing a Prefix



HomeAFScell	String	umich.edu
HomeFS	String	AFS
HomePrefix	String	=AFSHASH

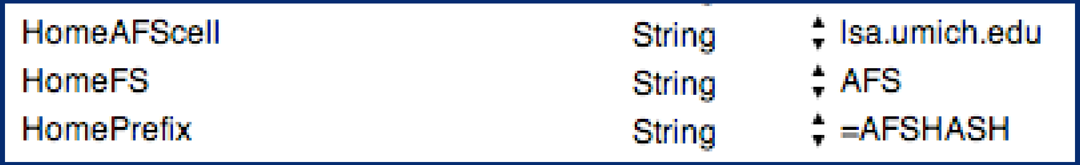
- HomeFS is a flag for how to interpret things. Currently only AFS is implemented.
- HomePrefix determines what comes before the user's uniqname in the path.
- =AFSHASH denotes the UM double-hash
- HomeAFScell is the cell name

Prefix examples:



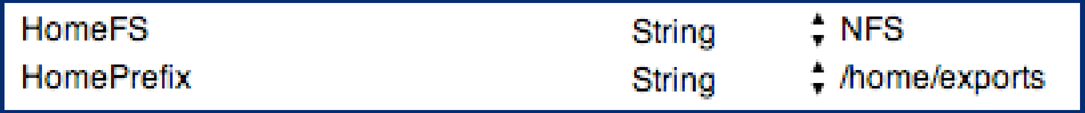
HomeAFScell	String	umich.edu
HomeFS	String	AFS
HomePrefix	String	=AFSHASH

Constructs: `/afs/umich.edu/user/k/o/kopmanis`



HomeAFScell	String	lsa.umich.edu
HomeFS	String	AFS
HomePrefix	String	=AFSHASH

Constructs: `/afs/lsa.umich.edu/user/k/o/kopmanis`



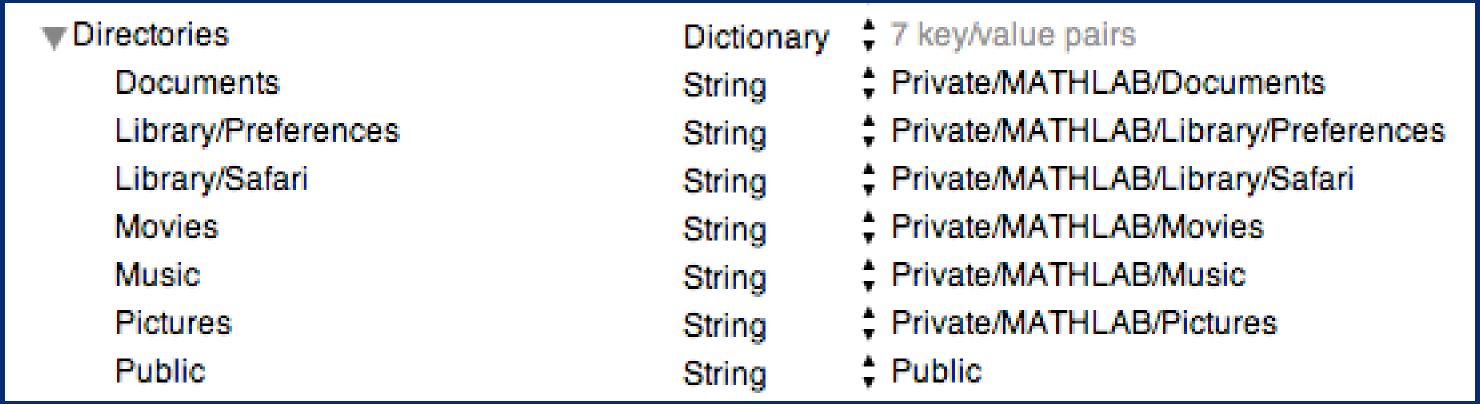
HomeFS	String	NFS
HomePrefix	String	/home/exports

Constructs: `/home/exports/kopmanis`

Directory Dictionary

- Works with key-value pairs
- keys are the "from" or "source" location
- key maps to /Users/username/key
- values are the "to" or "destination" location
- value maps to $PREFIX/value

key-value examples:



▼Directories	Dictionary	7 key/value pairs
Documents	String	Private/MATHLAB/Documents
Library/Preferences	String	Private/MATHLAB/Library/Preferences
Library/Safari	String	Private/MATHLAB/Library/Safari
Movies	String	Private/MATHLAB/Movies
Music	String	Private/MATHLAB/Music
Pictures	String	Private/MATHLAB/Pictures
Public	String	Public

With our previous umich.edu AFS prefix:

```
/Users/kopmanis/Documents
             /afs/umich.edu/user/k/o/kopmanis/Private/MATHLAB/Documents

/Users/kopmanis/Public          /afs/umich.edu/user/k/o/kopmanis/Public

/Users/kopmanis/Library/Preferences
    /afs/umich.edu/user/k/o/kopmanis/Private/MATHLAB/Library/Preferences
```

CreateIfNotPresent

- HomeLinks will build a structure according to the plist configuration file
- If "Yes", this flag signals that directories should be created in the target location if not present
- <u>Each</u> directory is tested along the way
- If $PREFIX is not present, no creation will be possible, so no mapping is performed (*Dec04*)

HomeLinks: Overview

- Build a network path prefix ($PREFIX) for the user logging in
- For each of the Directories in the Dictionary...
- use **ditto** to copy from /Users/username/key to $PREFIX/value

Wait a Minute!!!

What about Kerberos tickets and AFS tokens and file ACLs and permissions ?!

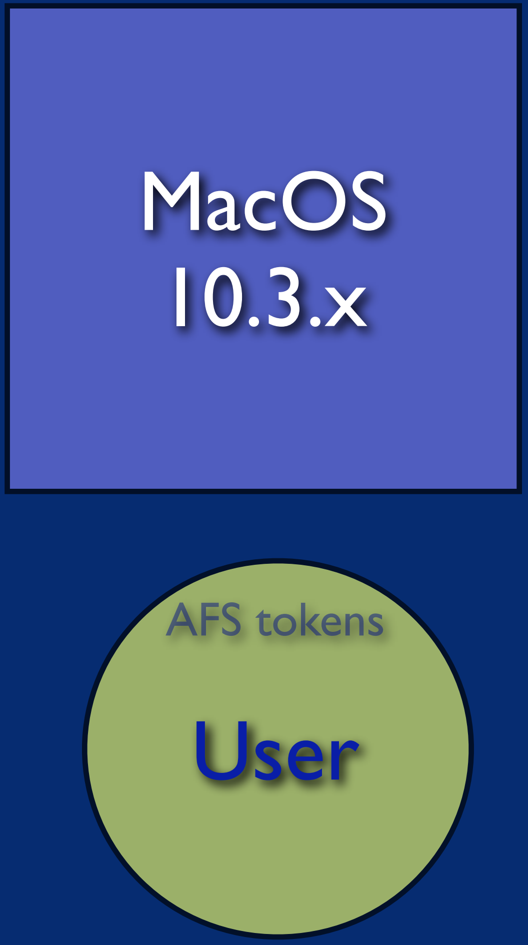
Panther Security Sessions

- OSX processes run as root or other admin users

MacOS
10.3.x

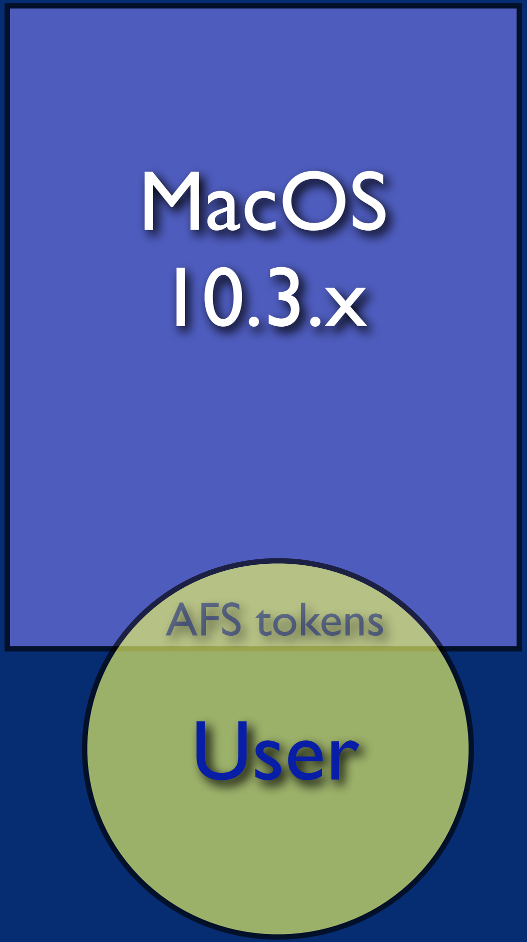
Panther Security Sessions

- OSX processes run as root or other admin users
- User authenticates at login to create a Security Session, which includes AFS tokens.



Panther Security Sessions

- OSX processes run as root or other admin users
- User authenticates at login to create a Security Session, which includes AFS tokens.
- HomeLinks, run by MacOSX, uses **sudo** to reach into user's Security Session to use AFS tokens of that user



Panther Security Sessions

- HomeLinks uses ITCS-Sites/LSA LoginHooks package to provide /etc/hooks structures
- LI81.HomeLinks is run at login time
- The magic sudo call is made in LI81.HomeLinks
- LI81.HomeLinks is a wrapper for the real script in /etc/HomeLinks/HomeLinks

/etc/hooks/L181.HomeLinks

```
#!/bin/bash
sudo -u $1 /etc/hooks/HomeLinks/Homelinks $1
```

/etc/HomeLinks/HomeLinks

```
!/bin/bash
######################################################
 First arg should be user shortname
######################################################

xport UNIQNAME=$1
xport UNIQUID=`/usr/bin/id -u $UNIQNAME`
xport DEBUG=0
xport CONFIGFILE="/etc/hooks/HomeLinks/HomeLinks.plist"
xport PLB=/usr/bin/PlistBuddy
 /etc/radmind.defaults

######################################################
unction PLB_get () {
 $PLB -c "print $1" $CONFIGFILE | grep -v "Not Exist"
 }

######################################################
unction PLB_get_Prefix () {
 user=$1
 HomePrefix=`PLB_get ":HomePrefix"`
 if [ "$HomePrefix" = "=AFSHASH" ]
    then
    echo /afs/$AFScell/user/${user:0:1}/${user:1:1}/$user/
    if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is HomePrefix0: /afs/$AFScell/user/${user:0:1}/${user:1:1}/
user/; fi
 elif [ "$HomePrefix" = "=SMBHASH" ]
    then
    # Nothing defined yet for SMB Homedir hashes
    echo $HomePrefix
    if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is HomePrefix1: $HomePrefix; fi
 else
    echo $HomePrefix
    if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is HomePrefix2: $HomePrefix; fi
 fi
 }

######################################################
 Create links to a directory mapping in /Users/$UNIQNAME/$1 to $2
unction link_directory () {
 # $APPLE is the "Apple-standard" directory location we're going to map
 APPLE=$1
 # $REAL is the "real" location we'll be mapping to
 REAL=$2

 APPLEPATH=/Users/$UNIQNAME/$APPLE
 if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "APPLEPATH=$APPLEPATH"; fi

 if [ ${REAL:0:1} = "/" ]
 then
    PREFIX=""
 else
    PREFIX=$HomePrefix
 fi
 if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "PREFIX=$PREFIX"; fi
 BUILDPATH=$PREFIX$REAL
 if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "BUILDPATH=$BUILDPATH"; fi
```

```
#  # and, if it doesn't (and we have $CreateIfNotPresent is set), create
  # the target directory and permit it to the user
  if [ "$CreateIfNotPresent" = "true" ]
  then
       if [ ! -d $BUILDPATH ]
       then
         if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "  Create: $BUILDPATH"; fi
         mkdir -p $BUILDPATH
         if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "  Copy: $APPLEPATH to $BUILDPATH"; fi
         ( cd $APPLEPATH ; tar cf - . ) | ( cd $BUILDPATH ; tar xpf - )
       fi
  fi

  # remove any existing directory first
  if [ -d $APPLEPATH ]
  then
    rm -rf $APPLEPATH
    if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "  Remove: $APPLEPATH"; fi
  fi

  # FINALLY, make the link
  if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "  Link: ln -s $BUILDPATH $APPLEPATH"; fi
  ln -sf $BUILDPATH $APPLEPATH
  }

########################################################
##  M A I N  ###########################################
########################################################

if [ ${UNIQUID} -lt 1000 ]
   then
   /usr/bin/logger -is  -t HomeLinks -p user.info "Nothing to be done for $UNIQNAME (id=$UNIQUID)"
   exit
fi
export CreateIfNotPresent=`PLB_get ":CreateIfNotPresent"`
HomeFS=`PLB_get ":HomeFS"`
if [ "$HomeFS" = "AFS" ]
   then
   /usr/bin/logger -is  -t HomeLinks -p user.info "Using AFS"
   if [ "$DEBUG" = "1" ]; then /usr/bin/logger -is "  AFS: `tokens`"; fi
   export AFScell=`cat /var/db/openafs/etc/ThisCell`
   export plistAFScell=`PLB_get ":HomeAFScell"`
   if [ "$plistAFScell" != "" ]
   then
     export AFScell=$plistAFScell
     /usr/bin/logger -is  -t HomeLinks -p user.info "Overriding ThisCell setting with: $AFScell"
   fi
   export HomePrefix=`PLB_get_Prefix $UNIQNAME`

   /usr/bin/logger -is  -t HomeLinks -p user.info "Creating directory structures for $UNIQNAME..."
   # $UNIQNAME directory should already be there

   # dump all Directories into a temp file
   $PLB -c "print :Directories" $CONFIGFILE | grep -v "}" | grep -v "Dict" | sort > /tmp/$UNIQNAME.login

   # read each line and build the directory
   while read variable equals value
   do
      # ready to link directory
      link_directory $variable $value
   done < /tmp/$UNIQNAME.login
   rm /tmp/$UNIQNAME.login

elif [ "$HomeFS" = "SMB" ]
   then
   /usr/bin/logger -is  -t HomeLinks -p user.info "Using SMB"
else
   /usr/bin/logger -is  -t HomeLinks -p user.info "ERROR: Unsupported Home FS!"
fi
```

HomeLinks - *Version 2 (Dec04)*

- Needs to test for the existence of HomeDir: A non-existent HomeDir results in a login that “jumps off a cliff”

HomeLinks - *Version 2 (Dec04)*

- Needs to test for the existence of HomeDir: A non-existent HomeDir results in a login that "jumps off a cliff"
- Needs to check for the success of the ditto runs: quotas or other limitations result in an incomplete template copy, possibly fatal to the session

HomeLinks.mpkg

Complete UM-Installable Meta-Package containing:

HomeLinks v2
LoginHooks
LabHomeDirs
plistbuddy

AVAILABLE SOON

https://www.math.lsa.umich.edu/software

(requires UMICH Kerberos)

Questions?

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