LDAP Servers and Applications

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- System Authentication
- Sendmail and LDAP
- Apache and LDAP
- Squid and LDAP
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- Active Directory and LDAP
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LDAP Servers

- Slapd
  - University of Michigan
  - OpenLDAP
- iPlanet/SunONE Directory Server
- Microsoft Active Directory (AD)
- Novell eDirectory
- Oracle Internet Directory
- IBM SecureWay Directory
- Critical Path InJoin Directory Server
- Data Connection Directory
- OctetString Virtual Directory Engine

OpenLDAP

- Based on UMich ldap server
- Available from http://www.openldap.org/
- Versions:
  - Stable: 2.1.30 - implements LDAPv3
  - Release: 2.2.14 - implements LDAPv3 and other features

OpenLDAP 2.1 features

OpenLDAP 2.1 was released June 2002 Functional enhancements and improved stability (from web site):

- Transaction oriented database backend
- Improved Unicode/DN Handling
- SASL authentication/authorization mapping
- SASL in-directory storage of authentication secrets
- Enhanced administrative limits / access controls
- Enhanced system schema checking
- LDAP C++ API
- Updated LDAP C & TCL APIs

OpenLDAP 2.1 features cont

- LDAPv3 extensions:
  - Enhanced Language Tag/Range option support
  - objectClass-based attribute lists
  - LDAP Who ami I? Extended Operation
  - LDAP no-op Control
  - Matched Values Control
  - Misc LDAP Feature Extensions
  - DNS-based service location
- Meta Backend
- Monitor Backend
- Virtual Context "glue" Backend

OpenLDAP 2.2 features

OpenLDAP 2.2 (released December 2003) Functional enhancements and improved scalability:

- "LDAP Sync"-based lightweight replication
- Proxy Cache Support
- Hierarchical Backend
- NS-SLAPI Support
- Backend Layering
- Access Control extensions including dynamic group support
- Extra LDAPv3 extensions (see later)

OpenLDAP LDAPv3 Support

OpenLDAP support includes:

- LDAPv3 (RFC 3377)
- SASL Bind (RFC 2829)
- Start TLS (RFC 2830)
- LDIFv1 (RFC 2849)

OpenLDAP LDAPv3 Extensions

- Language Tag options (RFC 2596)
- Language Range options
- DNS-based service location (RFC 2247 & RFC 3088)
- Password Modify operation (RFC 3062)
- Named Referrals / ManageDSAit control (RFC 3296)
- Simple Paged Result Control (RFC 2696)
- All Operational Attributes + attribute list feature (RFC 3673)
- supportedFeatures discover mechanism (RFC 3674)

OpenLDAP LDAPv3 Extensions cont

- Content Synchronization operation
- WhoAmI? operation
- Proxy Authorization control
- Matched Values control
- Assertion control
- Pre/Post Read controls
- No-Op control
- Modify/Increment extension
- Absolute True (&) and False (|) Filter extension

OpenLDAP LDAPv3 Not Supports

Does not support:

- DIT Structure Rules
- Name Forms
- Schema updates (using LDAP)

LDAPv3 unsupported extensions include:

- Dynamic Directory Services (RFC 2589)
- Operational Signatures (RFC 2649)
- Server Side Sorting of Search Results (RFC 2891)
- Collective Attributes (RFC 3671)
- Subentries (RFC 3672)
- Component Matching (RFC 3687)

OpenLDAP Platforms

- Runs on:
  - FreeBSD
  - Linux
  - NetBSD
  - OpenBSD
  - MacOS X
  - Most commercial UNIX systems
- Ports in progress:
  - BeOS
  - Microsoft Windows NT/2000

LDAP slapd architecture

- LDAP daemon called slapd
  - Choice of backend databases - see next slide
  - Multiple database instances
  - Access control - via ACLs and tcp wrappers
  - Threaded
  - Replication
  - Security - privacy via TLS, authentication via SASL
  - Internationalization

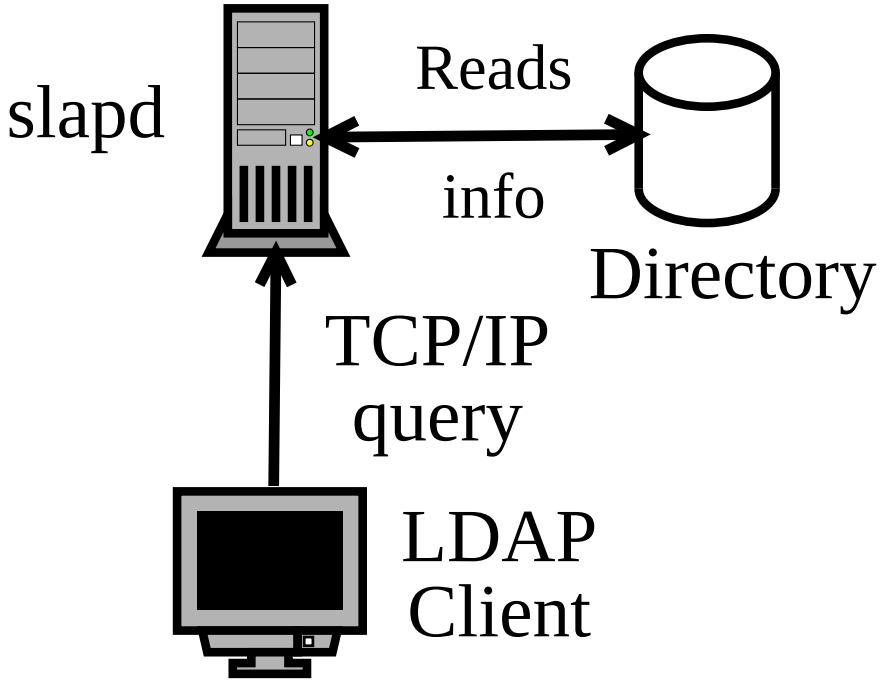
slapd backend databases

- BDB - Sleepycat Berkeley DB backend - standard in OpenLDAP 2.1 and above
- HDB - Hierachical version, similar to BDB
- LDBM - high performance disk based db - uses BerkeleyDB, GNU DBM, MDBM or NDBM
- DNSSRV - dns based backend to serve referrals from SRV records
- LDAP - ldap proxy backend
- META - ldap proxy backend for multiple servers and naming context masq - similar to LDAP
- NULL - null backend db, similar to /dev/null

slapd backend databases cont

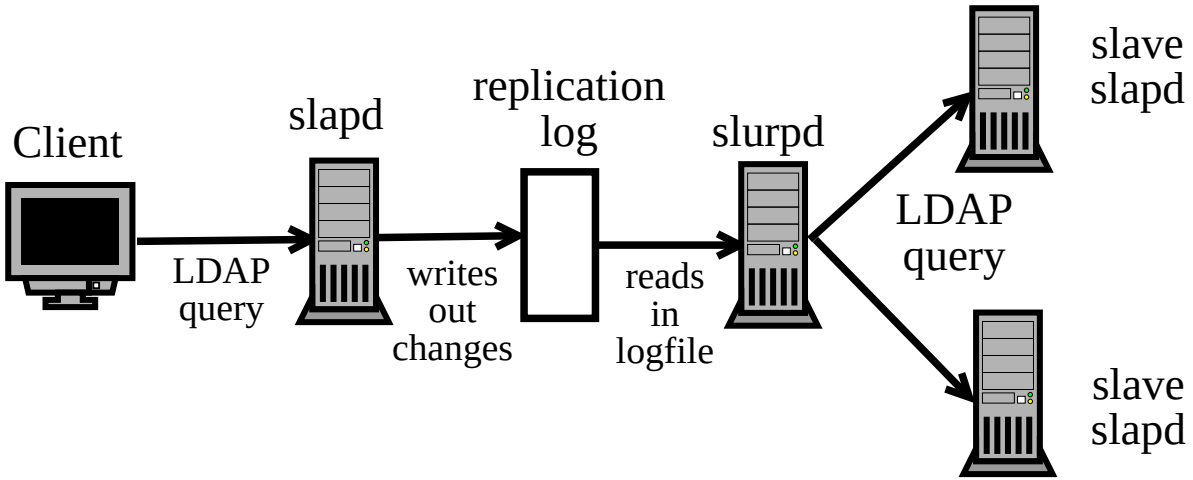
- SHELL - shell interpreter embedded backend
- PERL - perl interpreter embedded backend
- TCL - tcl interpreter embedded backend
- PASSWD - simple password file db - serves up user account info from /etc/passwd style files
- SQL - mapping sql to ldap to present information from legacy RDBMS (in OpenLDAP 2.x)

LDAP slapd architecture



LDAP slurpd architecture

- Replication daemon called slurpd
  - Frees slapd from worrying about hosts being down etc
  - Communicates with slapd through text file



Slurpd Replication Log File

Slapd writes out a replication log file containing:

- Replication host
- Timestamp
- DN of entry being modified
- List of changes to make

Slurpd Replication Log File Example

```
replica: slave.example.com:389
time: 93491423
dn: uid=bmarshal,ou=People,
            dc=example,dc=com
changetype: modify
replace: multiLineDescription
description: There once was a sysadmin...
-
replace: modifiersName
modifiersName: uid=bmarshal,ou=People,
            dc=example,dc=com
-
replace: modifyTimestamp
modifyTimestamp: 20010606122901Z
-
```

LDAP Sync Replication

- Allows clients to maintain copies of LDAP tree fragments
- OpenLDAP implementation called syncrepl
- In process of becoming a standard - see The LDAP Content Synchronization Operation Internet Draft by Kurt Zeilenga
- Provides stateful replication with both push and pull based sync

LDAP Sync Replication cont

- Subject to normal access controls to access data
- refreshOnly - pull based
  - Consumer servers not tracked
  - No historical information kept
  - Uses periodic polling
- refreshAndPersist - push based
  - Provider keeps track consumer servers who have requested updates
  - Sends updates as contents are modified

LDAP Sync Replication Implementation

- Database requires a syncrepl specification
- Launches syncrepl engine as a slapd thread
- If refreshOnly, thread wakes up after the interval time
- If refreshAndPersist, thread remains active and sends updates
- Provider only works with back-bdb or back-hdb backend
- Consumer works with any backend

Proxy Cache Engine

- Replicas that hold search filters instead of subtrees
- First checks to see if a query is in the cache, otherwise passed on
- Useful for websites that use dynamic data
- Uses Least Recently Used (LRU) policy for cache replacement

Proxy Cache Config

```
database        ldap
suffix          "dc=example,dc=com"
uri             ldap://ldap.example.com/
dc=example%2cdc=com
overlay proxycache
proxycache    bdb 100000 1 1000 100
proxyAttrset  0 mail postaladdress telephonenumber
proxyTemplate (sn=) 0 3600
proxyTemplate (&(sn=)(givenName=)) 0 3600
proxyTemplate (&(departmentNumber=)(secretary=*)) \
 0 3600
cachesize 20
directory ./testrun/db.2.a
index       objectClass eq
index       cn,sn,uid,mail  pres,eq,sub
```

Slapd.conf Example

```
#
# See slapd.conf(5) for details
#   on configuration options.
# This file should NOT be world readable.
#
include         /etc/openldap/slapd.at.conf
include         /etc/openldap/slapd.oc.conf
schemacheck     off

pidfile         /var/run/slapd.pid
argsfile        /var/run/slapd.args

defaultaccess read
```

Slapd.conf Example cont

```
access to attr=userpassword
    by self write
    by * read

access to *
    by self write
    by dn=".+" read
    by * read
```

Slapd.conf Example cont

```
#######################################
# ldbm database definitions
#######################################
database  ldbm
suffix    "dc=example, dc=com"
rootdn    "cn=Manager,dc=example,dc=com"
rootpw    {crypt}lAn4J@KmNp9
replica host=replica.example.com:389
    binddn="cn=Manager,dc=example,dc=com"
    bindmethod=simple credentials=secret
    replogfile /path/to/replication.log
# cleartext passwords, especially for
# the rootdn, should be avoid.  See
# slapd.conf(5) for details.
directory       /var/lib/openldap/
```

ACL for who

Can restrict by:

- Distinguished Name
- Filter that matches some attributes
- Attributes

ACL for what

Can restrict with:

- Anonymous users
- Authenticated users
- Self - ie, user who owns the entry
- Distinguished name
- IP address or DNS entry

ACL permissions

Permissions are:

- none
- auth
- compare
- search
- read
- write

ACL Priority

Access control priority:

- Local database
- Global rules
- Runs thru in order the rules appear in the config file
- First checks what is being requested, then who
- First matching rule is used
- This means ordering is important

ACL examples

```
access to attribute=userpassword
    by dn="cn=Manager,dc=example,
          dc=com" write
    by self write
    by * read

access to dn="(.*,)?dc=example,dc=com"
          attr=homePhone
    by self write
    by dn="(.*,)?dc=example,dc=com" search
    by domain=.*\.example\.com read
    by anonymous auth
```

OpenLDAP and SASL

- SASL - Simple Authentication and Security Layer (RFC2222)
- Offers several industry standard authentication mechanisms
  - PLAIN, LOGIN
  - DIGEST-MD5
  - KERBEROS_V4
  - GSSAPI
  - EXTERNAL

SASL Authentication

- Basic steps:
  - Configure slapd to communicate with client program (service key, public key, shared secret)
  - Map authentications identities to LDAP DN
- Authentication ID
  - If realm is the default, can leave that section out completely

```
uid=<username>,cn=<realm>,
      cn=<mechanism>,cn=auth
```

Mapping Auth Id to LDAP Entries

- Not intended that cn=auth exists, use mapping to existing users
- Use sasl-regexp directives to define maps
- sasl-regexp <search pattern> <replacement pattern>
- Search pattern uses regex as per regex(7)
  - . = any char
  - * = zero or more of previous char
  - + = one or more of previous char
  - ? = zero or one of previous char
  - () = store match in $n, where n is the n'th paren set
- Replacement pattern is users DN, or LDAP URL

sasl-regex examples

```
sasl-regex uid=(.*),cn=digest-md5,cn=auth
  uid=$1,ou=People,dc=example,dc=com

sasl-regex uid=(.*),cn=example.com,
    cn=kerberos_v4,cn=auth
  uid=$1,ou=People,dc=example,dc=com

sasl-regex uid=(.*),cn=digest-md5,cn=auth
  ldap:///ou=People,dc=example,dc=com
    ??sub?(uid=$1)
```

sasl-regex Recommendations

- Don’t set search pattern too leniently - easy to allow access when shouldn’t
- Allow for realm being omitted, as well as explicit realm entry
- List explicit realm entry first
- If users are spread over multiple ou’s, use a LDAP URL
- If LDAP URL returns more than one or zero entries, authentication fails

SASL DIGEST-MD5

- Client and server share a secret
- Server generates challenge, client response proving it knows the secret
- Stores secrets either in directory (Cyrus SASL 2.1) or seperate database (sasldb)
- Obviously important to protect passwords - either ACLs or file permissions
- Shared secrets needs access to plain text password

DIGEST-MD5 Passwords

- Secrets stored in sasldb (Cyrus SASL 2.1)

```
$ slaslpasswd2 -c <username>
```

- Secrets stored in LDAP directory
  - Password stored in userPassword in clear text
  - slapd.conf needs:

```
password-hash   {CLEARTEXT}
```

- Authentication id form:

```
uid=<username>,cn=<realm>,
  cn=digest-md5,cn=auth
```

Slapd and TLS

To generate a certificate:

```
$ openssl req -newkey rsa:1024 -keyout
    server.pem -nodes -x509 -days 365
    -out server.pem
```

Assuming that the slapd.conf file is properly configured, the following additions are required:

```
TLSCertificateFile    /usr/lib/ssl/misc/server.pem
TLSCertificateKeyFile /usr/lib/ssl/misc/server.pem
TLSCACertificateFile  /usr/lib/ssl/misc/server.pem
replica  host=hostname:389
   tls=yes
   binddn="normal bind parameters"
   bindmethod=simple
   credentials=password
```

Slapd and TLS cont

Configure your slapd init scripts to run with the following options:

```
slapd -h "ldap:/// ldaps:///"
```

To confirm that it is listening, run the following:

```
$ sudo netstat --inet --l -p | grep slapd
tcp  0   0 *:ldap   *:*  LISTEN  17706/slapd
tcp  0   0 *:ldaps  *:*  LISTEN  17706/slapd
```

To check the certificate:

```
$ openssl s_client -connect localhost:636 \
                   -showcerts
```

Referral - Subordinate

To delegate a subtree to another server, use the ref attribute to specify the ldap url to follow.

```
dn: dc=subtree, dc=example, dc=net
objectClass: referral
objectClass: extensibleObject
dc: subtree
ref: ldap://b.example.net/dc=subtree,
                    dc=example,dc=net/
```

Referral - Superior

To specify another ldap server to go to if the current request is outside the servers naming context, use the referral directive.

```
referral        ldap://root.openldap.org:389/
```

Referral - ManageDsaIT

- Managing referral objects is done using a tool which supports the ManageDsaIT control
- Tells the server that you want to manage the referral object as an entry
- Stops server from sending a referral result
- Use the -M option to ldapmodify or ldapsearch

OpenLDAP Schemas

Schema	Use
core	OpenLDAP core
cosine	Cosine and Internet X.500 (RFC 1274)
inetorgperson	InetOrgPerson
misc	Assorted
nis	Network Information Services (RFC 2307)
openldap	OpenLDAP Project
java	Java Object (RFC 2714)
corba	Corba Object References (RFC 2714)
krb5-kdc	Kerberos KDC
netscape-profile	Netscape Roaming Profiles
sendmail	Sendmail LDAP Routing

RootDSE

To discover what the server supports, use something like:

```
$ ldapsearch -s base -b "" +
dn:
namingContexts: dc=example,dc=com
supportedControl: 2.16.840.1.113730.3.4.2
supportedExtension: 1.3.6.1.4.1.4203.1.11.1
supportedExtension: 1.3.6.1.4.1.1466.20037
supportedFeatures: 1.3.6.1.4.1.4203.1.5.1
supportedLDAPVersion: 2
supportedLDAPVersion: 3
supportedSASLMechanisms: CRAM-MD5
supportedSASLMechanisms: DIGEST-MD5
subschemaSubentry: cn=Subschema
```

Schema Discovery

To discover what schemas etc the server supports, use something like:

```
$ ldapsearch -s base -b "cn=Subschema" +
```

It will return:

- ldapSyntaxes
- matchingRules
- attributeTypes
- objectClasses

Server Monitoring

- Compile slapd with –enable-monitor
- Added the following to slapd.conf:

```
modulepath      /usr/lib/ldap
moduleload      back_monitor
# The backend type
database        monitor
# Access controls
access to *
        by dn="cn=admin,dc=gumby" write
        by * read
```

Server Monitoring

- To search do the following:

```
$ ldapsearch -x -b 'cn=Monitor'
```

- Top level output:

```
dn: cn=Monitor
objectClass: top
objectClass: monitor
objectClass: extensibleObject
cn: Monitor
description: @(#) $OpenLDAP: slapd 2.1.17
     (May 17 2003 22:02:20) $
```

SunONE Directory Server

- Originally based on U.Mich LDAP server
- Was Netscape Directory Server, then Iplanet, then SunONE
- Available from http://www.sun.com/
- Current version is 5.2
- Platforms supported:
  - Solaris
  - Linux
  - Windows 2000
  - HP-UX
  - AIX

SunONE Directory Companion Products

- Directory Proxy Server
  - Provides a firewall for the directory - can route requests
- Identity Server
  - Help manage secure access to web-based resources
- Identity Synchronization for Windows
  - Helps synchronize authentication data between Windows NT, Active Directory and SunONE
- Metadirectory
  - Consolidates information from disparate sources, eg directorys and databases

SunONE Directory Server Components

- Directory server
- Admin server
- Server console for remote management
- Command line tools
- SNMP agent
- Migration tools for previous versions
- Client tools

SunONE Directory Server Architecture

- Core server to process requests
- Directory server console for managing server
- Frontends for LDAP, DSML and SNMP
- Plugins for access control, replication etc
- Initial directory tree, for server config etc

SunONE Directory Server features

- LDAPv3 - RFC2251
  - Search filters - RFC2254
  - Search references (smart referrals)
  - LDAP URL - RFC2255
  - LDIF - RFC2849
- DSMLv2
  - HTTP and SOAP transports
  - Native DSML support, not gateway
  - Allows non-LDAP clients access to data
  - Allows interfacing using XML
  - DSML front end is restricted HTTP server
- All access controls apply to both

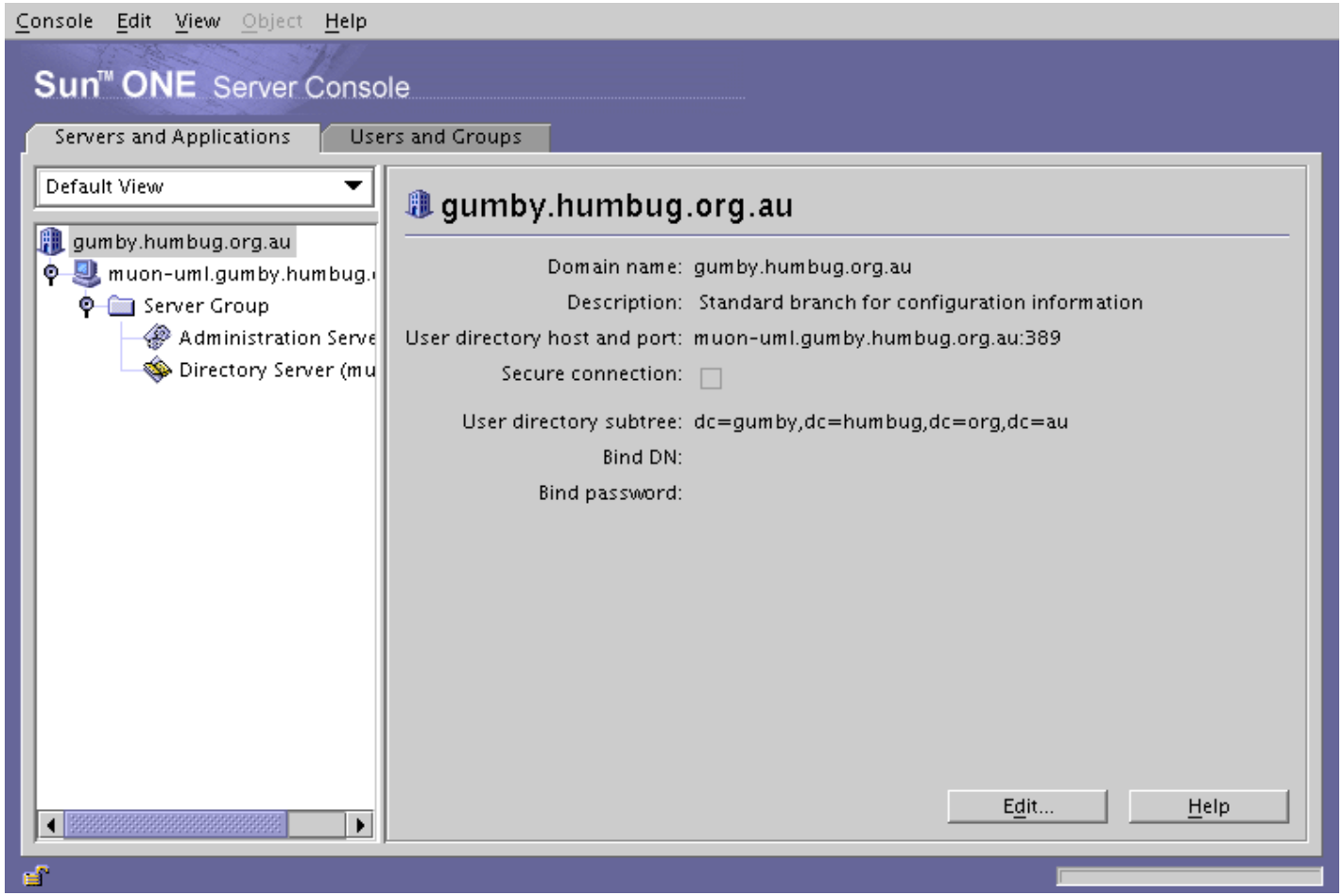
SunONE Directory Server features cont

- Multiplatform - including 64 bit systems
- Multidatabase design
- Large cache support - can support > 4GB caches
- Improved update performance
  - Group flush
  - Index compression
  - Replication compression
  - Improved checkpointing
- Improved searching
  - 64 bit server process
  - Improved algorithms for reading caches

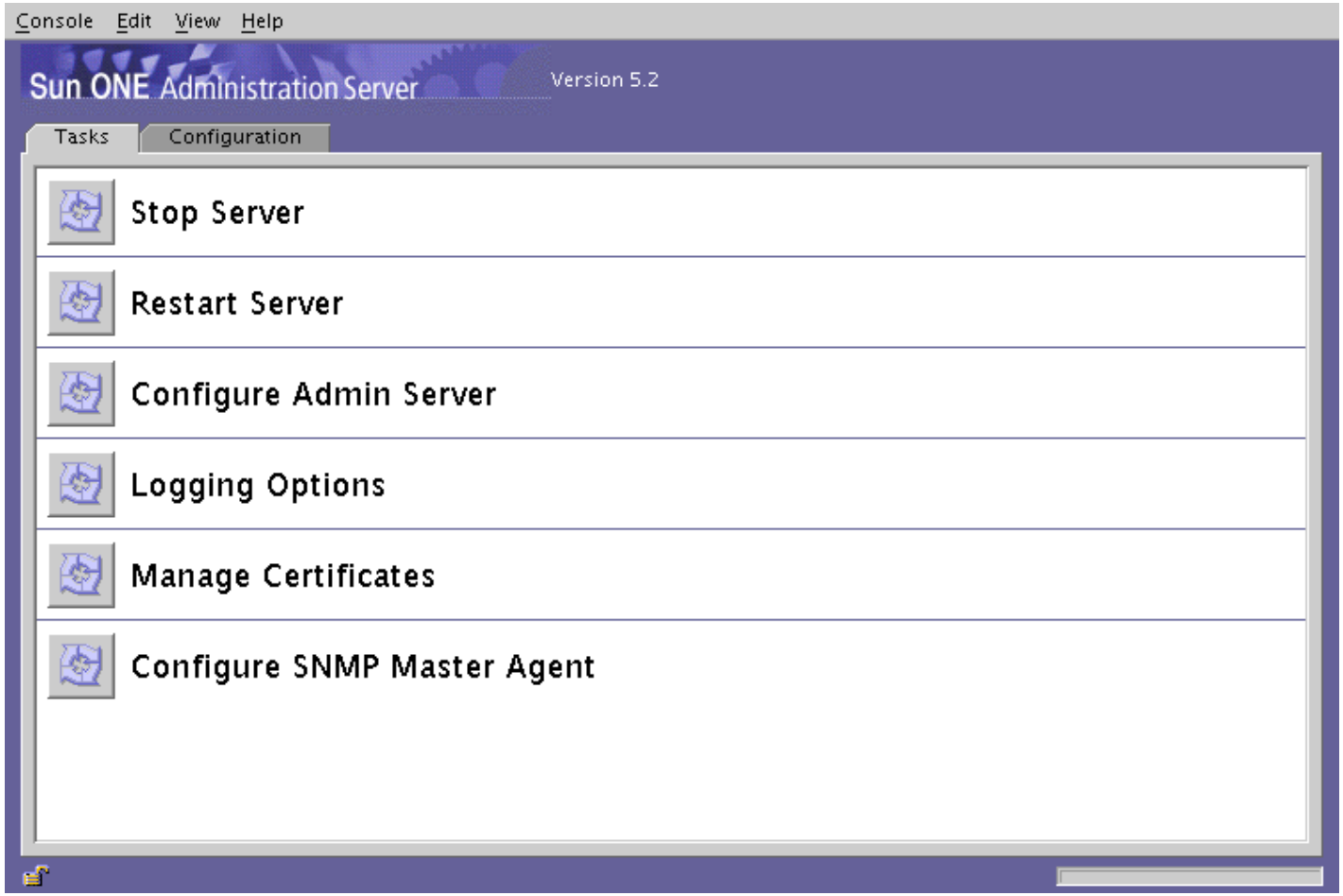
SunONE Directory Server features cont

- Supports Sun Cluster
- Advanced replication
  - Simple replication
  - Cascading replication
  - Multi-master replication
  - Fractional replication
- Indexes
- SSL, TLS and SASL encrytion and authentication
- Dynamic groups
- Schema and ACL replication

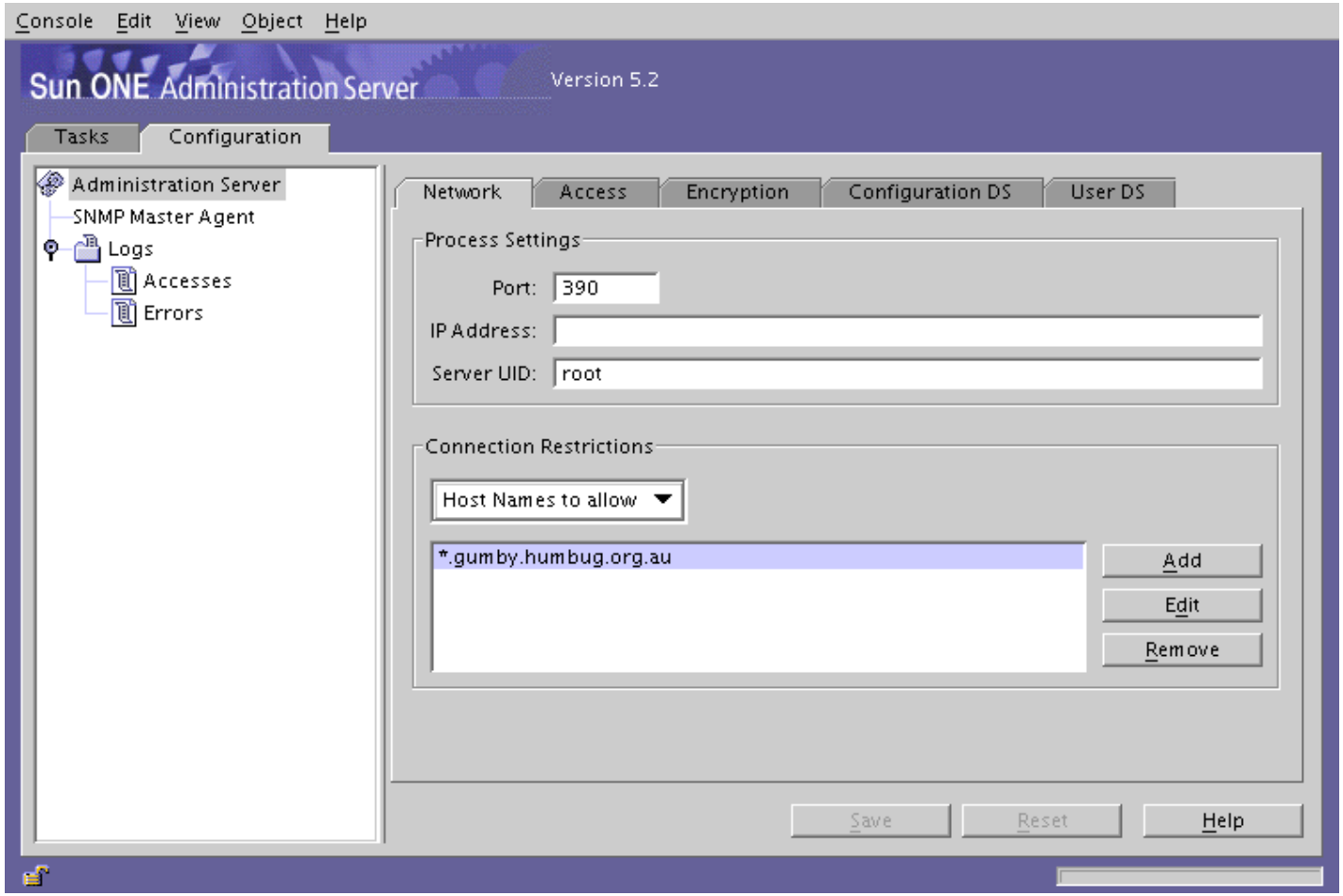
SunONE Server Console



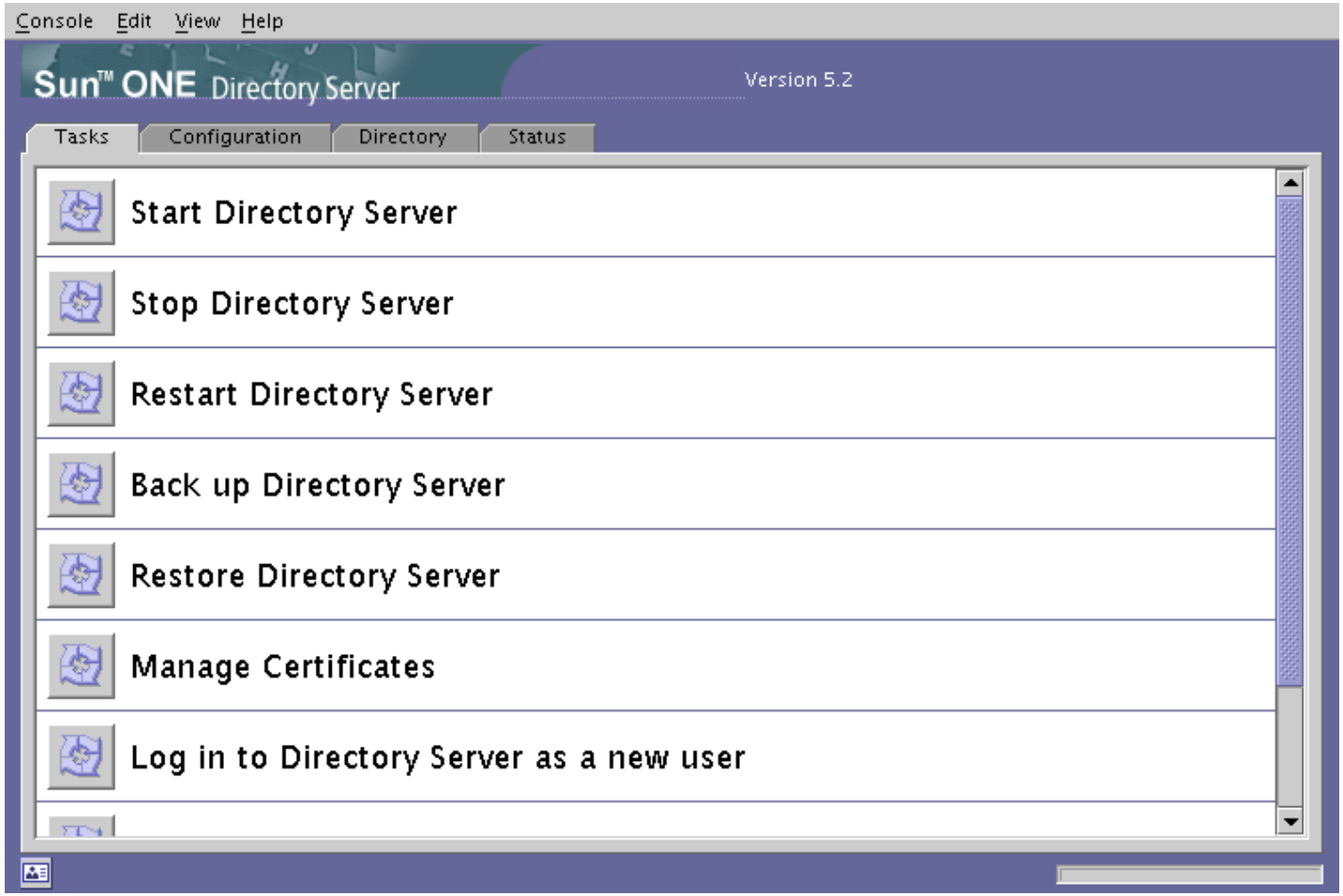
SunONE Admin Tasks



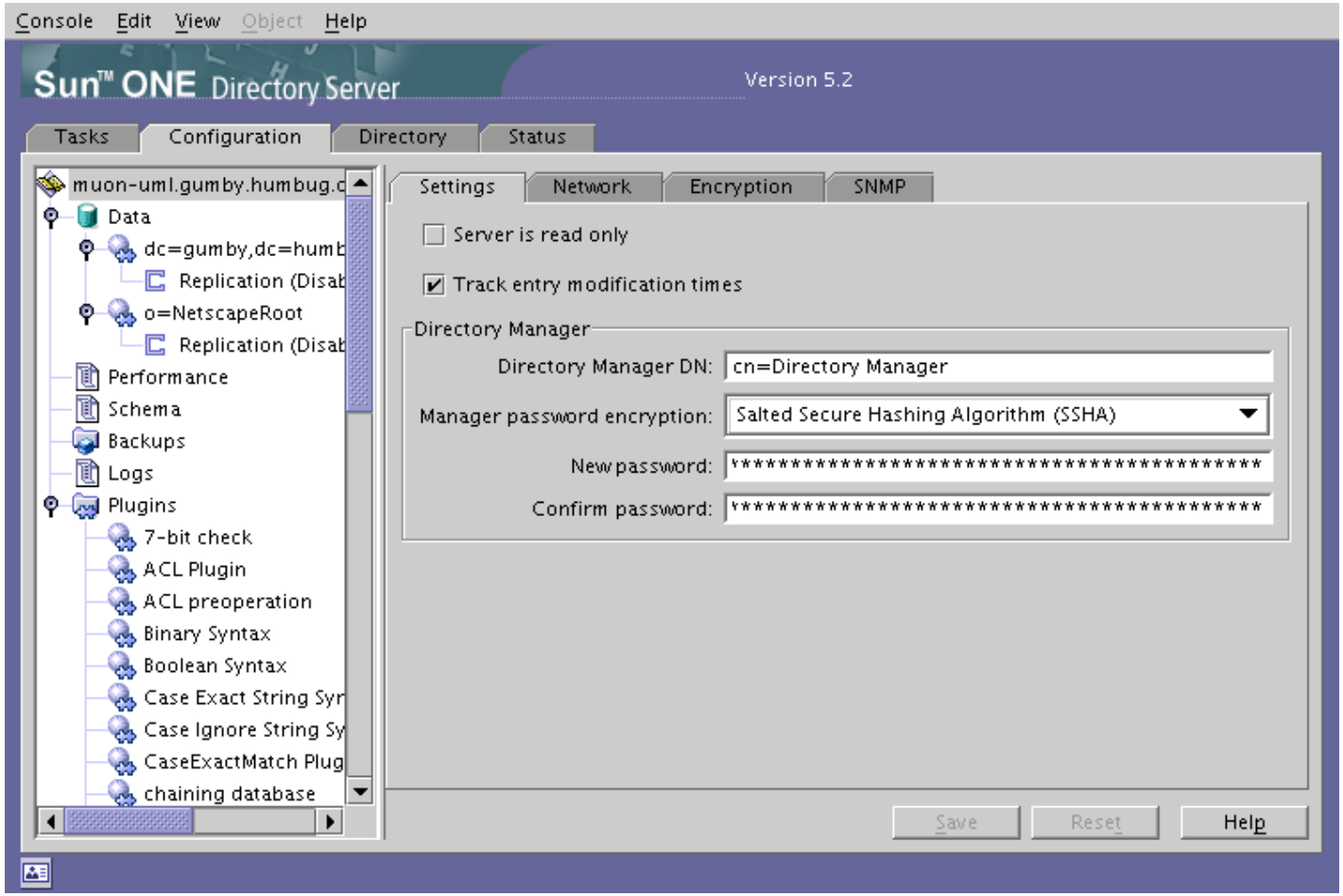
SunONE Admin Config



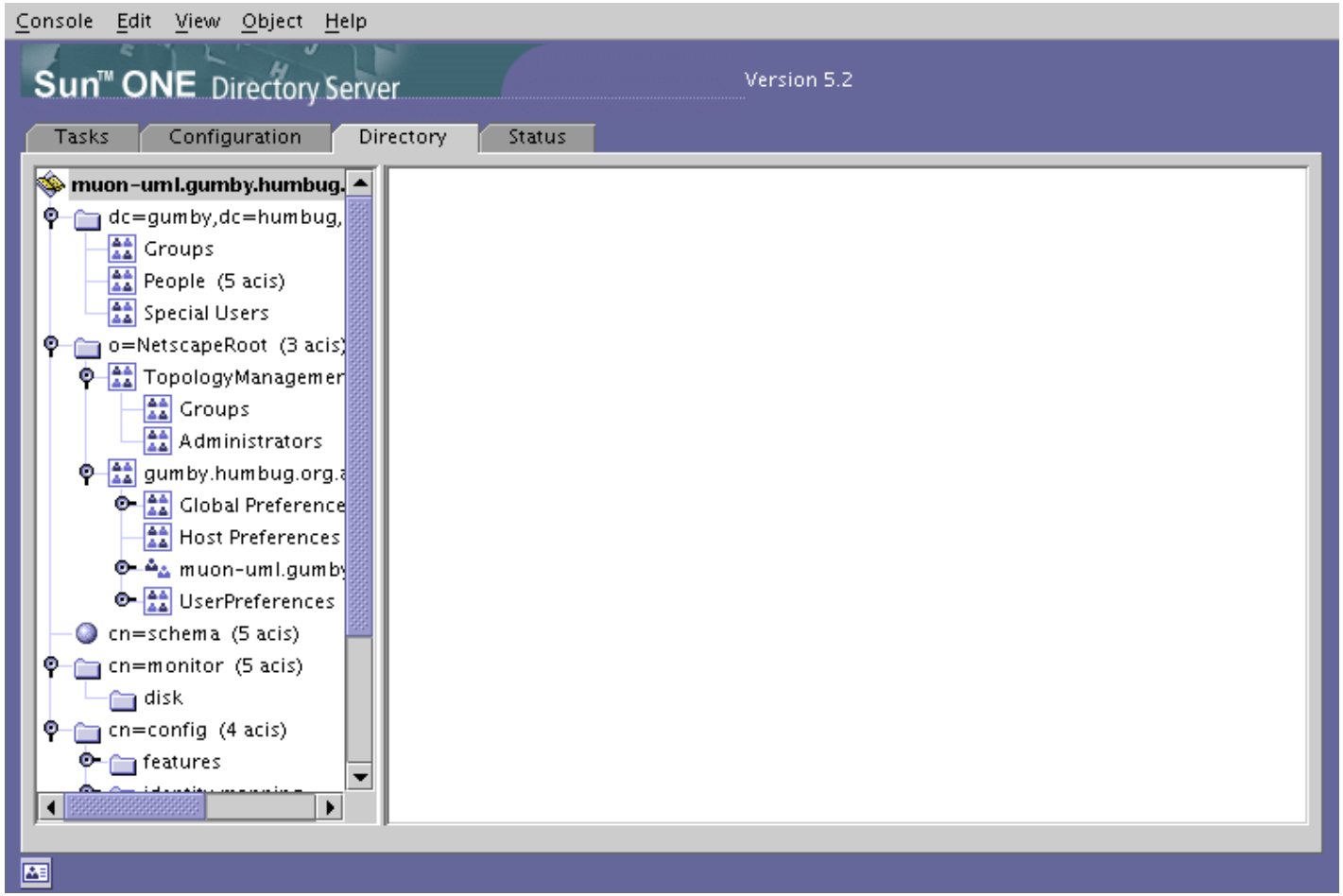
SunONE Directory Server Tasks



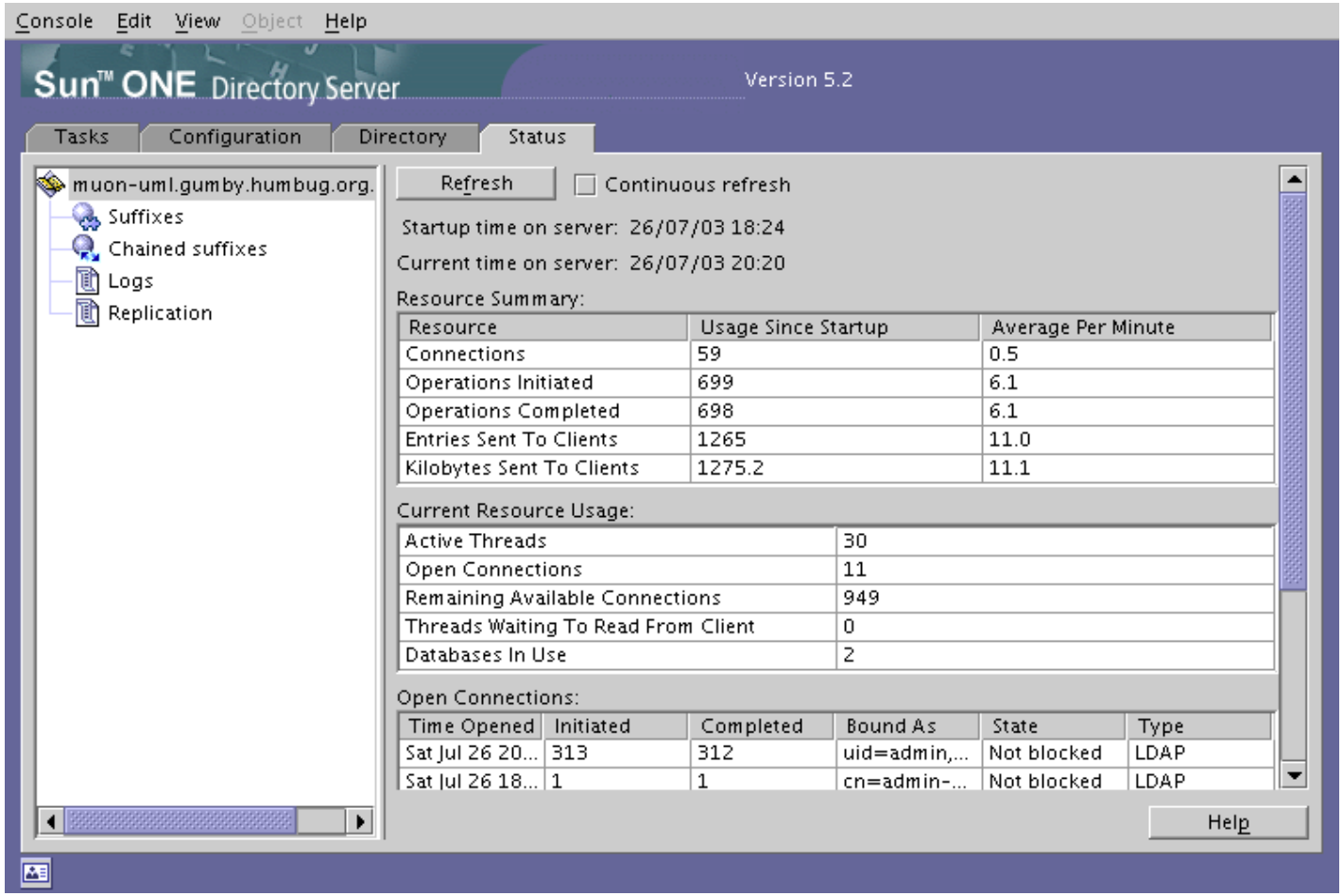
SunONE Directory Server Config



SunONE Directory Server Directory



SunONE Directory Server Status



Active Directory and LDAP

Provides a directory for a Microsoft network:

- Centrally manage
- Central security
- Central user administration
- Integrates with DNS
- Information replication
- Provides all the services a domain controller did

Active Directory Application Mode

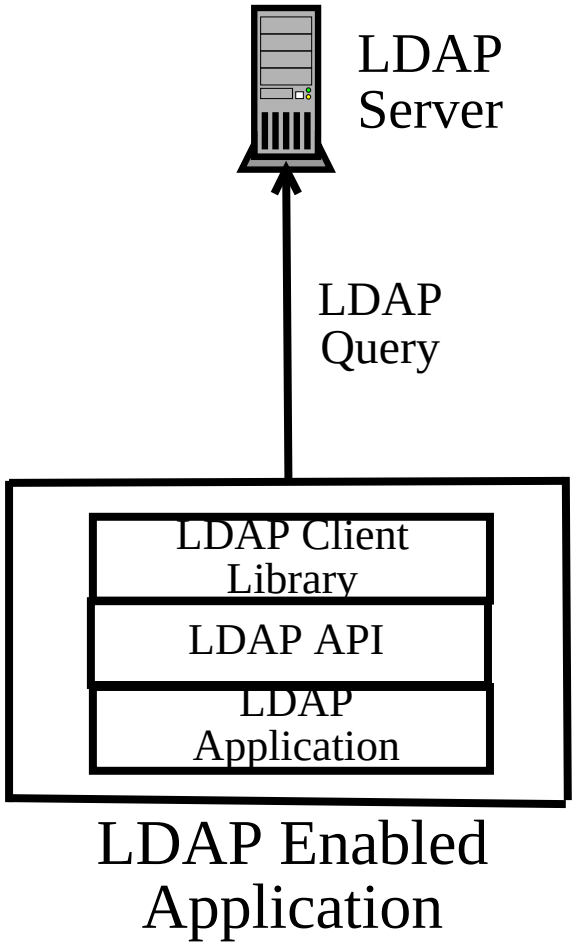
Windows 2003 has Active Directory Application Mode (or ADAM)

- Stand alone directory service
- Uses same core code as AD
- Non system service
  - Can run on non-DCs
  - Run multiple versions and configure independently
- Allows integration with applications
- LDAPv3 compliant - supports most LDAPv3 RFCs

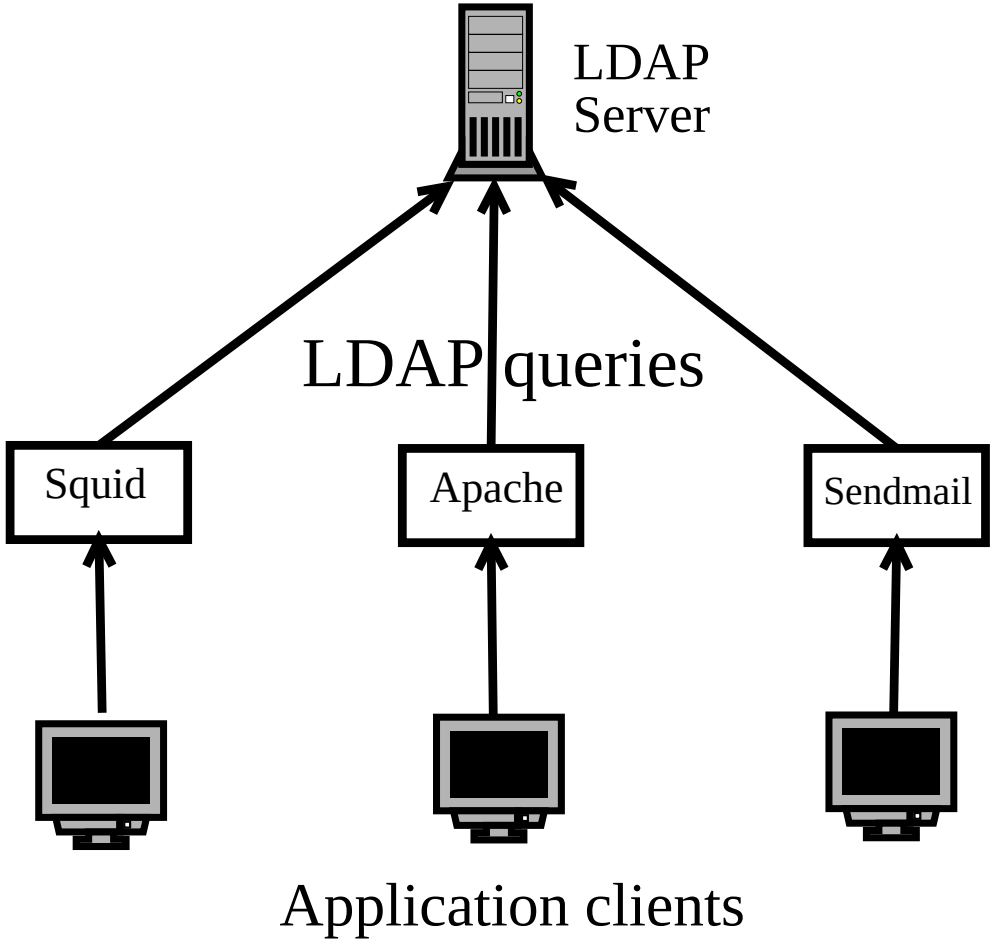
Security Considerations for Directory Servers

- Slapd defaults to binding to all IPv4 and IPv6 interfaces, consider binding to only the required ones - eg, listen just on localhost
- Firewall the port to restrict access
- Use tcp wrappers to restrict at application level
- Use TLS or SSL if possible
- Consider VPN / other encryption techniques
- Consider directory proxy at frontend

Using LDAP in Applications



Using Multiple Applications



Linux Authentication

- Consists of two main parts
  - PAM - Pluggable Authentication Modules
  - NSS - Name Service Switch

PAM

- Allows sysadmin to choose how applications authenticate
- Consists of dynamically loadable object files - see dlopen(3)
- Modules stored in /lib/security/pam_modulename.so
- Seperates development of applications from developing of authentication schemes
- Allows changing of authentication schema without modifying applications

PAM cont

- Remember in early days when Linux changed to shadow passwords
  - Used to have hard coded authentication method - /etc/passwd
  - Needed to recompile any programs that authenticated
  - Very frustrating for most users
- Can have different apps auth against different databases
- Can also do restrictions on various things - eg login time, resources used

PAM Config files

- Each application has a (hard coded) service type
- Config files can be kept in:
  - /etc/pam.conf
  - /etc/pam.d, with a seperate file per service type
- Format for /etc/pam.conf:

```
service module-type control-flag
        module-path arguments
```

- Format for /etc/pam.d/service:

```
module-type control-flag
        module-path arguments
```

- Can have multiple entries for each module-type - known as stacking modules

PAM Module Types

- Authentication
  - Establishes the users is who they say they are by asking for password (or some other kind of authencation token)
  - Can grant other privileges (such as group membership) via credential granting
- Account
  - Performs non-authentication based account management
  - Restrict access based on time of day, see if accounts have expired, check user and process limits etc

PAM Module Types cont

- Session
  - Deals with things that have to be done before and after giving a user access
  - Displaying motd, mounting directories, showing if a user has mail, last login, updating login histories etc
- Password
  - Updating users authentication details - ie, changing passwords

Name Service Switch (NSS)

- Provides access to user information after authentication
- Provides more information than just username and password
- Originally done by changing the C library
- Now done using dynamic loadable modules
- Follows design from Sun Microsystems
- Can get this information from places such as LDAP
- Modules stored in /lib/libnss_name.so
- Configuration file is /etc/nsswitch.conf

Name Service Caching Daemon - NSCD

- Caches name service lookups
- Part of glibc
- Config file is /etc/nscd.conf
- Useful for not requiring an ldap lookup for everything

System Authentication

- Uses RFC2307
- Provides a mapping from TCP/IP and unix entities into LDAP
- Gives a centrally maintained db of users
- Can create own tools to maintain, or use ready made ones
- Could dump out to locally files - not ideal
- Use PADL's nss_ldap and pam_ldap tools

System Authentication Migration

Used PADLs MigrationTools

Script	Migrates
migrate_fstab.pl	/etc/fstab
migrate_group.pl	/etc/group
migrate_hosts.pl	/etc/hosts
migrate_networks.pl	/etc/networks
migrate_passwd.pl	/etc/passwd
migrate_protocols.pl	/etc/protocols
migrate_rpc.pl	/etc/rpc
migrate_services.pl	/etc/services

System Authentication Migration cont

These scripts are called on the appropriate file in /etc in the following manner:

```
# ./migrate_passwd.pl /etc/passwd
                      ./passwd.ldif
```

The migration tools also provide scripts to automatically migrate all configuration to LDAP, using migrate_all_online,offline.sh. See the README distributed with the package for more details.

System Auth - Usage

- ldappasswd

```
ldappasswd -W -D 'uid=bmarshal,ou=People,
    dc=example,dc=com' 'uid=bmarshal'
```

- ldapsearch

```
ldapsearch -L 'uid=*'
ldapsearch -L 'objectclass=posixGroup'
ldapsearch -L 'objectclass=posixAccount'
ldapsearch -D 'uid=bmarshal,ou=People,
     dc=example,dc=com' -W -L
     'uid=bmarshal'
```

- ldapmodify (where bmarshal.ldif is ldapsearch -L 'uid=bmarshal')

```
ldapmodify -W -r -D "cn=Manager,
    c=example,dc=com" < bmarshal.ldif
```

Example user LDIF

```
dn: uid=bmarshal,ou=People,
        dc=example,dc=com
uid: bmarshal
cn: Brad Marshall
objectclass: account
objectclass: posixAccount
objectclass: top
loginshell: /bin/bash
uidnumber: 500
gidnumber: 120
homedirectory: /mnt/home/bmarshal
gecos: Brad Marshall,,,,
userpassword: {crypt}aknbKIfeaxs
```

Example group LDIF

```
dn: cn=sysadmin,ou=Group,
        dc=example,dc=com
objectclass: posixGroup
objectclass: top
cn: sysadmin
gidnumber: 160
memberuid: bmarshal
memberuid: dwood
memberuid: jparker
```

Server Configuration

/etc/openldap/slapd.conf

```
include         /etc/openldap/slapd.at.conf
include         /etc/openldap/slapd.oc.conf
schemacheck     off

pidfile         /var/run/slapd.pid
argsfile        /var/run/slapd.args

defaultaccess read
```

Server Configuration cont

```
access to attr=userpassword
    by self write
    by * read

access to *
    by self write
    by dn=".+" read
    by * read
```

Server Configuration cont

```
#######################################
# ldbm database definitions
#######################################

database    ldbm
suffix      "dc=example, dc=com"
rootdn      "cn=Manager, dc=example, dc=com"
rootpw      {crypt}lAn4J@KmNp9
replica host=replica.example.com:389
   binddn="cn=Manager,dc=example,dc=com"
   bindmethod=simple credentials=secret
   replogfile /var/lib/openldap/replication.log
# cleartext passwords, especially for the
# rootdn, should be avoid.  See slapd.conf(5)
# for details.
directory       /var/lib/openldap/
```

PAM Configuration

/etc/pam_ldap.conf - See actual file for more details

```
# Your LDAP server.
# Must be resolvable without using LDAP.
host 127.0.0.1

# The distinguished name of the search base.
base dc=example,dc=com

# The LDAP version to use (defaults to 3
# if supported by client library)
ldap_version 3

# The port.
# Optional: default is 389.
#port 389
```

PAM Configuration cont

```
# Hash password locally; required for
# University of Michigan LDAP server,
# and works with Netscape Directory
# Server if you're using the UNIX-Crypt
# hash mechanism and not using the NT
# Synchronization service. This is the
# default.
pam_password crypt

# Use nds for Novell Directory
# Use ad for Active Directory
# Use exop for Openldap password
# change extended operations
```

Allow Group of Users Access To Host

To allow a group of users access to a host:

- Create an entry for the host as follows:

```
dn: cn=hostname,ou=hosts,dc=example,dc=com
objectClass: ipHost
objectClass: device
objectClass: extensibleObject
ipHostNumber: 192.168.1.2
cn: hostname.example.com
cn: hostname
member: uid=fflinstone,ou=People,dc=example,dc=c
member: uid=brubble,ou=People,dc=example,dc=com
```

Allow Group of Users Access To Host cont

- Add the following to the config:

```
# Define the DN for the host
pam_groupdn cn=hostname,ou=hosts,dc=example,dc=c
# Define the attribute type
pam_member_attribute member
```

One User, Access to Multiple Hosts

- Add a host attribute for each host you want to access to the user

```
host: bedrock.example.com
host: springfield.example.com
```

- Enable host check attribute in the config

```
# Enable host attribute lookups
pam_check_host_attr yes
```

- If there are no host attributes on a user, access is denied

pam.d configuration

/etc/pam.d/ssh

```
#%PAM-1.0
auth       required     pam_nologin.so
auth       sufficient   pam_ldap.so
auth       required     pam_unix.so try_first_pass
auth       required     pam_env.so # [1]

account    sufficient   pam_ldap.so
account    required     pam_unix.so
```

pam.d configuration cont

```
session  sufficient pam_ldap.so
session  required   pam_unix.so
session  optional   pam_lastlog.so # [1]
session  optional   pam_motd.so # [1]
session  optional   pam_mail.so standard noenv # [1
session  required   pam_limits.so

password sufficient pam_ldap.so
password required   pam_unix.so try_first_pass
```

NSS configuration

/etc/libnss_ldap.conf - see local file for more details

```
# Your LDAP server.
# Must be resolvable without using LDAP.
host 127.0.0.1

# The distinguished name of the search base.
base dc=example,dc=com

# The LDAP version to use (defaults to 2)
ldap_version 3

# The port.
# Optional: default is 389.
#port 389
```

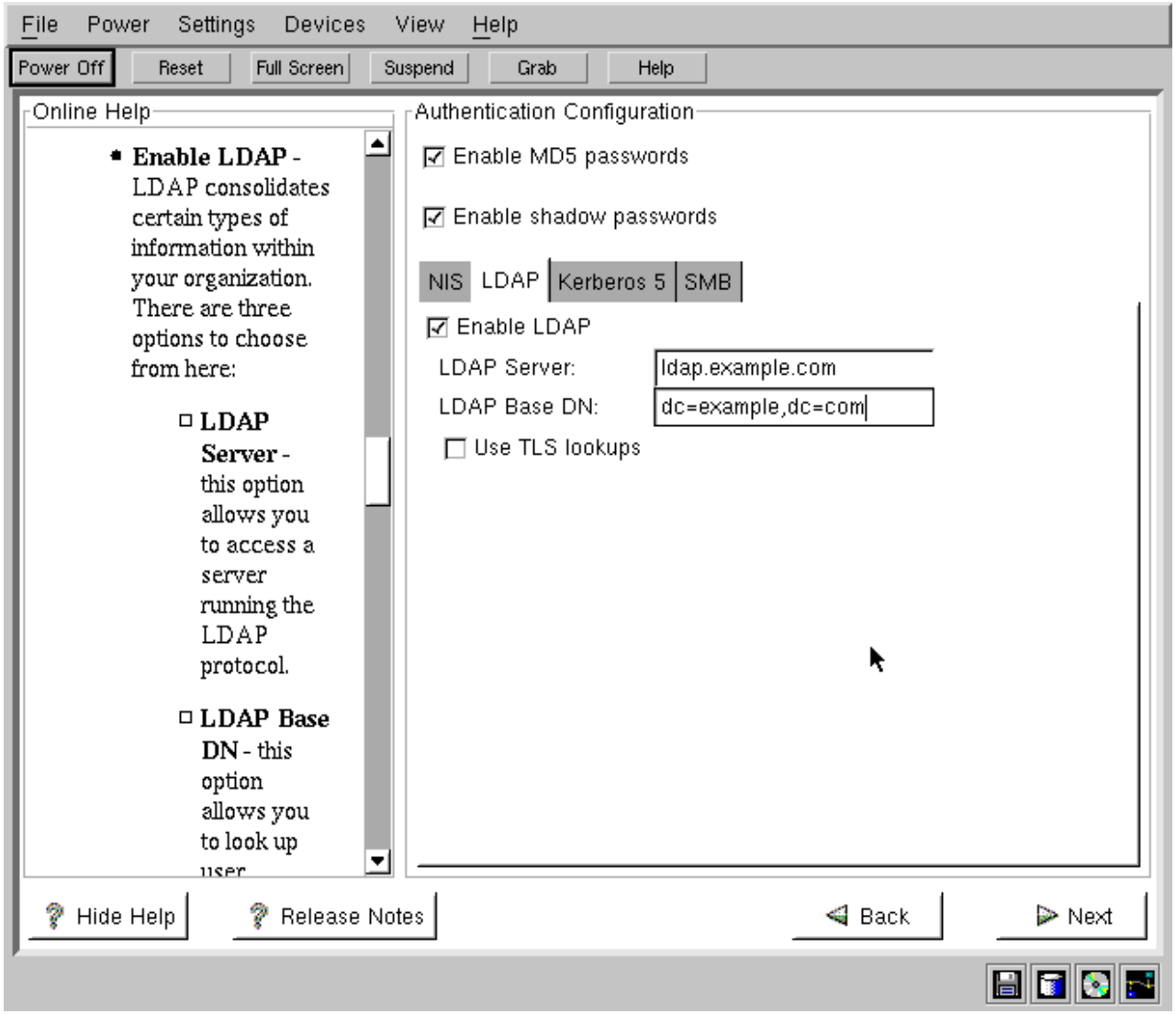
NSS configuration - nsswitch.conf

/etc/nsswitch.conf

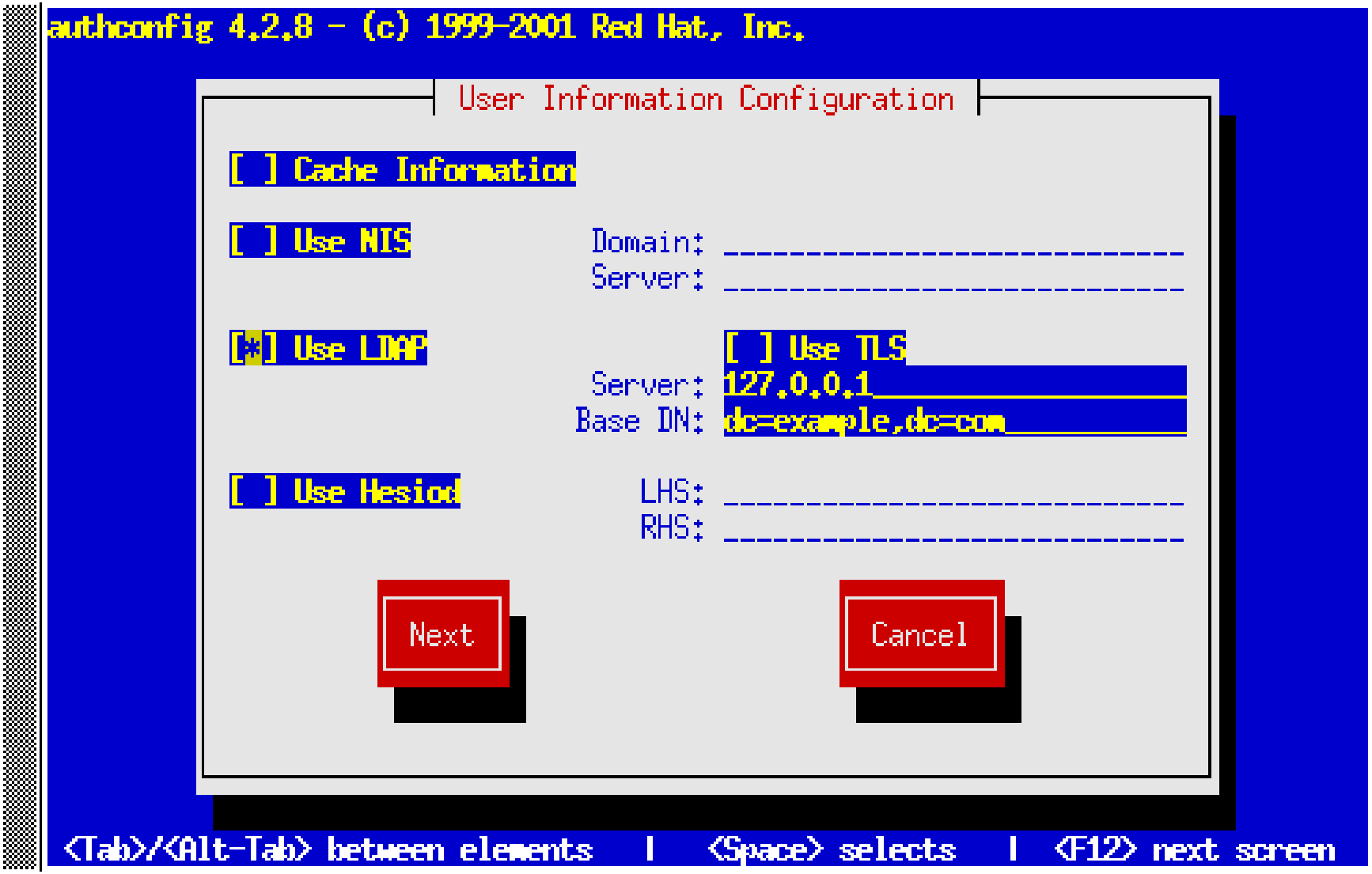
```
passwd:         compat ldap
group:          compat ldap
shadow:         compat ldap
```

Note that the order of the nss sources will modify which source is canonical. That is, if you list ldap first, it will be checked first.

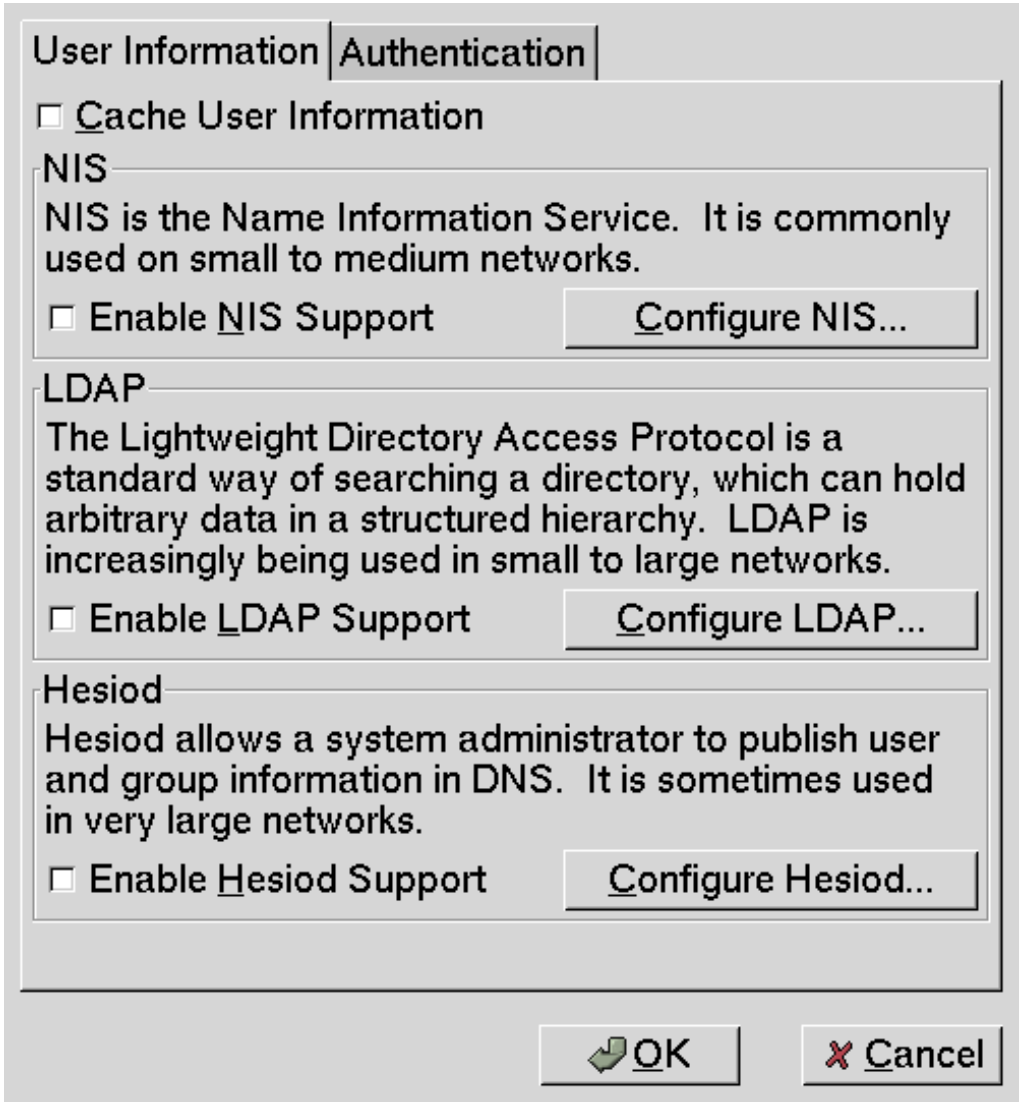
Redhat 7.3 Install Config



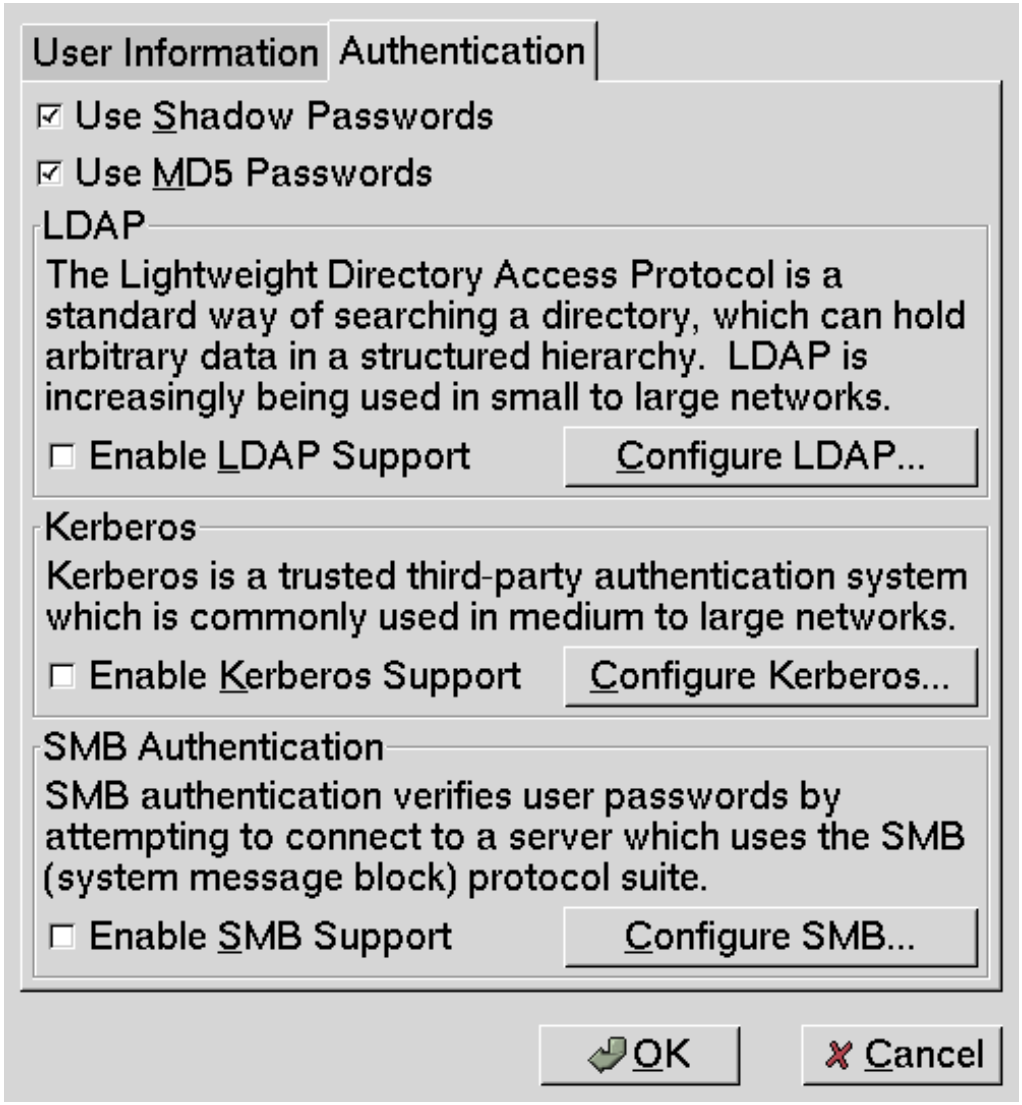
RH7.3 Authconfig - Text



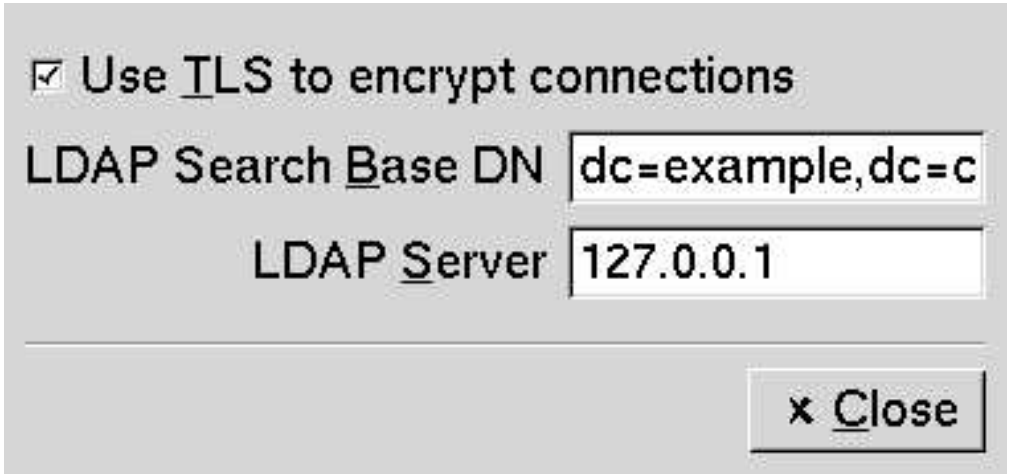
RH7.3 Authconfig - GTK User



RH7.3 Authconfig - GTK Authentication



RH7.3 Authconfig - GTK LDAP



Windows LDAP Auth - pGina

- Replacement for domain auth in Windows
- GINA (Graphical Identification and Authentication) module
- Inserts itself between Winlogon and MS's GINA module
- Handles certain operations, passes rest on transparently
- Winlogon loads pGina which then loads plugin
- If plugin allows user to login, will
  - Create account for user
  - Add to specified groups
  - Map drives
  - Other config options

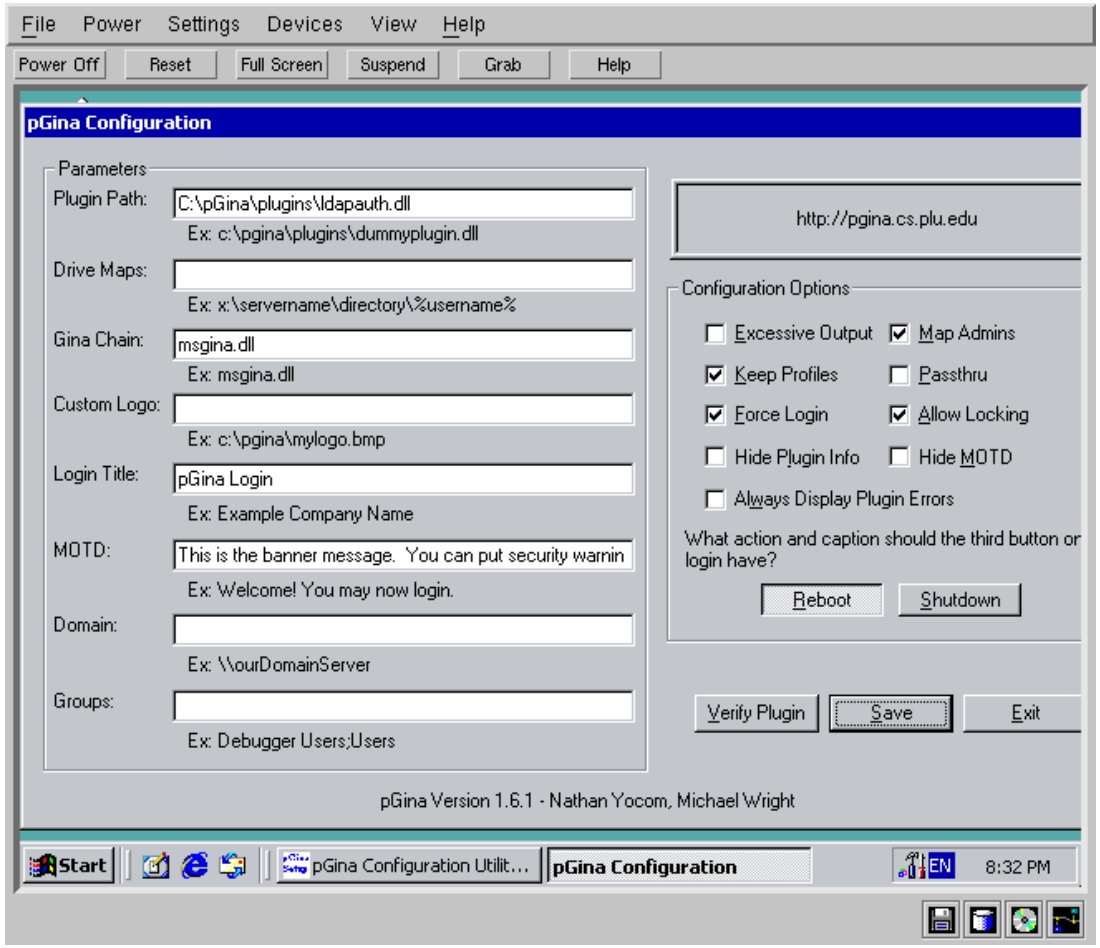
pGina Config

- Download and install pGina from http://pgina.sf.net/
- Install ldapauth.dll into c:
  pgina
  plugins
- Run regedit and create a new key called ldapauth in
  HKey_Local_Machine
  Software
  pGina
  - ldapServer ldap.example.com
  - ldapPrepend uid=
  - ldapMethod 0
  - ldapContext0 ou=People,dc=example,dc=com

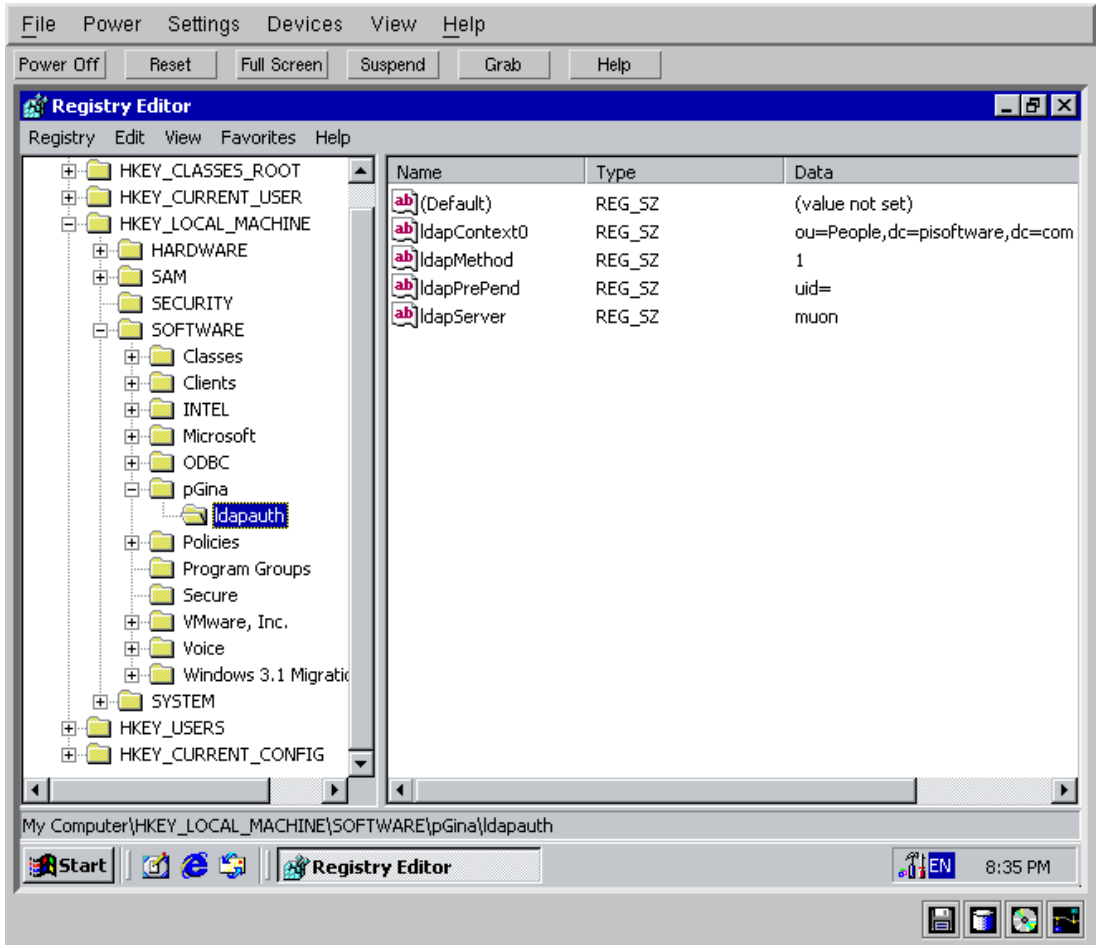
pGina Registry Entries

Key	Value
ldapMethod	1 = Multimap, 2 = search, 3 = map
useSSL	Use SSL
ldapPrePend	For map and multimap what it puts before the username
ldapAppend	For map, what goes after the username
ldapContext0-255	For multimap, different contexts to try
ldapAdminUsername	User to bind as
ldapAdminPassword	Password for ldapAdminUsername
userOK0-255	LDAP Group(s) user must be in
adminOK0-255	LDAP Group(s) user must be a member to be in Admin group

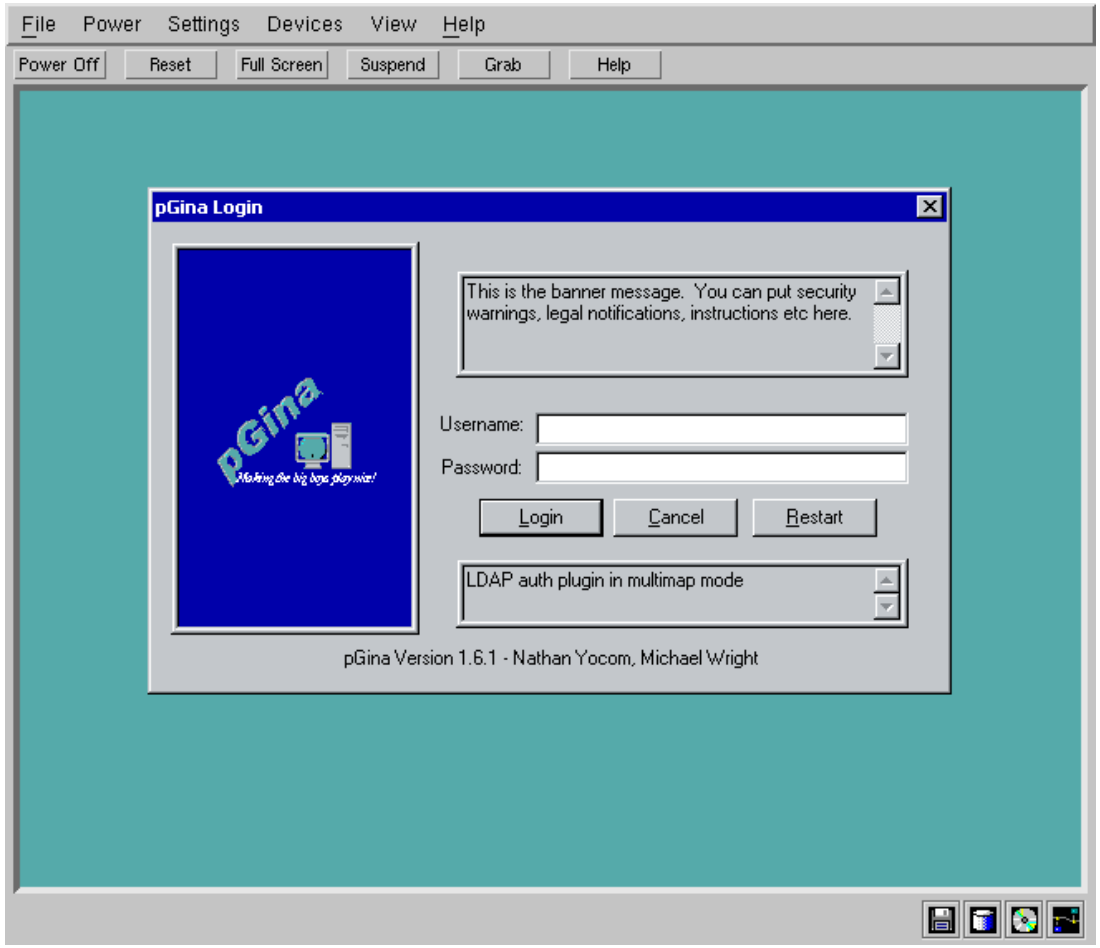
pGina Config



pGina ldapauth Regedit



pGina Login


File Power Settings Devices View Help
Power Off
Reset
Full Screen
Suspend
Grab
Help
pGina Login
This is the banner message. You can put security warnings, legal notifications, instructions etc here.
Username:
Password:
Login
Cancel
Restart
LDAP auth plugin in multimap mode
pGina Version 1.6.1 - Nathan Yocom, Michael Wright

Sendmail and LDAP

- Sendmail traditionally uses flat files stored on the server
- Reduces need to manually sync data across multiple servers
- Allows cross-platform, standardised, centralised repository of user data
- Can use data in multiple applications - internal email directory etc

Sendmail and LDAP compiling

To check that sendmail has LDAP support, run:

```
sendmail -d0.1 -bv root
```

The output should contain:

```
Compiled with: LDAPMAP
```

To compile sendmail with LDAP support:

```
APPENDDEF('confMAPDEF', '-DLDAPMAP')
APPENDDEF('confINCDIRS',
    '-I/path/to/openldap-1.2.11/include')
APPENDDEF('confLIBSDIRS',
    '-L/path/to/openldap-1.2.11/libraries')
APPENDDEF('confLIBS', '-lldap -llber')
```

Now you can rebuild as normal.

Sendmail and LDAP config

The base config that you need to add to sendmail.mc is:

```
LDAPROUTE_DOMAIN('example.com')dnl
define(confLDAP_DEFAULT_SPEC,
          -h ldap.example.com
          -b dc=example.com)
```

To define a group of hosts, use:

```
define('confLDAP_CLUSTER', 'Servers')
```

To enable LDAP aliases:

```
define('ALIAS_FILE', 'ldap:')
```

To enable other lookups, use:

```
FEATURE('access_db', 'LDAP')
FEATURE('virtusertable', 'LDAP')
```

To enable classes:

```
RELAY_DOMAIN_FILE('@LDAP')
```

Sendmail LDAP Map Values

FEATURE()	sendmailMTAMapName
access_db	access
authinfo	authinfo
bitdomain	bitdomain
domaintable	domain
genericstable	generics
mailertable	mailer
uucpdomain	uucpdomain
virtusertable	virtuser

Sendmail Alias LDIF example

```
dn: sendmailMTAKey=postmaster,
      dc=example, dc=com
objectClass: sendmailMTA
objectClass: sendmailMTAAlias
objectClass: sendmailMTAAliasObject
sendmailMTAAliasGrouping: aliases
sendmailMTACluster: Servers
sendmailMTAKey: postmaster
sendmailMTAAliasValue: bmarshal
```

Sendmail Mailertable LDIF example

Group LDIF:

```
dn: sendmailMTAMapName=mailer,
      dc=example, dc=com
objectClass: sendmailMTA
objectClass: sendmailMTAMap
sendmailMTACluster: Servers
sendmailMTAMapName: mailer
```

Sendmail Mailertable LDIF example cont

Entry LDIF:

```
dn: sendmailMTAKey=example.com,
        sendmailMTAMapName=mailer,
        dc=example, dc=com
objectClass: sendmailMTA
objectClass: sendmailMTAMap
objectClass: sendmailMTAMapObject
sendmailMTAMapName: mailer
sendmailMTACluster: Servers
sendmailMTAKey: example.com
sendmailMTAMapValue: \
     relay:[smtp.example.com]
```

Sendmail LDAP Classes Values

Command	sendmailMTAClassName
CANONIFY_DOMAIN_FILE()	Canonify
EXPOSED_USER_FILE()	E
GENERICS_DOMAIN_FILE()	G
LDAPROUTE_DOMAIN_FILE()	LDAPRoute
LDAPROUTE_EQUIVALENT_FILE()	LDAPRouteEquiv
LOCAL_USER_FILE()	L
MASQUERADE_DOMAIN_FILE()	M
MASQUERADE_EXCEPTION_FILE()	N
RELAY_DOMAIN_FILE()	R
VIRTUSER_DOMAIN_FILE()	VirtHost

Sendmail Classes LDIF example

```
dn: sendmailMTAClassName=R,
    dc=example, dc=com
objectClass: sendmailMTA
objectClass: sendmailMTAClass
sendmailMTACluster: Servers
sendmailMTAClassName: R
sendmailMTAClassValue: example.com
sendmailMTAClassValue: foobar.com
sendmailMTAClassValue: 10.56.23
```

Exim

```
system_aliases:
  driver = aliasfile
  search_type = ldap
  hide query = \
    user = "cn=admin,dc=example,dc=com" \
    pass = mypasswd \
    ldap:/// \
    cn=${quote_ldap:$local_part},dc=example,\
    dc=com?mailbox?base?
```

Use ldapm for search_type to return multiple entries

Bind and LDAP

- Uses a sdb ldap backend
- Available from http://www.venaas.no/ldap/bind-sdb/
- Uses schema called dNSZone
- Build bind9 with the sdb backend, see the instructions included
- Add the following to named.conf:

```
zone "example.com" {
   type master;
   database "ldap ldap://ldap.example.com/ \
      dc=example,dc=com,o=DNS,dc=example,dc=com 172
};
```

Bind and LDAP LDIF

```
dn: relativeDomainName=@, dc=example, dc=com, \
     o=DNS, dc=example, dc=com
objectClass: dNSZone
relativeDomainName: @
zoneName: example.com
dNSTTL: 3600
dNSClass: IN
sOARecord: ns.example.com. hostmaster.example.com.
    2002052201 3600 1800 604800 86400
nSRecord: ns.example.com.
nSRecord: ns.other-domain.com.
mXRecord: 10 mail.example.com.
mXRecord: 20 mail.other-domain.com.
```

Bind and LDAP LDIF cont

Equivalent to:

```
@   3600  IN  SOA  ns.example.com. hostmaster.examp
                  2002052201 3600 1800 604800 86400 )
            NS      ns.example.com.
            NS      ns.other-domain.com.
            MX      10 mail.example.com.
            MX      20 mail.other-domain.com.
```

Bind and LDAP LDIF cont

```
dn: relativeDomainName=my-hosta, dc=example,
     dc=com, o=DNS, dc=example, dc=com
objectClass: dNSZone
relativeDomainName: my-hosta
zoneName: example.com
dNSTTL: 86400
dNSClass: IN
aRecord: 10.10.10.10
mXRecord: 10 mail.example.com.
mXRecord: 20 mail.other-domain.com.
```

Bind and LDAP LDIF

Equivalent to:

```
my-hosta        A    10.10.10.10
                MX   10 mail.example.com.
                MX   20 mail.other-domain.com.
```

Apache and LDAP

- Allows you to restrict access to a webpage with data from LDAP
- Download mod_auth_ldap.tar.gz from http://www.muquit.com/muquit/software/mod_auth_ldap/mod_auth_ldap.html
- Install either as a DSO or by compiling in - see webpage for more details

Apache and LDAP cont

- Add the following to httpd.conf:

```
<Directory "/var/www/foo">
Options Indexes FollowSymLinks
AllowOverride None
order allow,deny
allow from all
AuthName "RCS Staff only"
AuthType Basic
```

Apache and LDAP cont

```
LDAP_Server ldap.server.com
LDAP_Port 389
Base_DN "dc=server,dc=com"
UID_Attr uid
#require valid-user
require user foo bar doe
#require roomnumber "C119 Center Building"
#require group
#  cn=sysadmin,ou=Group,dc=server,dc=com
</Directory>
```

Squid and LDAP

- Allows you to restrict access to Squid via ldap
- Add the following to the configure line: –enable-auth-modules=LDAP
- See documentation at http://orca.cisti.nrc.ca/ gnewton/ opensource/squid_ldap_auth/
- Add the following to squid.conf:

```
authenticate_program /path/to/ldap_auth \
      -b dc=yourdomain,dc=com ldap.domain.com
acl ldapauth proxy_auth REQUIRED
#acl ldapauth proxy_auth bmarshal pag
```

- Restart squid

Samba and winbind

- Install winbind from Samba
- Add the following to /etc/samba/smb.conf

```
security = domain
workgroup = DOMAIN
winbind separator = +
winbind cache time = 10
template shell = /bin/bash
template homedir = /home/%D/%U
winbind uid = 10000-20000
winbind gid = 10000-20000
password server = ip.ad.dr.es
wins server = ip.ad.dr.es
```

Samba and winbind cont

- /etc/nsswitch.conf (under debian)

```
passwd:         compat winbind
group:          compat winbind
shadow:         compat winbind
```

- Addition to /etc/pam.d/login

```
auth        sufficient pam_winbind.so
account     sufficient pam_winbind.so
session     sufficient pam_winbind.so
```

Samba and winbind cont

- Create a machine account for the workstation in Active Directory in Programs | Administrative Tools | Active Directory Users and Computers
- Join the domain by the following

```
$ sudo smbpasswd -j <domainname> \
    -r <domainservername> -U Administrator
```

- Restart samba and winbind
- Login as DOMAIN+username

Samba and LDAP

- Install OpenLDAP 2.0.x
- Compile samba 2.2.3 or later with –with-ldapsam
- Download and install smbldap-tools from www.idealx.org
- Copy samba.schema into OpenLDAP schema dir
- Configure slapd.conf as below
- Import base.ldif
- Configure smb.conf as below
- As root, run:

```
# smbpasswd -w secret
# smbldap-useradd.pl -a -m \
          -g 200 administrator
    \item Get the local system authing off LDAP
```

Samba and LDAP - slapd.conf

```
# Schema and objectClass definitions
include         /etc/ldap/schema/core.schema
include         /etc/ldap/schema/cosine.schema
include         /etc/ldap/schema/nis.schema
include         /etc/ldap/schema/inetorgperson.sche
include         /etc/ldap/schema/misc.schema
include         /etc/ldap/schema/samba.schema
```

Samba and LDAP - slapd.conf cont

```
database        ldbm
# The base of your directory
suffix          "dc=gumby"
# Where the database file are physically stored
directory       "/var/lib/ldap"
# Root user
rootdn  "cn=Manager,dc=gumby"
rootpw  secret
# Indexing options
index objectClass,rid,uid, \
uidNumber,gidNumber,memberUID eq
index cn,mail,surname, \
givenname eq,subinitial
```

Samba and LDAP - smb.conf

```
[global]
   workgroup = GROUP
   security = user
   wins support = yes
   os level = 80
   domain master = true
   domain logons = yes
   local master = yes
   preferred master = true
   passwd program = /usr/local/sbin/ \
       smbldap-passwd.pl -o %u
```

Samba and LDAP - smb.conf cont

```
ldap suffix = dc=gumby
ldap admin dn = cn=Manager,dc=gumby
ldap port = 389
ldap server = 127.0.0.1
ldap ssl = No
add user script = /usr/local/sbin/ \
      smbldap-useradd.pl -w %u
domain admin group = @"Domain Admins"
logon path = \\%N\profiles\%u
logon drive = H:
logon home = \\homesrv\%u
logon script = logon.cmd
```

Samba and LDAP - smb.conf cont

```
[netlogon]
   comment = Network Logon Service
   path = /data/samba/netlogon
   guest ok = yes
   writable = no
   share modes = no

; share for storing user profiles
[profiles]
   path = /data/samba/profiles
   read only = no
   create mask = 0600
   directory mask = 0700
```

Samba and LDAP - Example ldif

```
dn: uid=administrator,ou=Users,dc=gumby
cn: administrator
sn: administrator
uid: administrator
gidNumber: 200
homeDirectory: /home/administrator
loginShell: /bin/bash
gecos: System User
description: System User
objectClass: inetOrgPerson
objectClass: posixAccount
objectClass: sambaAccount
pwdLastSet: 0
logonTime: 0
logoffTime: 2147483647
```

Samba and LDAP - Example ldif cont

```
kickoffTime: 2147483647
pwdCanChange: 0
pwdMustChange: 2147483647
displayName: System User
acctFlags: [UX]
primaryGroupID: 1401
homeDrive: H:
smbHome: \\muon\homes
profilePath: \\muon\profiles\administrator
scriptPath: administrator.cmd
lmPassword: 81CBCEA8A9AF93BBAAD3B435B51404EE
ntPassword: 561CBDAE13ED5ABD30AA94DDEB3CF52D
uidNumber: 0
rid: 1000
```

Samba and LDAP - Joining Domains

- WinNT
  - Go to Control Panel | Network | Identification
  - Click on Change, then choose Member Of Domain, and enter the domain
  - Click on Create Computer Account in the Domain, then enter a domain admin username and password
  - Reboot

Samba and LDAP - Joining Domains cont

- Win2k
  - Right click on My Computers | Properties
  - Go to Network Identification | Properties
  - Click on Member Of Domain, and input the domain you want to join
  - Enter a username / password combination for a domain administrator
  - Reboot

Samba and LDAP - Joining Domains cont

- Win95
  - Go to Control Panel | Network | Configuration
  - Click on Client for Microsoft Network | Properties
  - In the General tab, tick the box in Logon Validation for Logon to Windows NT Domain and put the domain in the Windows NT Domain textbox
  - Go to Control Panel | Passwords | User Profiles
  - Select the setting that says users can customize their own profiles
  - Reboot

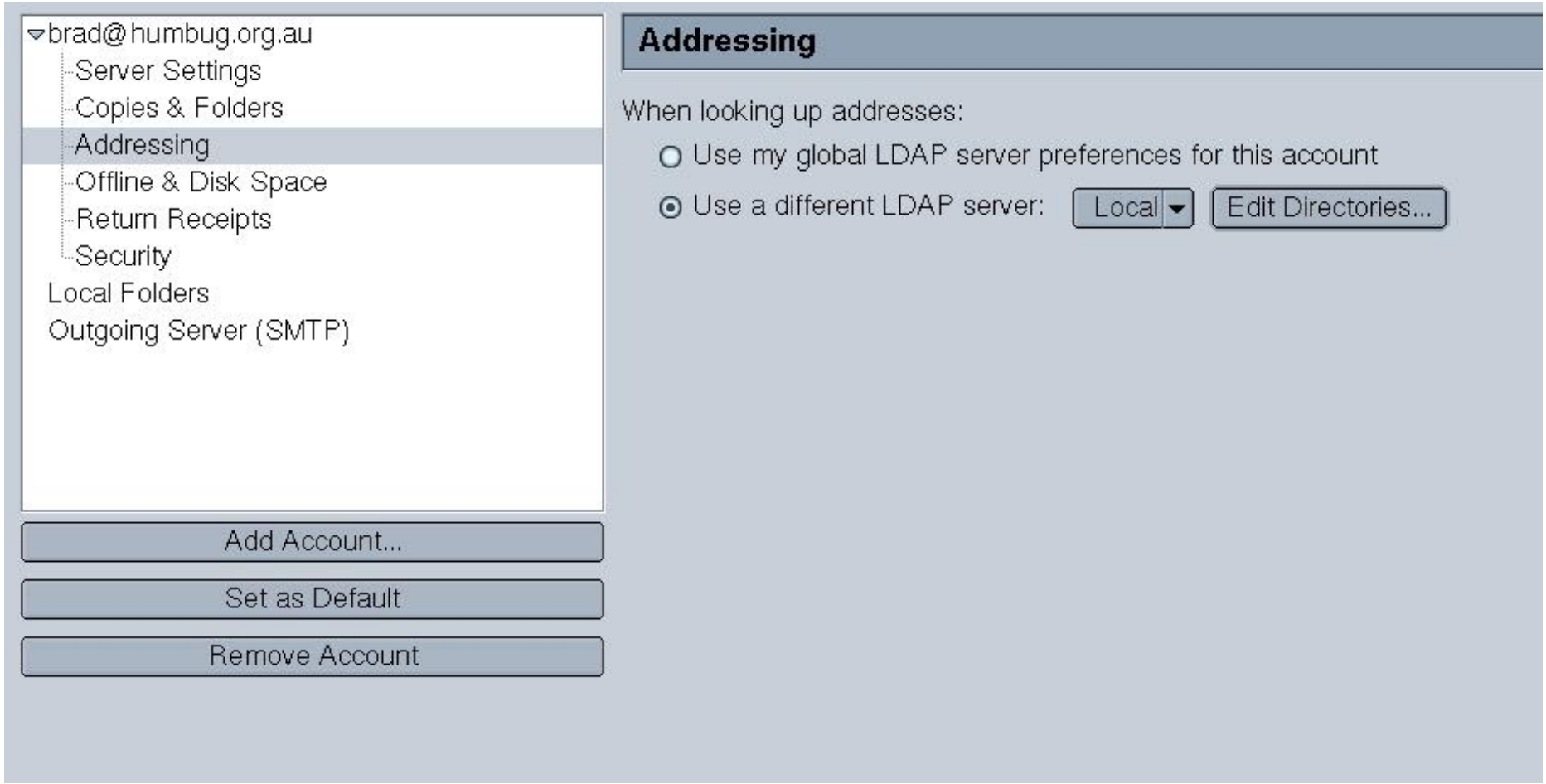
Netscape Addressbook and LDAP

Go to:

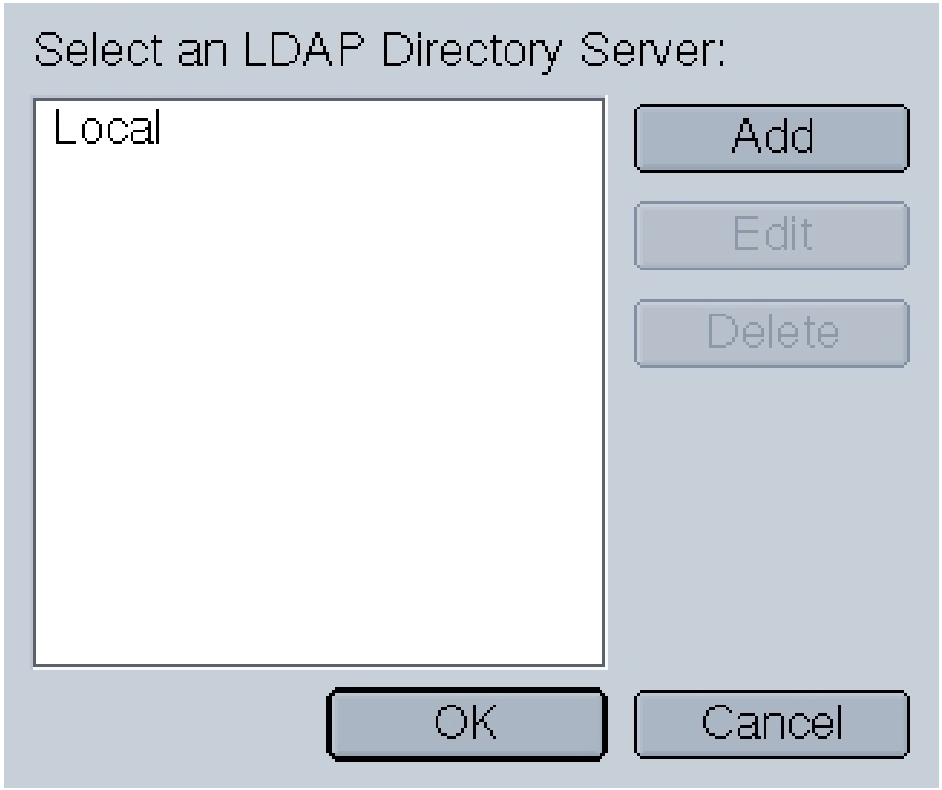
- Edit | Mail & Newsgroup Account Setup | Addressing
- Click on Edit Directories | Add
- Fill out hostname, base DN etc

Now when you compose a message, it will search your ldap server.

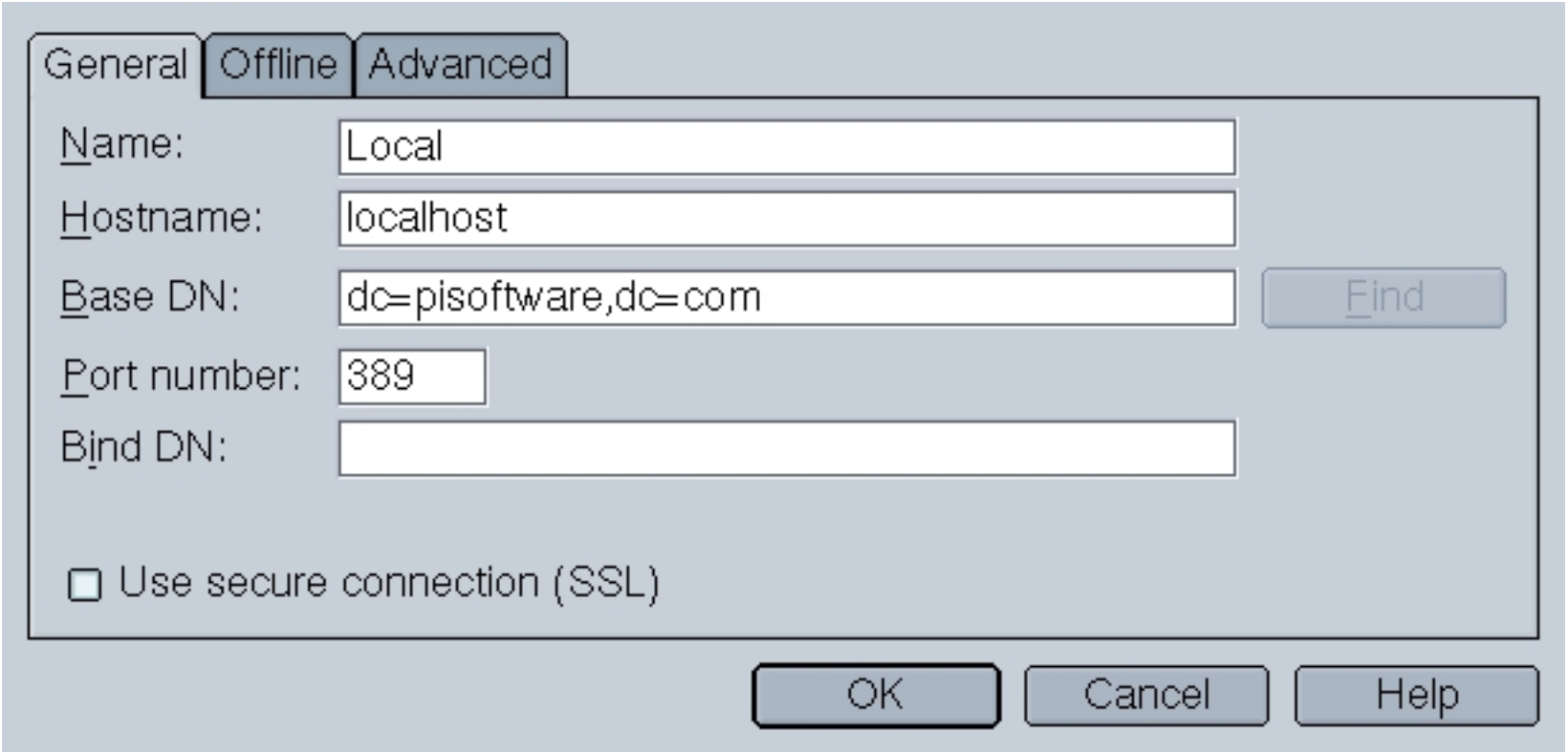
Netscape Addressbook Adding



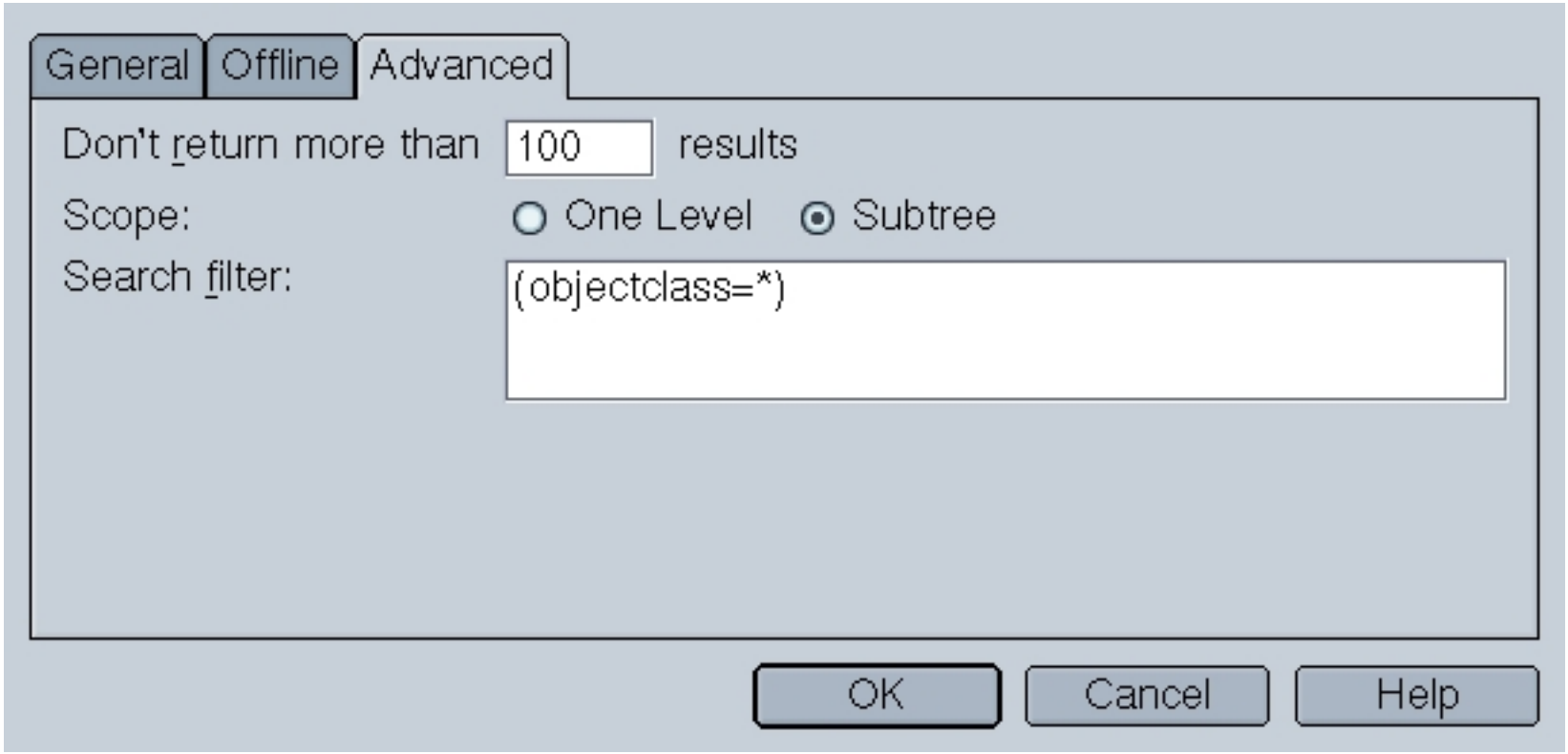
Netscape Addressbook Editing



Netscape Addressbook Editing cont



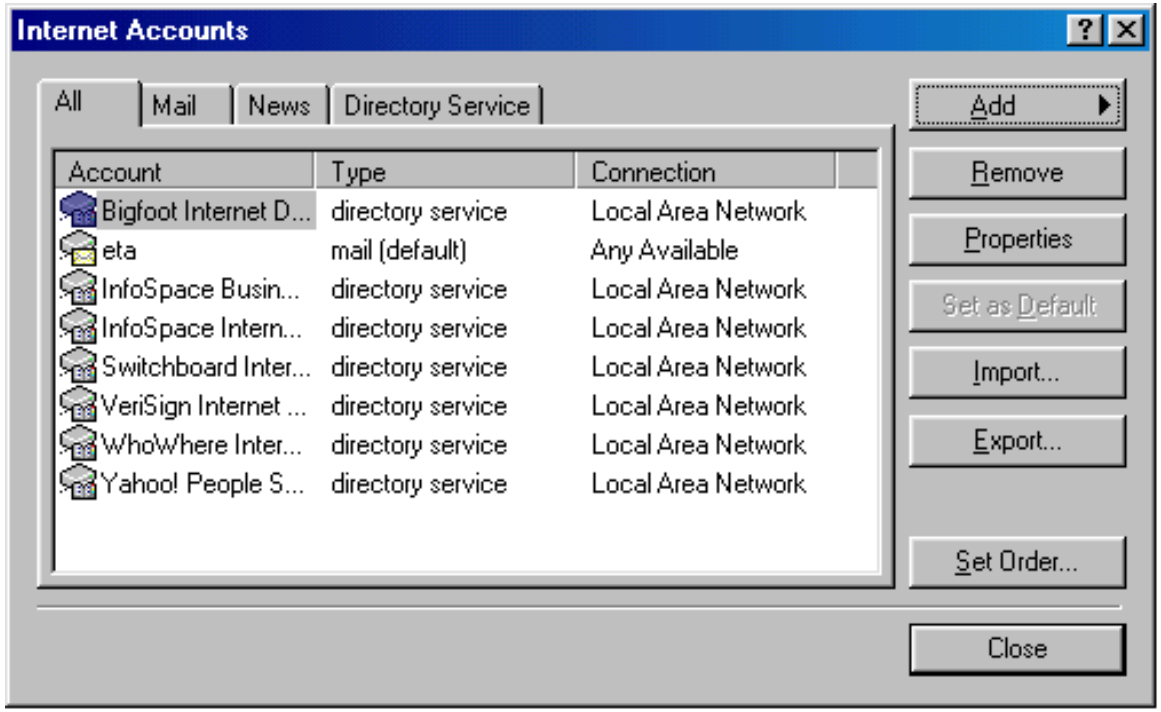
Netscape Addressbook Editing cont



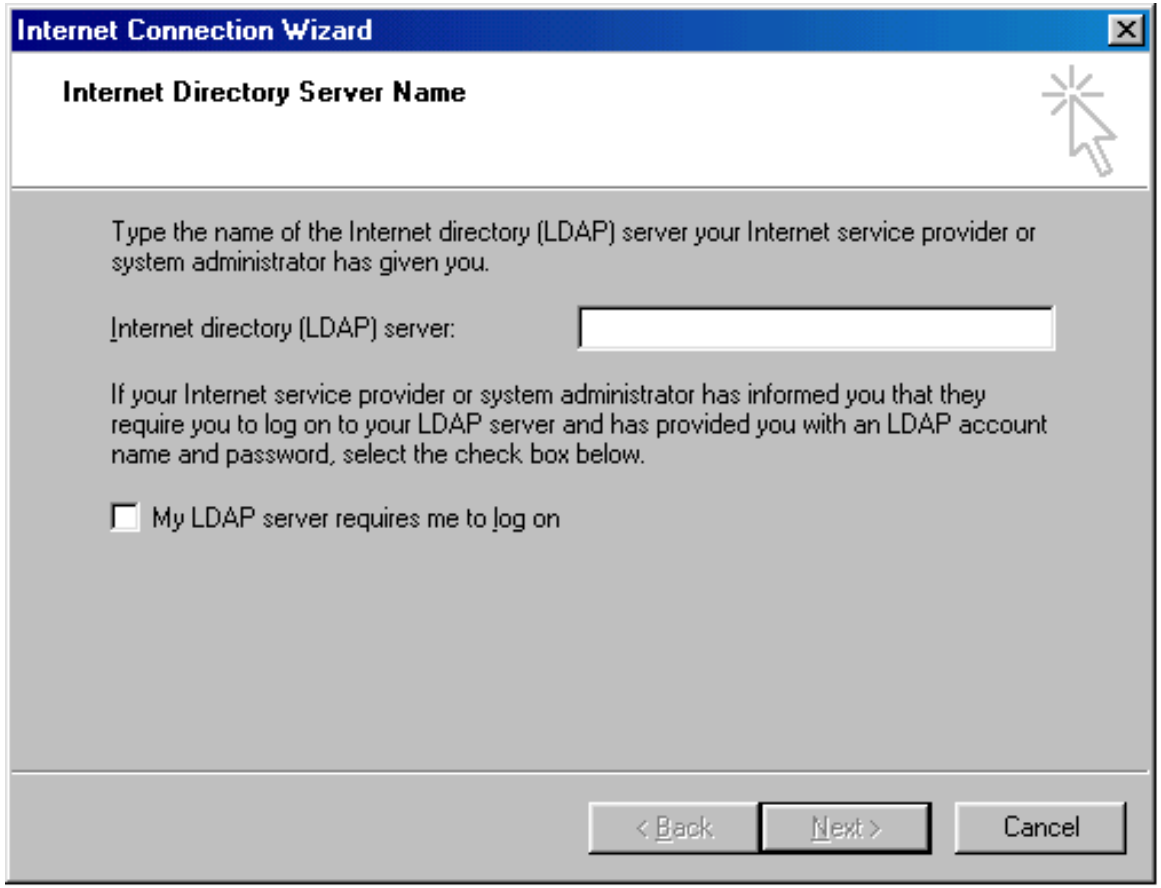
Outlook Express Addressbook

- Go to Tools | Accounts
- Click on Add | Directory Service
- Enter the hostname in the Internet Directory Server field, click on Next
- Click yes to using the directory to check addresses, then Next, then Finish
- Select the Account you just created, click on Properties
- Click on Advanced, then enter the search base

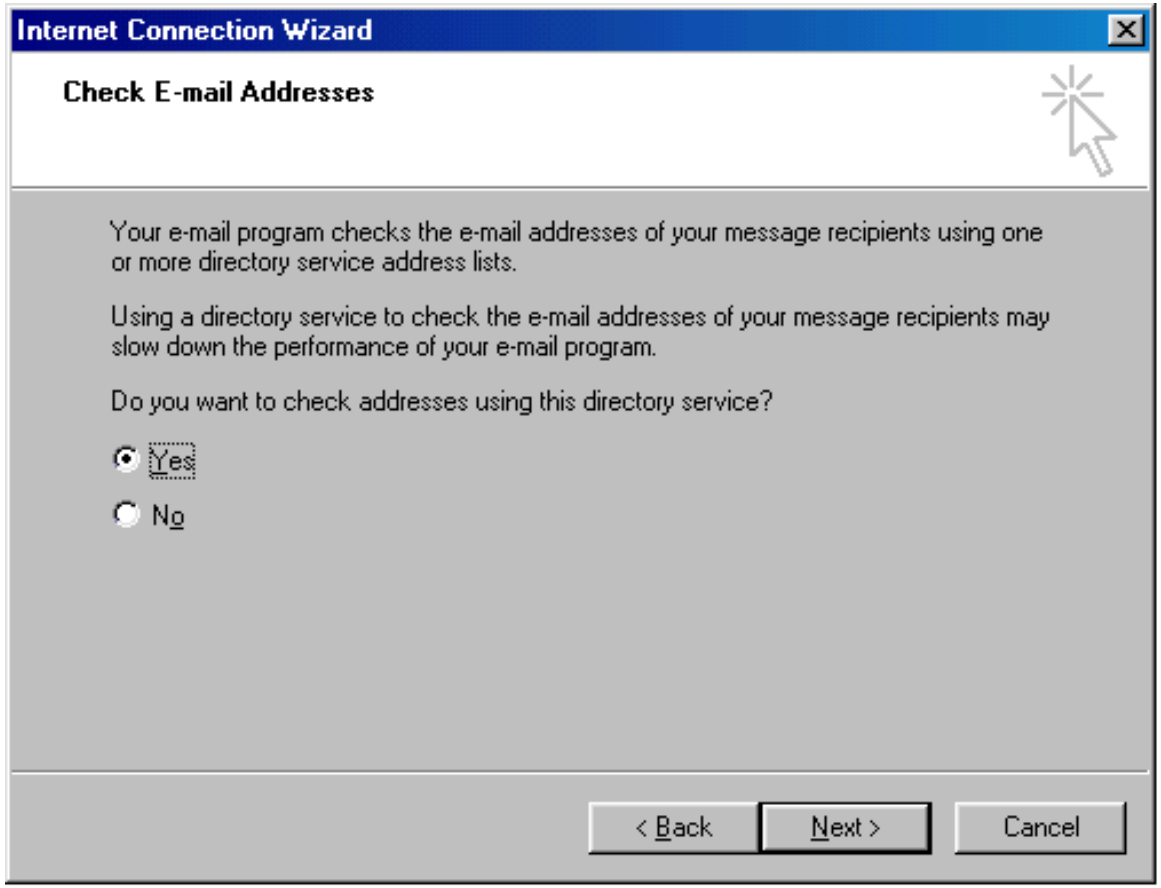
Outlook Express Directory



Outlook Express Directory



Outlook Express Directory



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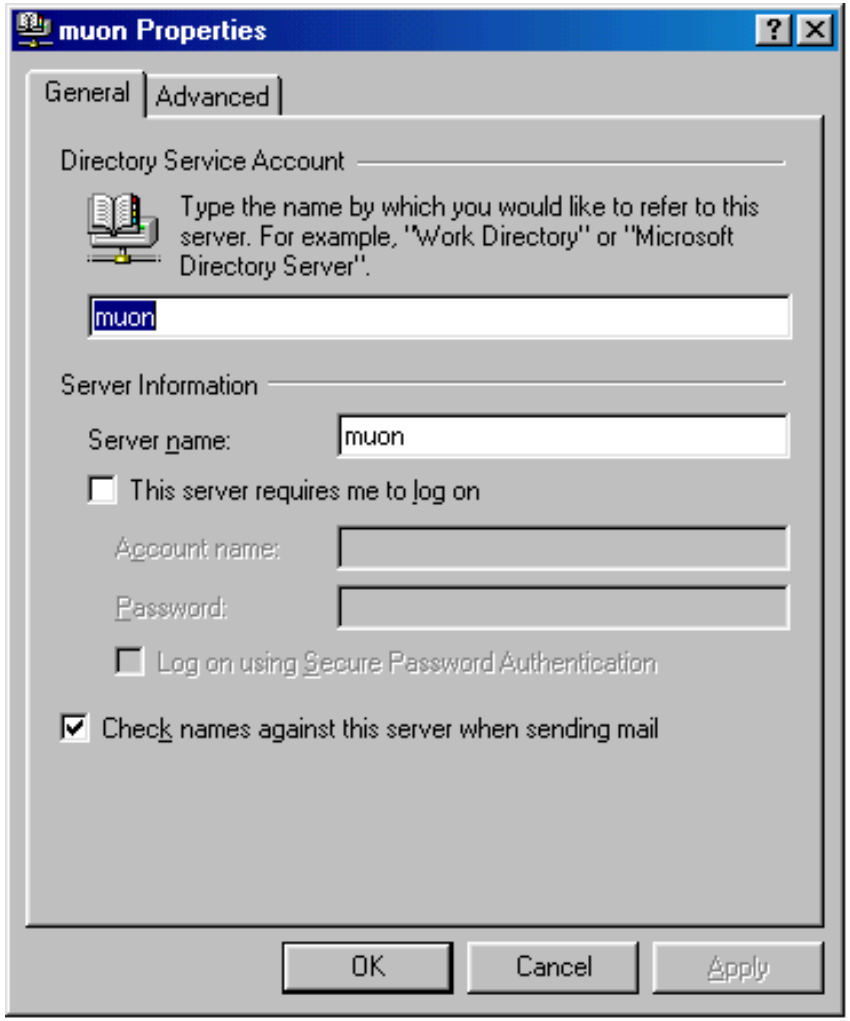
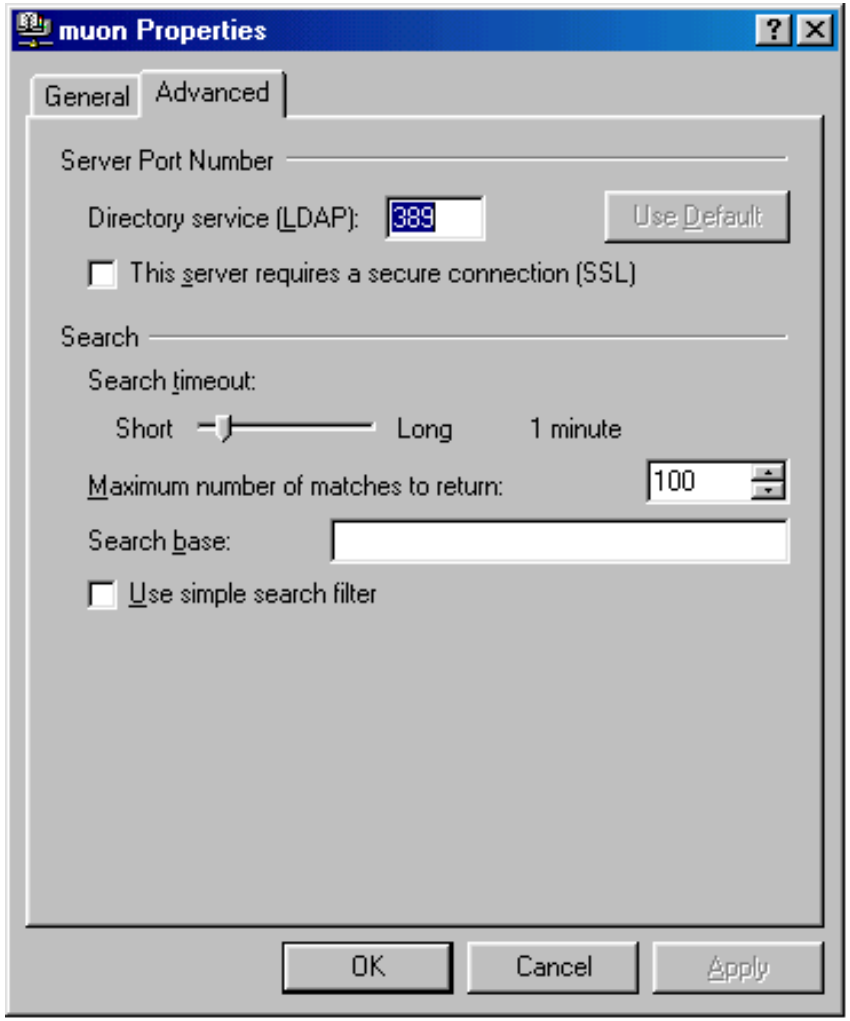


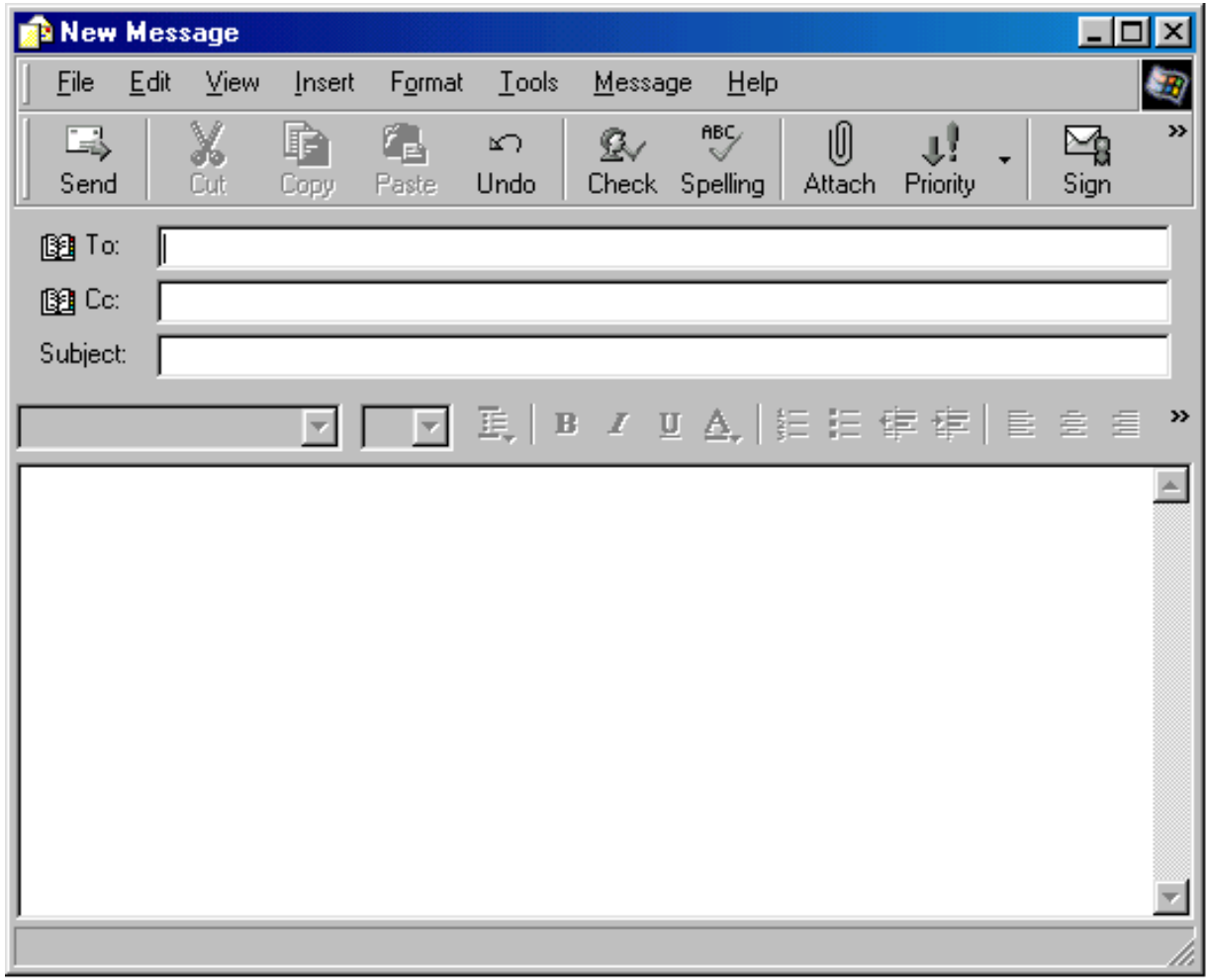
Outlook Express Directory



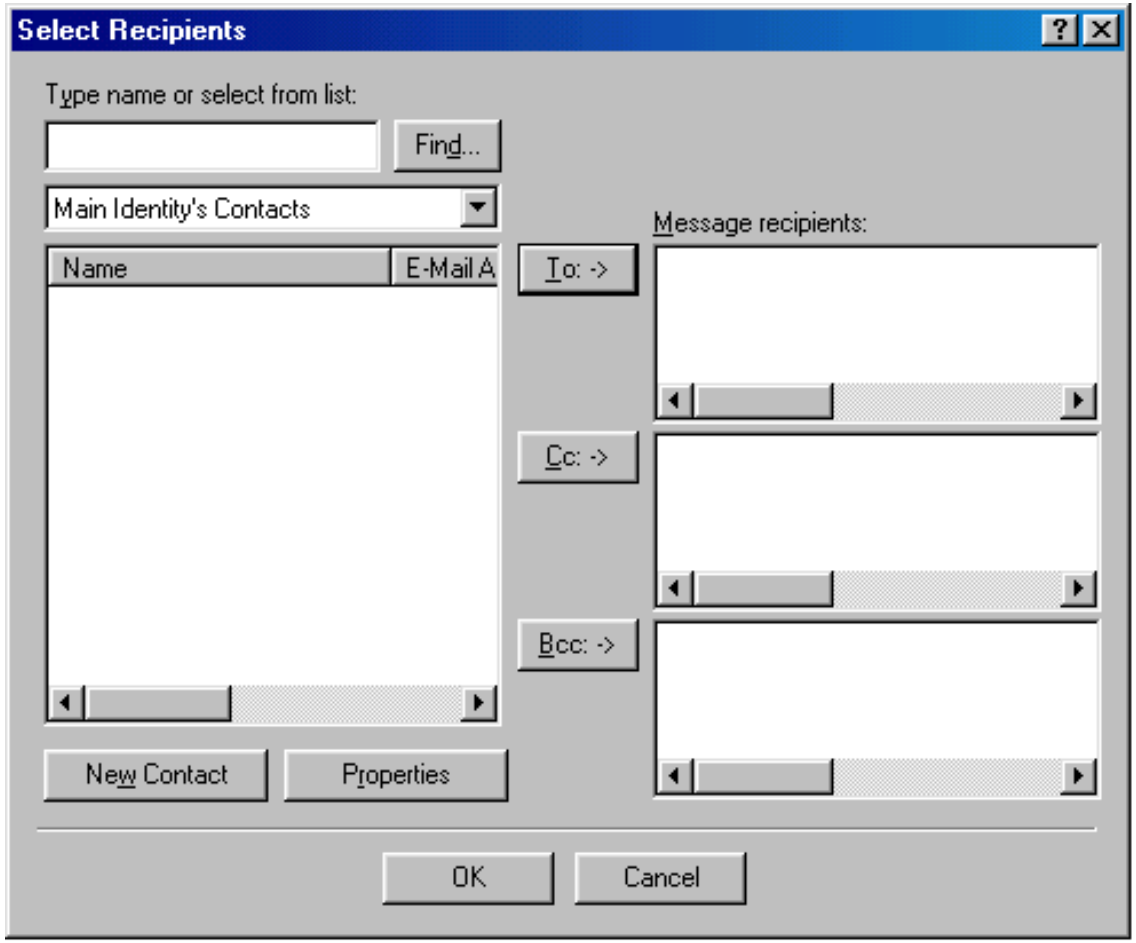
Outlook Express Addressbook - Composing

- Click on New Mail, then click on To | Find
- Pull down the Look in menu and select your directory
- Type in what who you’re looking for in the Name field, then hit Find Now

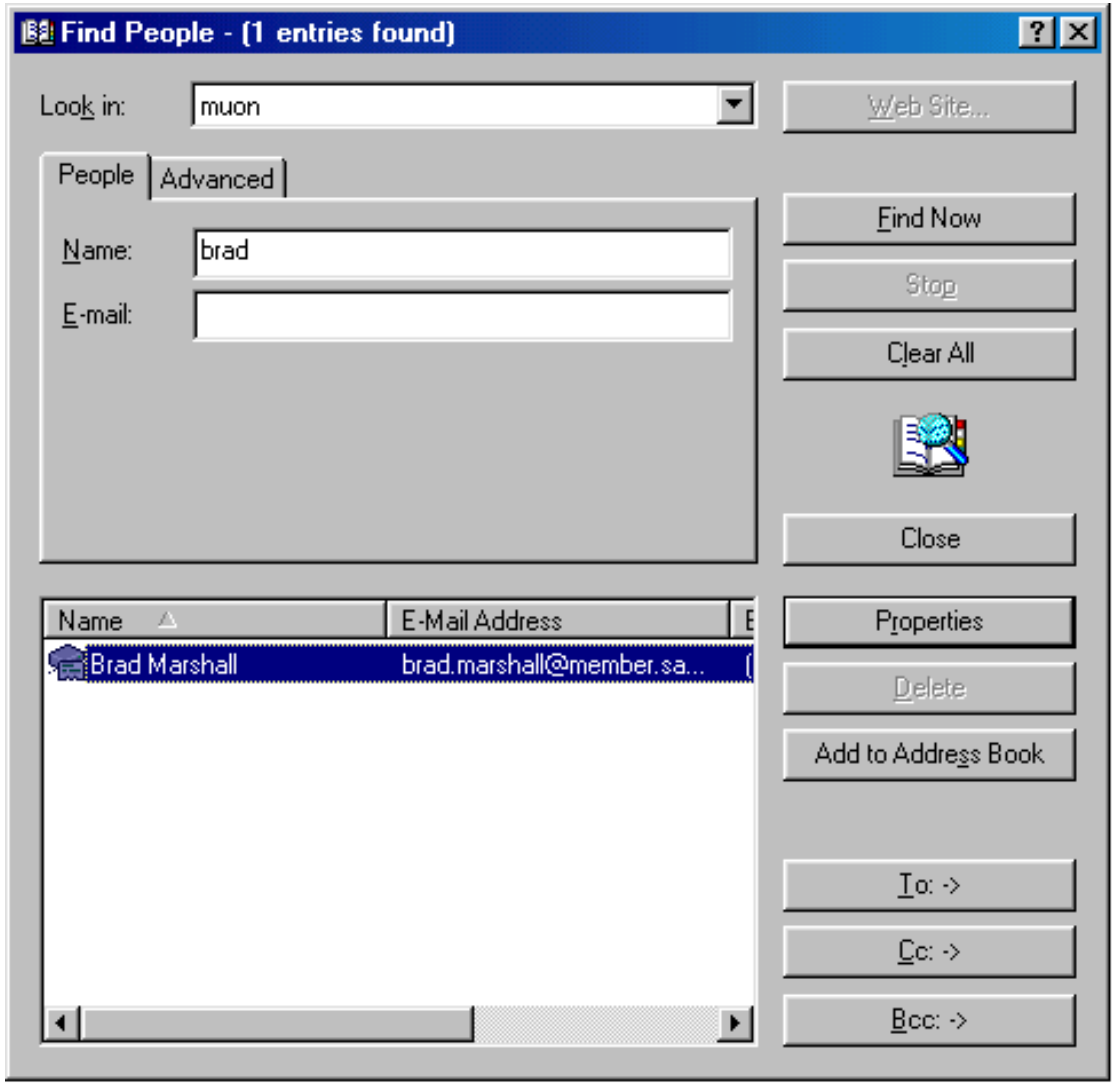
Outlook Express Addressbook - Composing



Outlook Express Addressbook - Composing



Outlook Express Addressbook - Composing



Address Book LDIF

```
dn: cn=Brad Marshall, ou=addressbook, dc=gumby
objectClass: top
objectClass: person
objectClass: organizationalPerson
objectClass: inetOrgPerson
cn: Brad Marshall
givenName: Brad
sn: Marshall
mail: brad.marshall@member.sage-au.org.au
```

Address Book LDIF cont

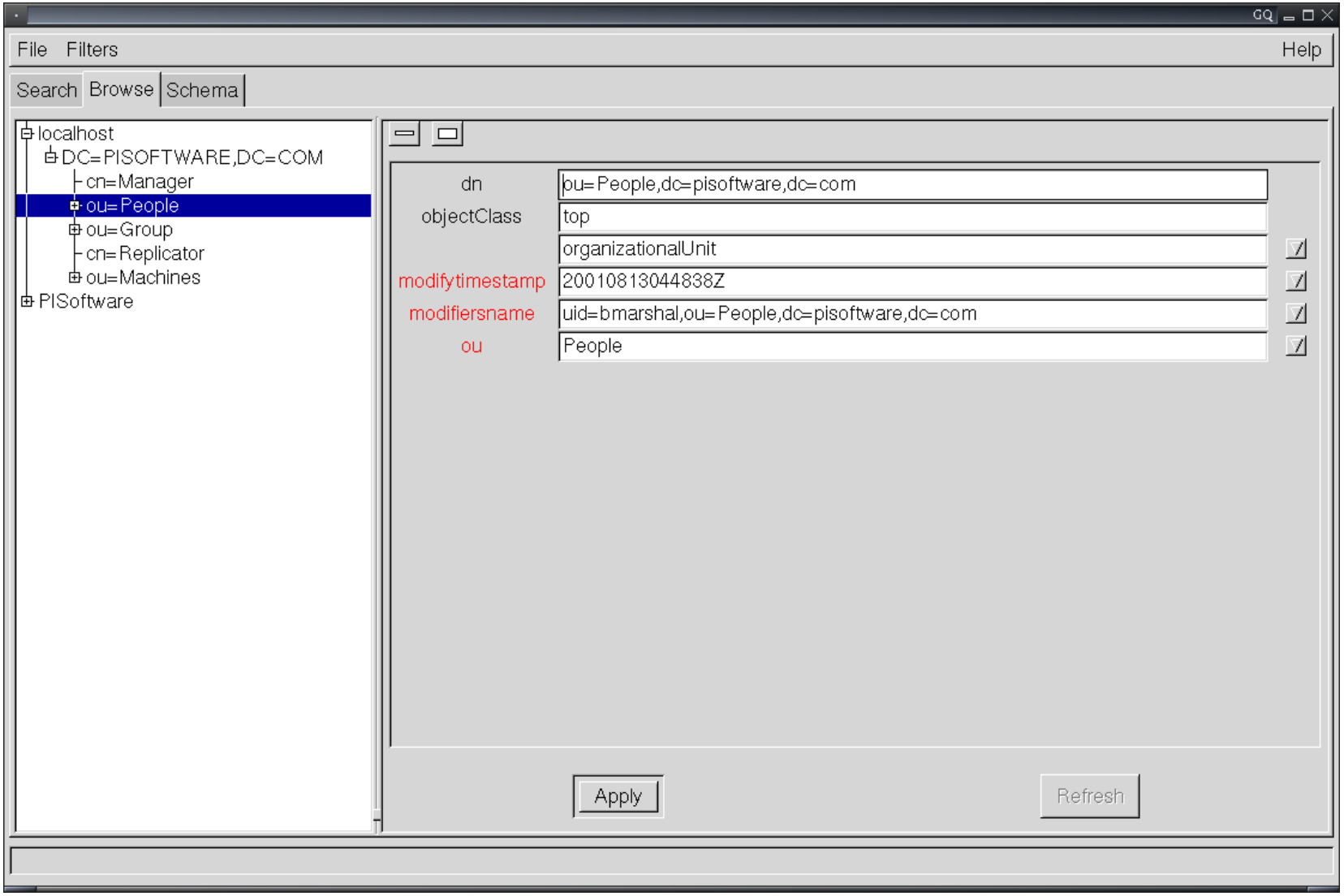
```
physicalDeliveryOfficeName: Central Queensland Uni
postalAddress: Bruce Highway
l: Rockhampton
ou: addressbook
st: Qld
postalCode: 4701
telephoneNumber: 123456789
facsimileTelephoneNumber: 234567890
pager: 1800-PAGER
mobile: 1800-MOBILE
homePhone: 1800-HOME
```

LDAP GUIs

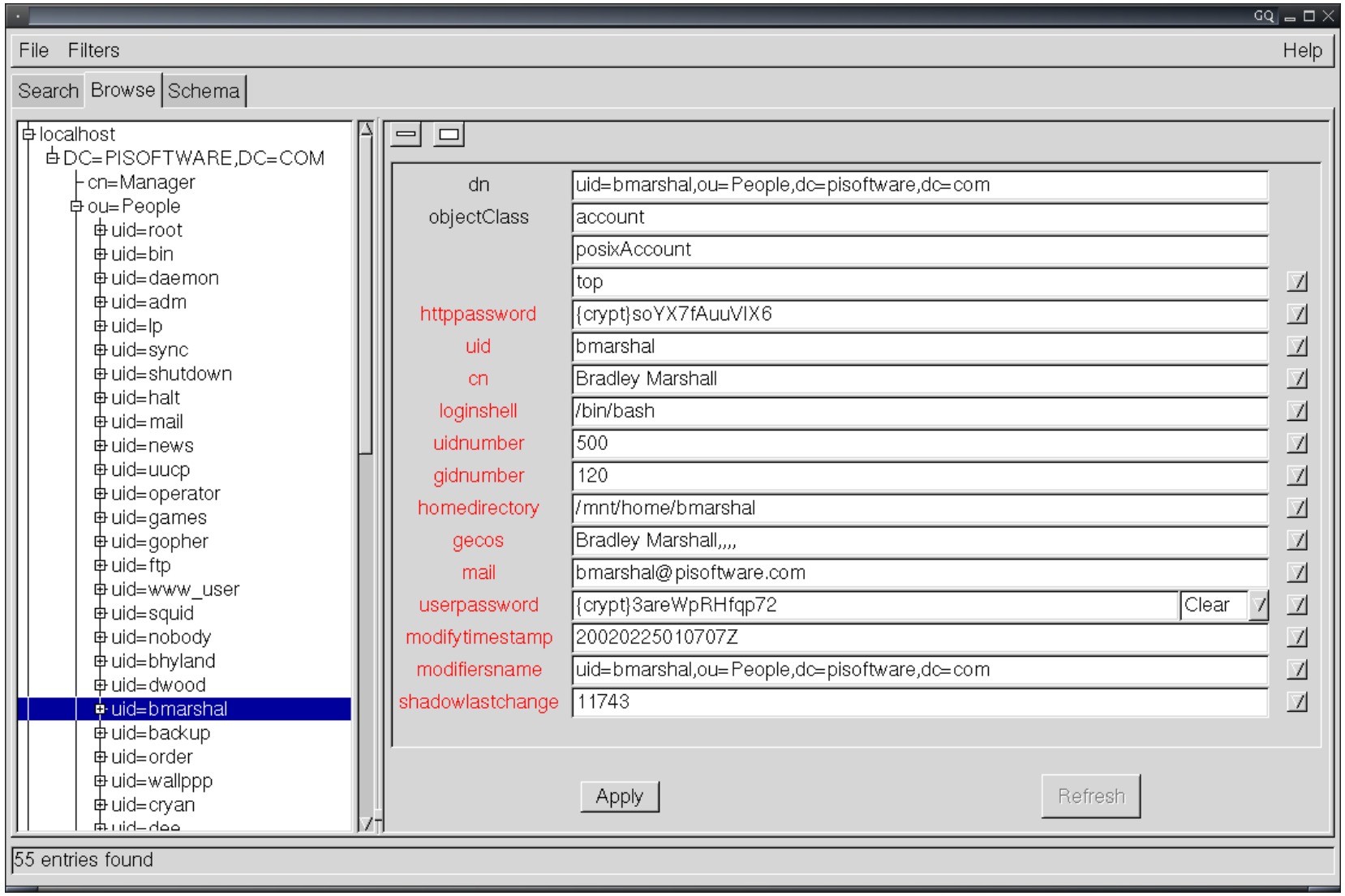
There are many LDAP administration GUIs, such as:

- directory administrator: Manages users and groups
- gq: Browse and search LDAP schemas and data
- ldapexplorer: PHP based administration tools
- vlad: LDAP visualisation tools (browse and edit attributes)
- eudc: Emacs Unified Directory Client - common interface to LDAP, bbdb etc

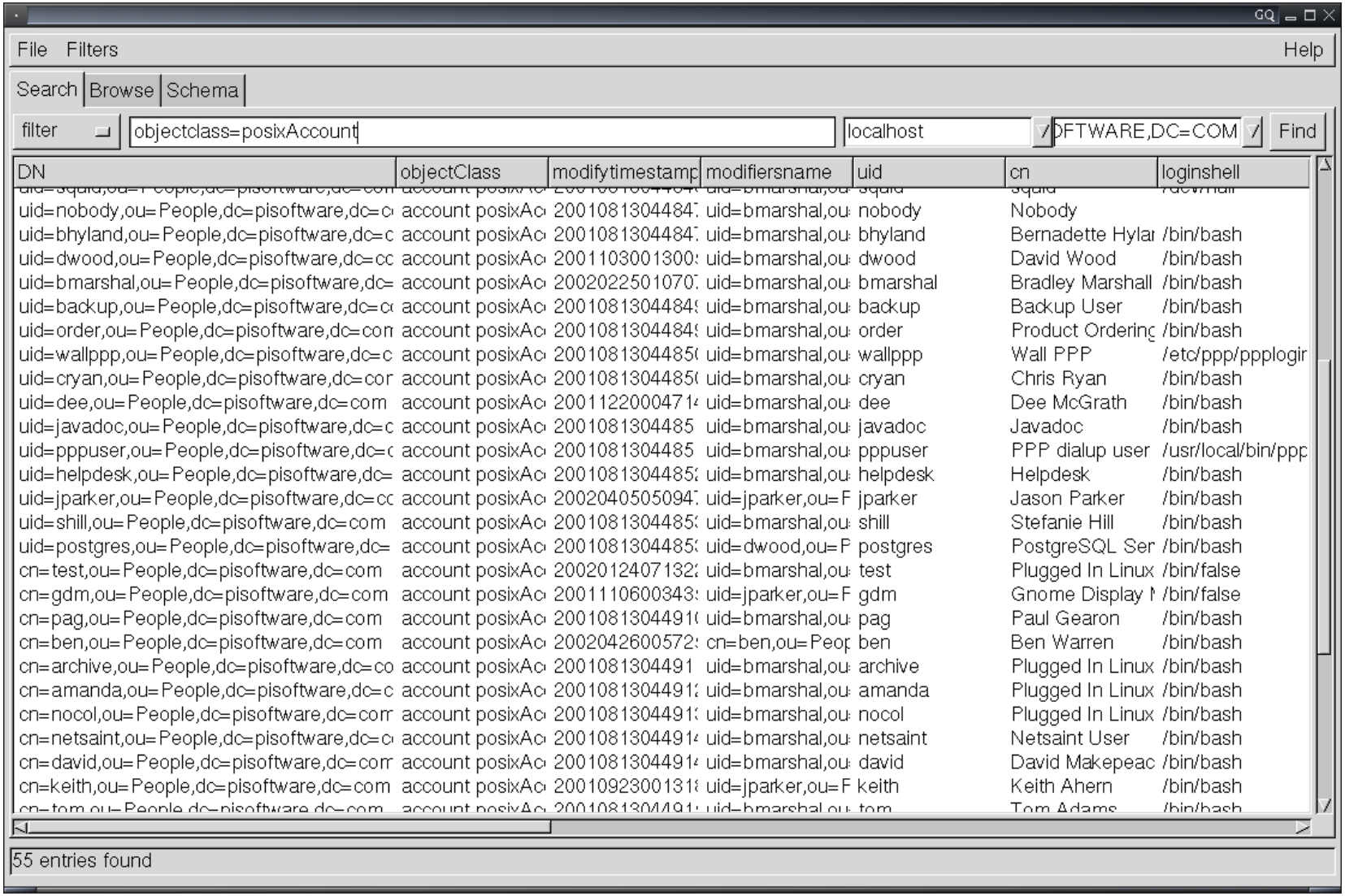
LDAP GUIs - GQ View People



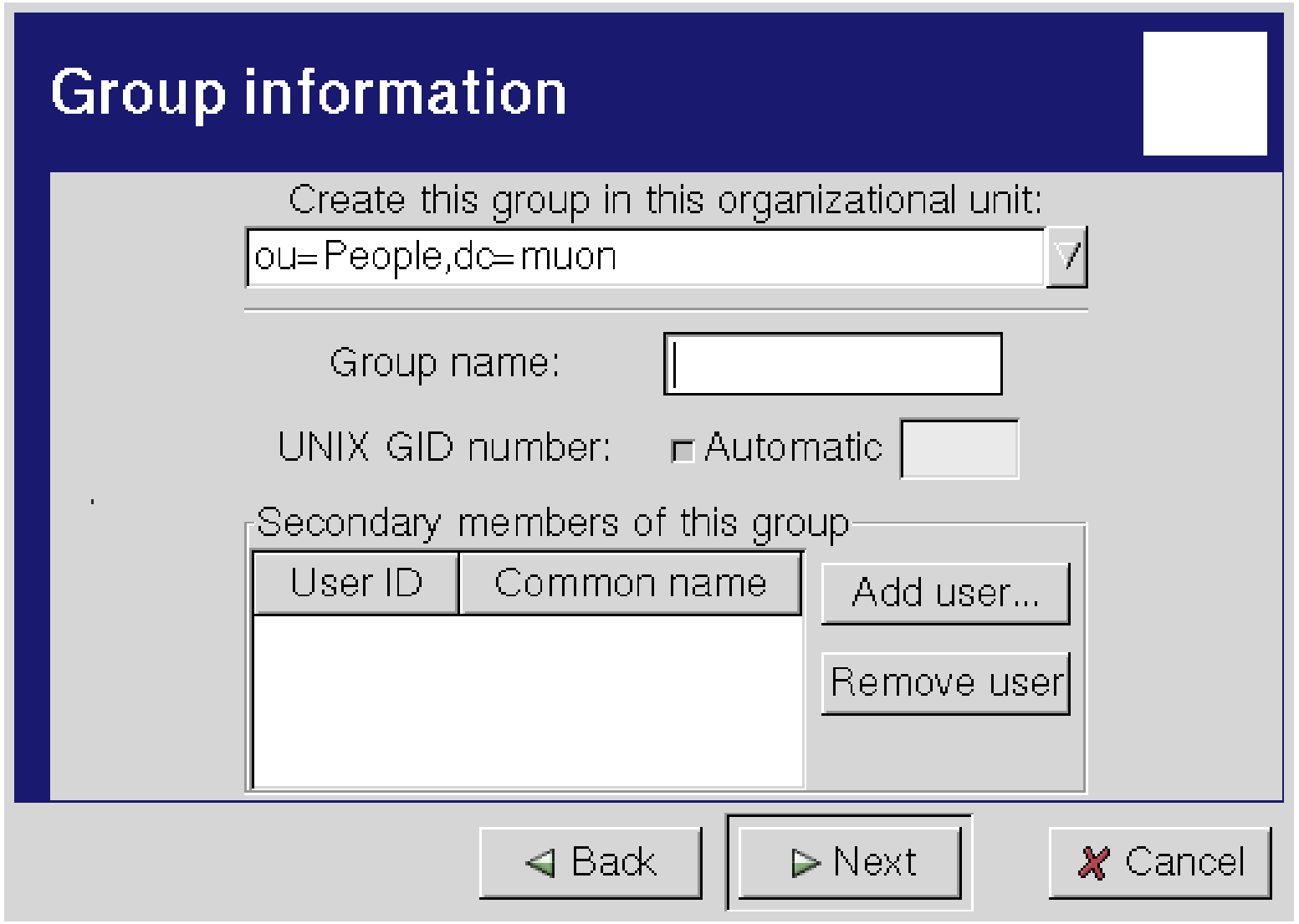
LDAP GUIs - GQ View User



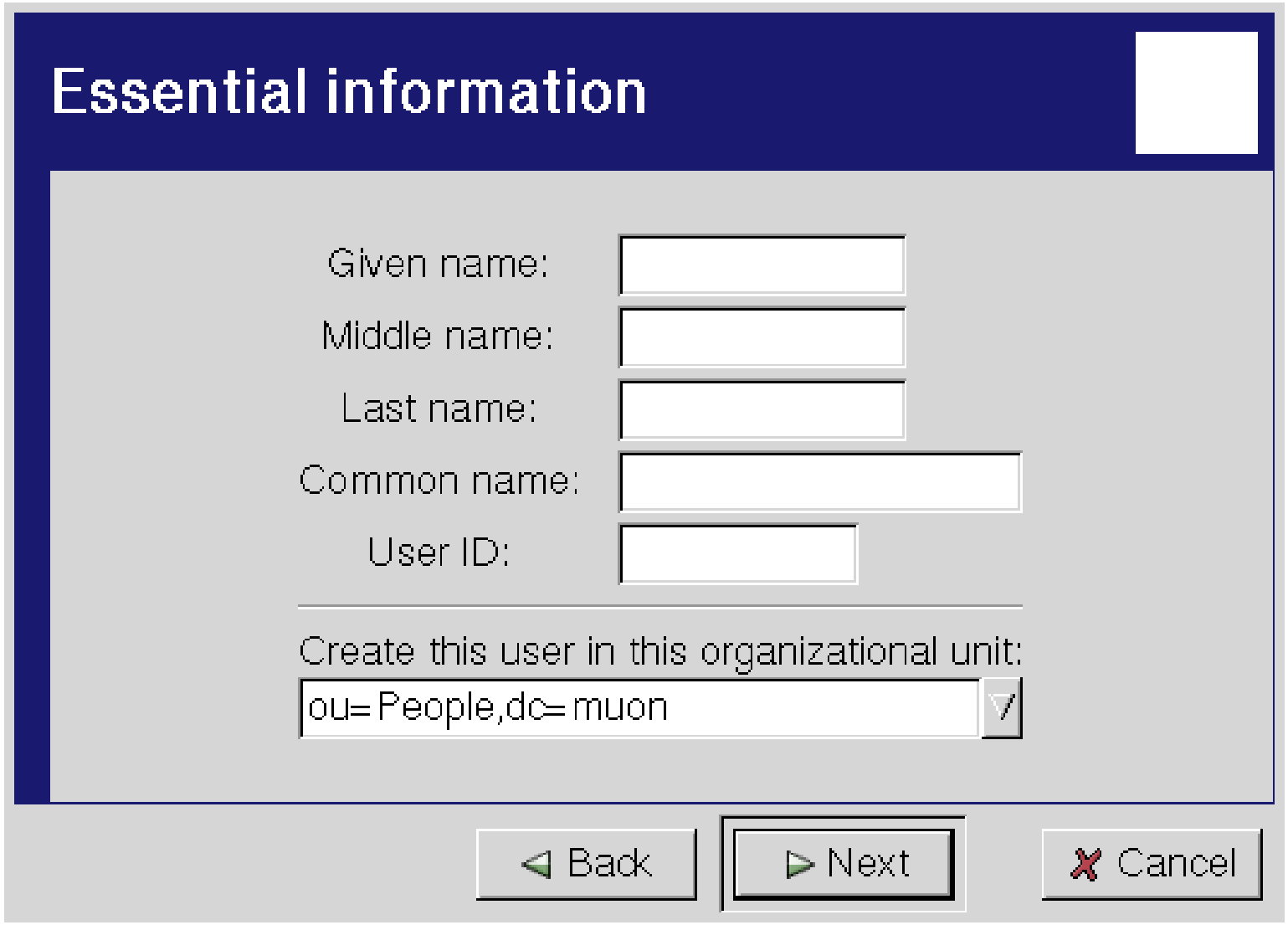
LDAP GUIs - GQ Search



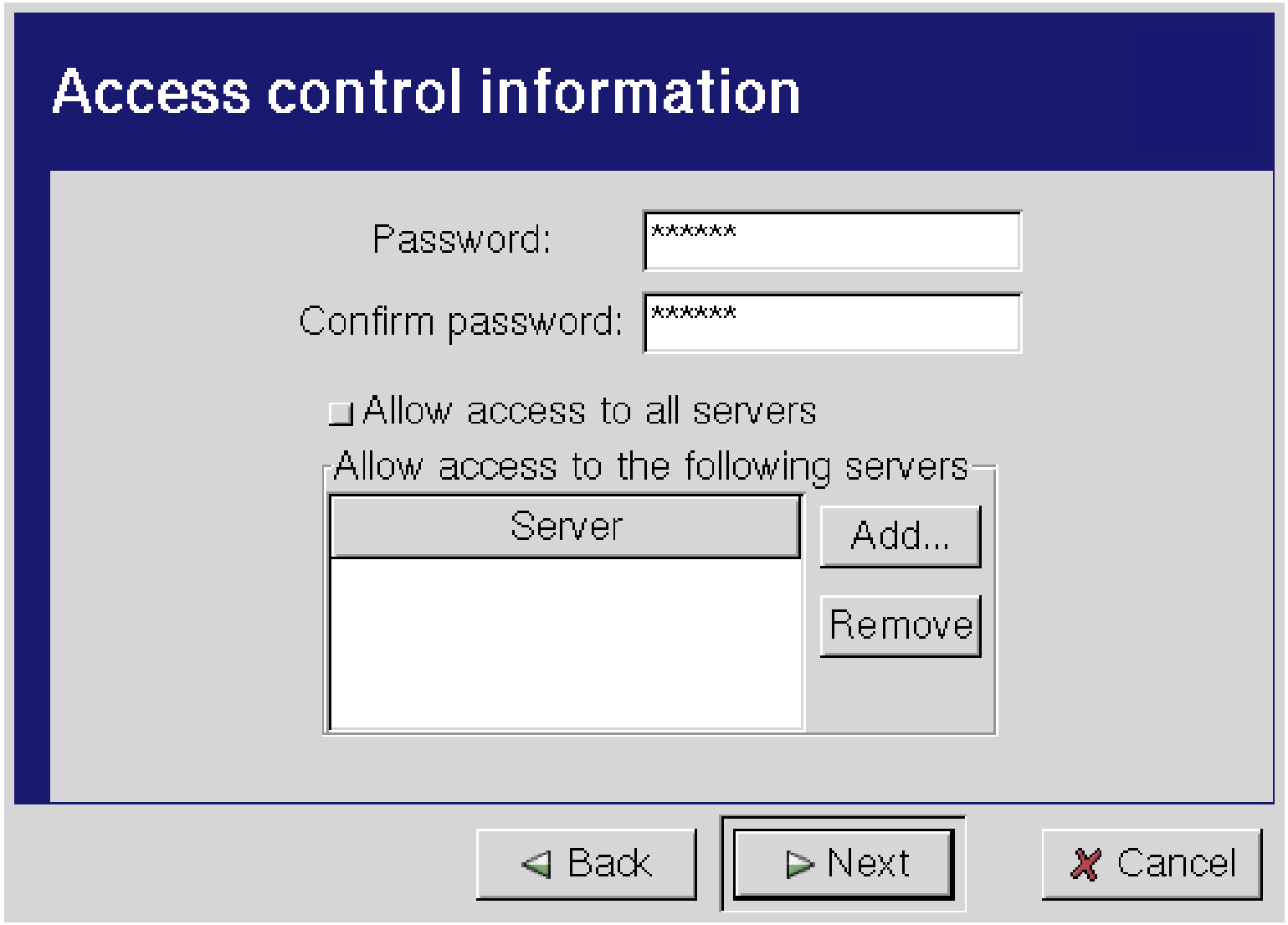
LDAP GUIs - Directory Admin Group



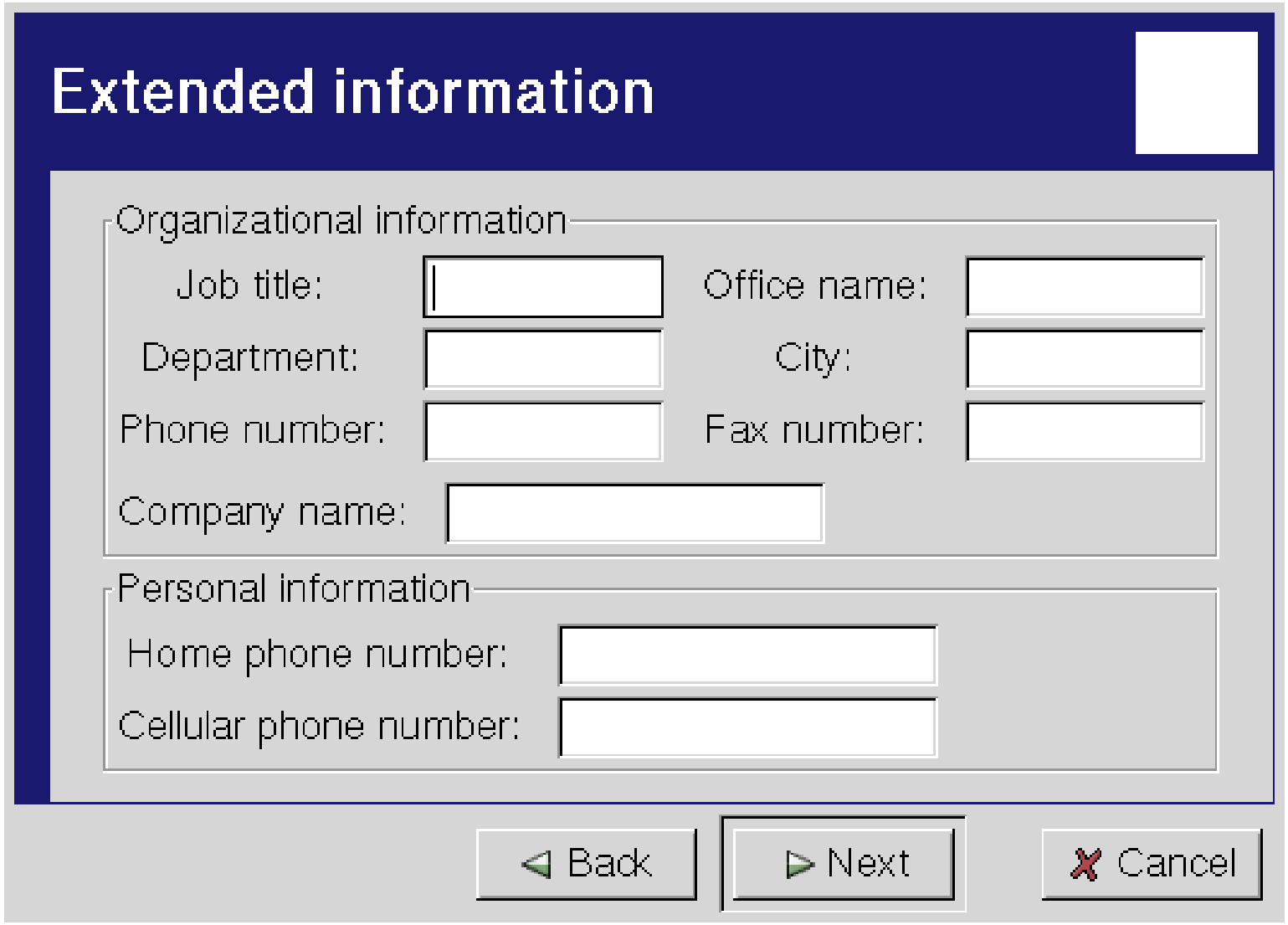
LDAP GUIs - Directory Admin New User



LDAP GUIs - Directory Admin New User

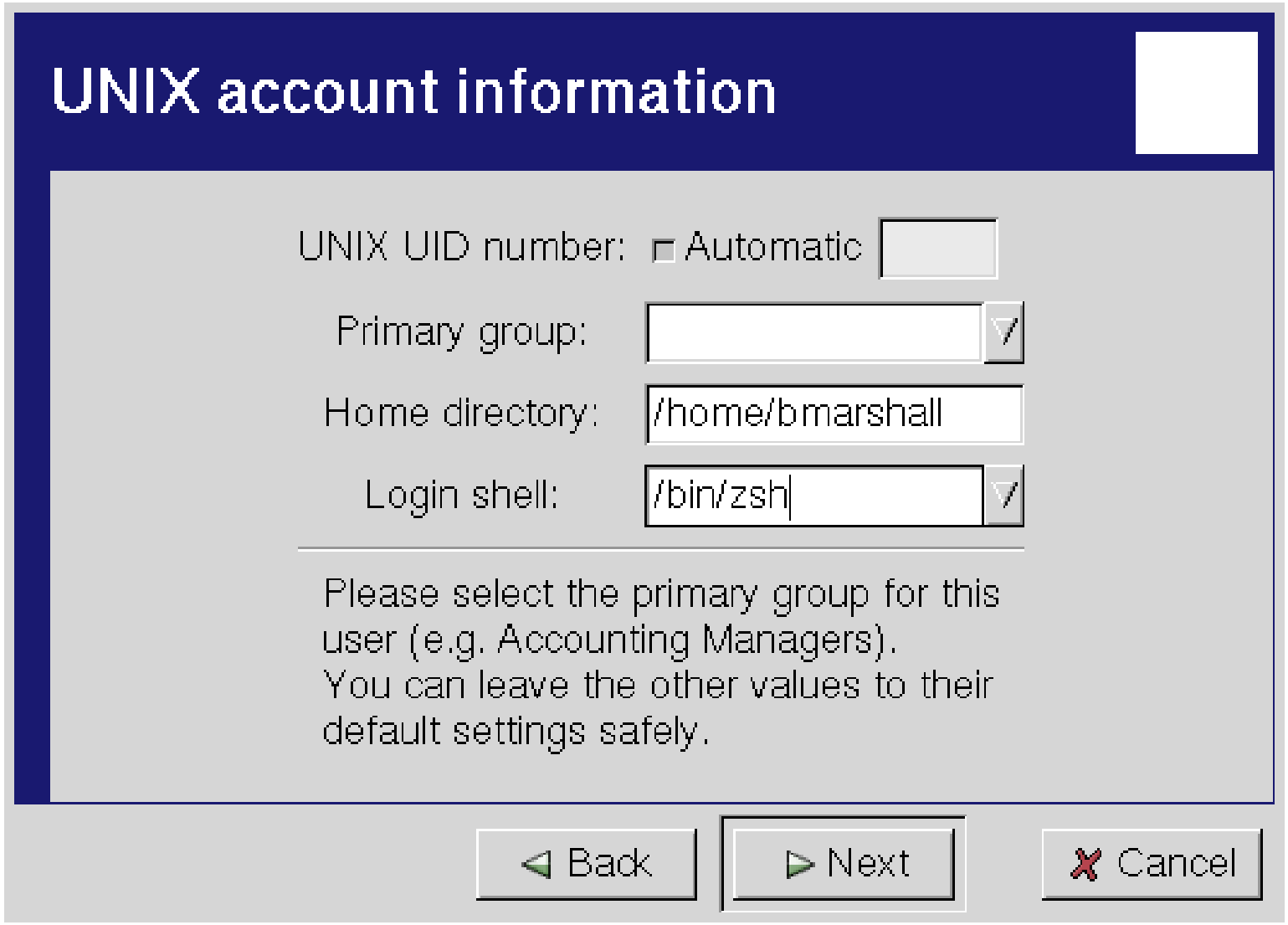


LDAP GUIs - Directory Admin New User

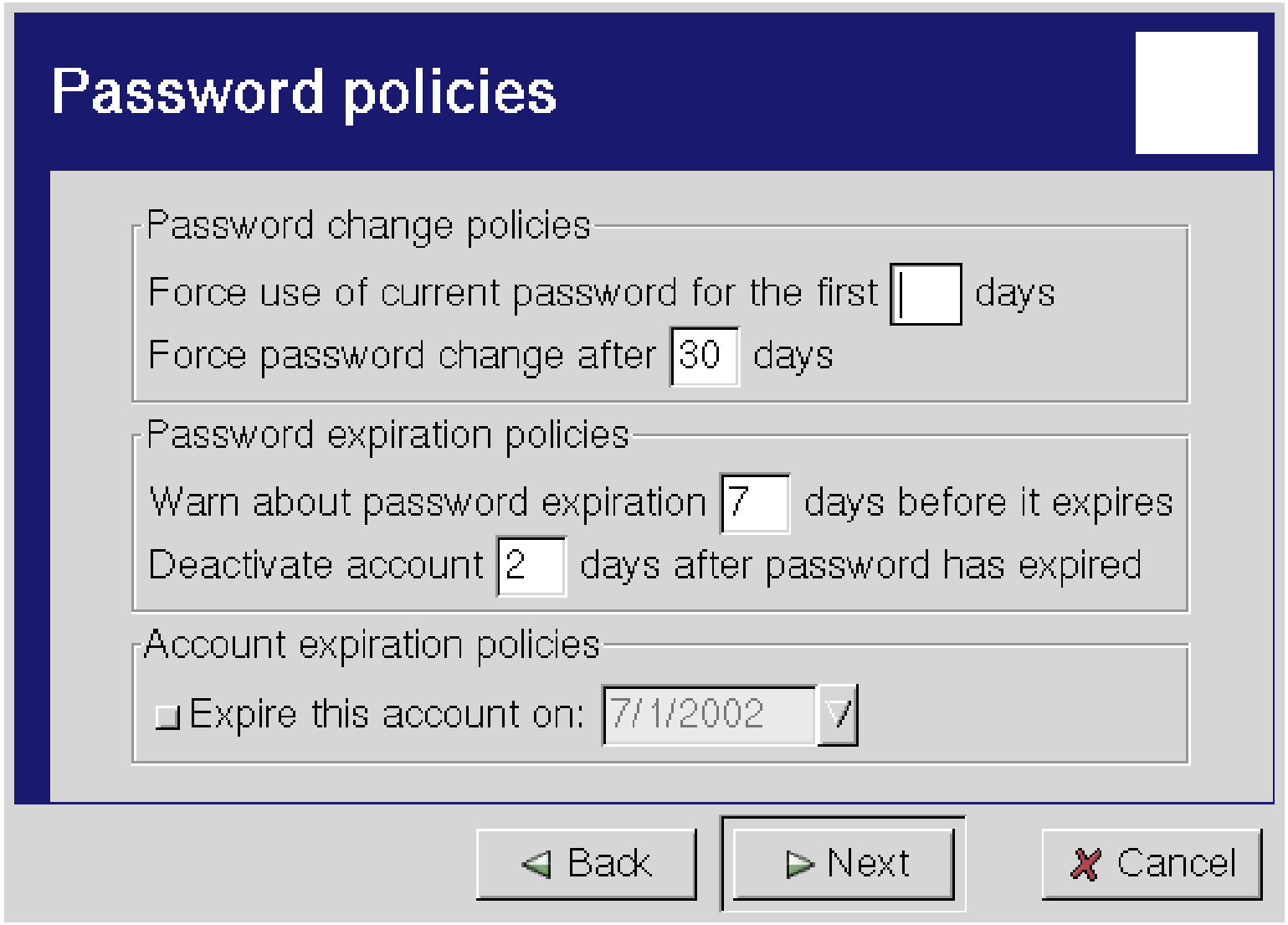


LDAP GUIs - Directory Admin New User

LDAP GUIs - Directory Admin New User



LDAP GUIs - Directory Admin New User



Perl and LDAP - Basic Query

```
use Net::LDAP;
my($ldap) = Net::LDAP->new('ldap.example.com')
   or die "Can't bind to ldap: $!\n";
$ldap->bind;
my($mesg) = $ldap->search(
base => "dc=example,dc=com",
            filter => '(objectclass=*)');
$mesg->code && die $mesg->error;
map { $_->dump } $mesg->all_entries;
# OR
foreach $entry ($mesg->all_entries)
       { $entry->dump; }
$ldap->unbind;
```

Perl and LDAP - Adding

```
$ldap->bind(
            dn       => $manager,
            password => $password,
        );

$result = $ldap->add( dn => $groupdn,
              attr => [ 'cn' => 'Test User',
                        'sn' => 'User',
                        'uid' => 'test',
                      ];
$ldap->unbind;
```

Perl and LDAP - Deleting

```
$ldap->bind(
            dn       => $manager,
            password => $password,
        );

$ldap->delete( $groupdn );
$ldap->unbind;
```

Perl and LDAP - Modifying

```
$ldap->modify( $dn,
        changes => [
                # Add sn=User
            add     => [ sn => 'User' ],
                # Delete all fax numbers
            delete  => [ faxNumber => []],
                # Delete phone number 911
            delete  => [ telephoneNumber =>
                    ['911']],
                # Change email address
            replace => [ email =>
                    'test@example.com']
    ]
);
$ldap->unbind;
```

PHP and LDAP - Binding

```
$ds=ldap_connect($hostname);
if ($ds) {
  ldap_set_option($ds, LDAP_OPT_PROTOCOL_VERSION, 3

  $r=ldap_bind($ds, $ldaprdn, $ldappass);

  ldap_close($ds);
}
```

PHP and LDAP - Searching

```
$sr=ldap_search($ds,"dc=example,
   dc=com", "objectclass=*");
$info = ldap_get_entries($ds, $sr);
for ($i=0; $i<$info["count"]; $i++) {
    echo "dn is: ". $info[$i]["dn"] ."<br>";
    echo "first objectclass entry is: ".
        $info[$i]["objectclass"][0] ."<br>";
}
```

PHP - Adding And Removing Attributes

Adding values to an attribute

```
$add=ldap_search($ds,"dc=example,
   dc=com", "objectclass=*");
$info = ldap_get_entries($ds, $add);
$dn = "uid=marshalb,ou=People,dc=example,dc=com";
$newattr['cn'] = "Brad Marshall";
\\ Add an attribute
ldap_mod_add($ds, $dn, $newattr);
\\ Remove an attribute
ldap_mod_del($ds, $dn, $newattr);
```

See http://www.php.net/manual/en/ref.ldap.php

Questions?

Any Questions ?

References

- Understanding and Deploying LDAP Directory Services
  Timothy A. Howes, Mark C. Smith and Gordon S. Good
  Macmillan Network Architecture and Development Series

- Implementing LDAP
  Mark Wilcox
  Wrox Press Ltd

- Perl for System Administration
  David N. Blank-Edelman
  O'Reilly

- http://samba.idealx.org/dist/samba-ldap-howto.pdf