System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)

Sun Microsystems, Inc.
4150 Network Circle
Santa Clara, CA 95054
U.S.A.

Part No: 816–4556–10
January 2005

041202@10536

Contents

Examples

Preface

Solaris Administration Guide: Naming and Directory Services (DNS, NIS and LDAP) describes the set up, configuration, and administration of the Solaris™ 10 operating system naming and directory services: DNS, NIS, and LDAP. This manual is part of the Solaris 10 Release System and Network Administration manual set.

Who Should Use This Book

This manual is written for experienced system and network administrators.

Although this book introduces networking concepts relevant to Solaris naming and directory services, it explains neither the networking fundamentals nor the administration tools in the Solaris OS.

How This Book Is Organized

This manual is divided into parts according to the respective naming services.

Part I: About Naming and Directory Services

Part II: DNS Setup and Administration

Part III: NIS Setup Administration

Part IV: LDAP Naming Services Setup and Administration

How the System Administration Volumes Are Organized

Here is a list of the topics that are covered by the volumes of the System Administration Guides.

Book Title	Topics
System Administration Guide: Basic Administration	User accounts and groups, server and client support, shutting down and booting a system, managing services, and managing software (packages and patches)
System Administration Guide: Advanced Administration	Printing services, terminals and modems, system resources (disk quotas, accounting, and crontabs), system processes, and troubleshooting Solaris software problems
System Administration Guide: Devices and File Systems	Removable media, disks and devices, file systems, and backing up and restoring data
System Administration Guide: IP Services	TCP/IP network administration, IPv4 and IPv6 address administration, DHCP, IPsec, IKE, Solaris IP filter, Mobile IP, IP network multipathing (IPMP), and IPQoS
System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)	DNS, NIS, and LDAP naming and directory services, including transitioning from NIS to LDAP and transitioning from NIS+ to LDAP
System Administration Guide: Naming and Directory Services (NIS+)	NIS+ naming and directory services
System Administration Guide: Network Services	Web cache servers, time-related services, network file systems (NFS and Autofs), mail, SLP, and PPP
System Administration Guide: Security Services	Auditing, device management, file security, BART, Kerberos services, PAM, Solaris cryptographic framework, privileges, RBAC, SASL, and Solaris Secure Shell
System Administration Guide: Solaris Containers-Resource Management and Solaris Zones	Resource management topics projects and tasks, extended accounting, resource controls, fair share scheduler (FSS), physical memory control using the resource capping daemon (rcapd), and dynamic resource pools; virtualization using Solaris Zones software partitioning technology

Related Books

- Sun Java System Directory Server *Deployment Guide*, which is included with the Sun Java Enterprise System documentation
- Sun Java System Directory Server *Administration Guide*, which is included with the Sun Java Enterprise System documentation
- *DNS and Bind*, by Cricket Liu and Paul Albitz, (4th Edition, O'Reilly, 2001)
- *Understanding and Deploying LDAP Directory Services*, by Timothy A. Howes, Ph.D and Mark C. Smith

Accessing Sun Documentation Online

The docs.sun.com[SM] Web site enables you to access Sun technical documentation online. You can browse the docs.sun.com archive or search for a specific book title or subject. The URL is `http://docs.sun.com`.

Ordering Sun Documentation

Sun Microsystems offers select product documentation in print. For a list of documents and how to order them, see "Buy printed documentation" at `http://docs.sun.com`.

Typographic Conventions

The following table describes the typographic changes that are used in this book.

TABLE P–1 Typographic Conventions

Typeface or Symbol	Meaning	Example
`AaBbCc123`	The names of commands, files, and directories, and onscreen computer output	Edit your `.login` file. Use `ls -a` to list all files. `machine_name% you have mail.`
`AaBbCc123`	What you type, contrasted with onscreen computer output	`machine_name%` **`su`** `Password:`
AaBbCc123	Command-line placeholder: replace with a real name or value	The command to remove a file is `rm` *filename*.
AaBbCc123	Book titles, new terms, and terms to be emphasized	Read Chapter 6 in the *User's Guide*. These are called *class* options. Do *not* save the file. (Emphasis sometimes appears in bold online.)

Shell Prompts in Command Examples

The following table shows the default system prompt and superuser prompt for the C shell, Bourne shell, and Korn shell.

TABLE P–2 Shell Prompts

Shell	Prompt
C shell prompt	`machine_name%`
C shell superuser prompt	`machine_name#`
Bourne shell and Korn shell prompt	`$`
Bourne shell and Korn shell superuser prompt	`#`

PART I About Naming and Directory Services

This part introduces the naming and directory services for the Solaris OS. It also describes the `nsswitch.conf` file that you use to coordinate the use of the different services.

CHAPTER 1

Naming and Directory Services (Overview)

This chapter provides an overview of naming and directory services used in Solaris. This chapter also briefly describes DNS, NIS, and LDAP naming services. See *System Administration Guide: Naming and Directory Services (NIS+)* for detailed information about NIS+.

What Is a Naming Service?

Naming services store information in a central place, which enables users, machines, and applications to communicate across the network. This information can include the following.

- Machine (host) names and addresses
- User names
- Passwords
- Access permissions
- Group membership, printers, and so on

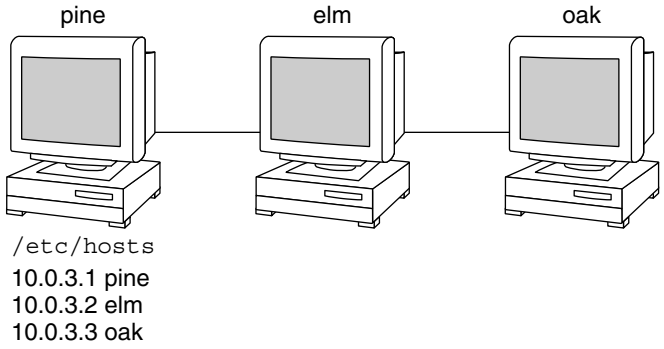
Without a central naming service, each machine would have to maintain its own copy of this information. Naming service information can be stored in files, maps, or database tables. If you centralize all data, administration becomes easier.

Naming services are fundamental to any computing network. Among other features, naming service provide functionality that does the following.

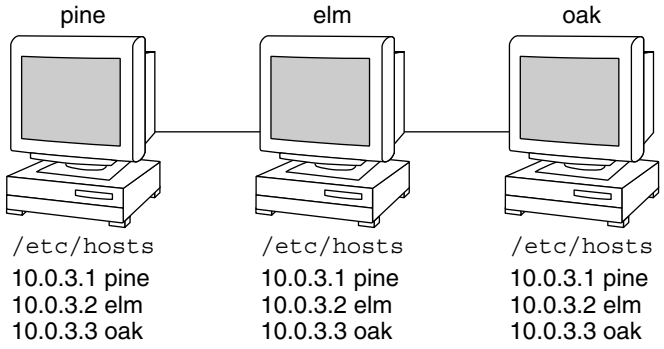
- Associates (*binds*) names with objects
- Resolves names to objects
- Removes bindings
- Lists names
- Renames

A network information service enables machines to be identified by common names instead of numerical addresses. This makes communication simpler because users do not have to remember and try to enter cumbersome numerical addresses like `192.168.0.0`.

For example, take a network of three machines that are named, `pine`, `elm`, and `oak`. Before `pine` can send a message to either `elm` or `oak`, `pine` must know their numerical network addresses. For this reason, `pine` keeps a file, `/etc/hosts` or `/etc/inet/ipnodes`, that stores the network address of every machine in the network, including itself.



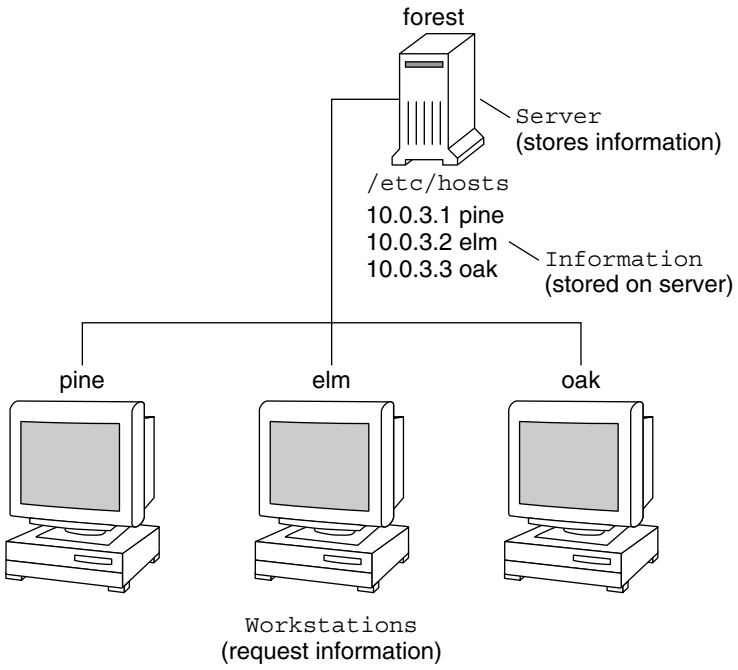
Likewise, in order for `elm` and `oak` to communicate with `pine` or with each other, the machines must keep similar files.



In addition to storing addresses, machines store security information, mail data, network services information and so on. As networks offer more services, the list stored of information grows. As a result, each machine might need to keep an entire set of files which are similar to `/etc/hosts` or `/etc/inet/ipnodes`.

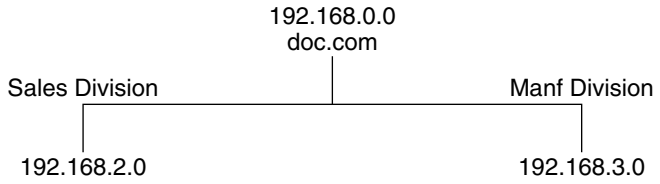
A network information service stores network information on a server, which can be queried by any machine.

The machines are known as *clients* of the server. The following figure illustrates the client-server arrangement. Whenever information about the network changes, instead of updating each client's local file, an administrator updates only the information stored by the network information service. Doing so reduces errors, inconsistencies between clients, and the sheer size of the task.

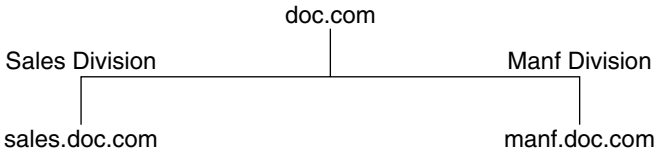


This arrangement, of a server providing centralized services to clients across a network, is known as *client-server computing*.

Although the main purpose of a network information service is to centralize information, the network information service can also simplify network names. For example, assume your company has set up a network which is connected to the Internet. The Internet has assigned your network the network number `192.168.0.0` and the domain name `doc.com`. Your company has two divisions, Sales and Manufacturing (Manf), so its network is divided into a main net and one subnet for each division. Each net has its own address.



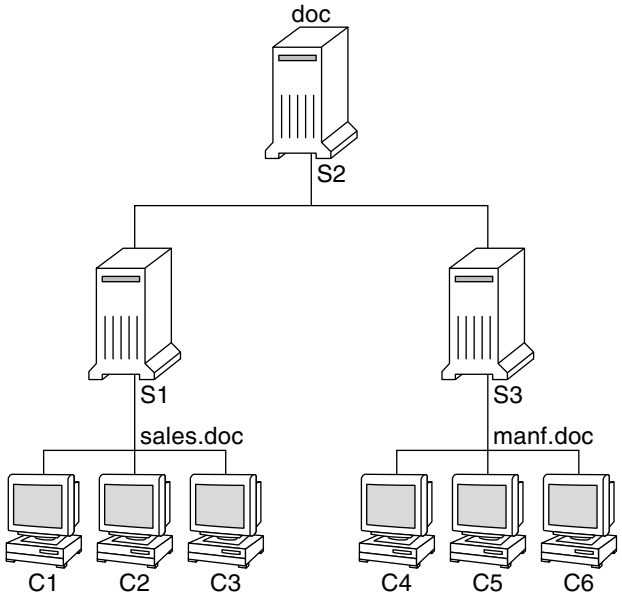
Each division could be identified by its network address, as shown above, but descriptive names made possible by naming services would be preferable.



Instead of addressing mail or other network communications to `198.168.0.0`, mail could be addressed to `doc`. Instead of addressing mail to `192.168.2.0` or `192.168.3.0`, mail could be addressed to `sales.doc` or `manf.doc`.

Names are also more flexible than physical addresses. Physical networks tend to remain stable, but company organization tends to change.

For example, assume that the `doc.com` network is supported by three servers, S1, S2, and S3. Assume that two of those servers, S1 and S3, support clients.

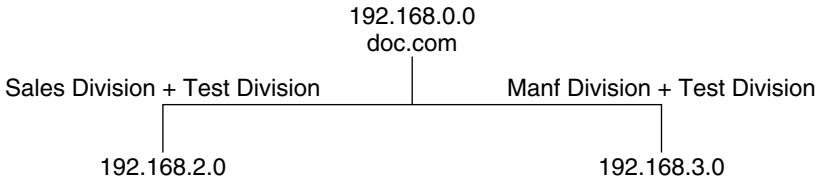


Clients C1, C2, and C3 would obtain their network information from server S1. Clients C4, C5, and C6 would obtain information from server S3. The resulting network is summarized in the following table. The table is a generalized representation of that network but does not resemble an actual network information map.

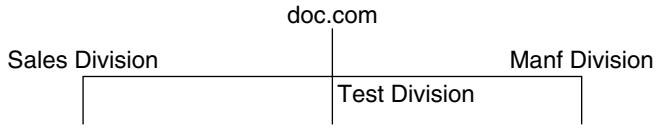
TABLE 1–1 Representation of docs.com network

Network Address	Network Name	Server	Clients
192.168.1.0	doc	S1	
192.168.2.0	sales.doc	S2	C1, C2, C3
192.168.3.0	manf.doc	S3	C4, C5, C6

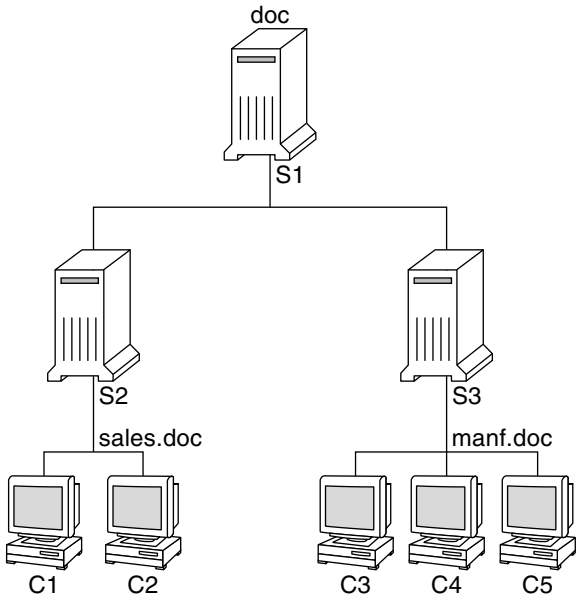
Now, assume that you create a third division, Testing, which borrowed some resources from the other two divisions, but did not create a third subnet. The physical network would then no longer parallel the corporate structure.



Traffic for the Test Division would not have its own subnet, but would instead be split between `192.168.2.0` and `192.168.3.0`. However, with a network information service, the Test Division traffic could have its own dedicated network.



Thus, when an organization changes, its network information service can change its mapping as shown here.



Now, clients C1 and C2 would obtain their information from server S2. C3, C4 and C5 would obtain information from server S3.

Subsequent changes in your organization would be accommodated by changes to the network information structure without reorganizing the network structure.

Solaris Naming Services

The Solaris platform provides the following naming services.

- DNS, the *Domain Name System* (see "Description of the DNS Naming Service" on page 27)
- `/etc` files, the original UNIX® naming system (see "Description of the `/etc` Files Naming Service" on page 28)
- NIS, the *Network Information Service* (see "Description of the NIS Naming Service" on page 28)
- NIS+, the *Network Information Service Plus* (see *System Administration Guide: Naming and Directory Services (NIS+)*)
- LDAP, the *Lightweight Directory Access Protocol* (see Part IV *LDAP Naming Services Setup and Administration*)

Most modern networks use two or more of these services in combination. When more than one service is used, the services are coordinated by the `nsswitch.conf` file which is discussed in Chapter 2.

Description of the DNS Naming Service

DNS is the naming service provided by the Internet for TCP/IP networks. DNS was developed so that machines on the network could be identified with common names instead of Internet addresses. DNS performs naming between hosts within your local administrative domain and across domain boundaries.

The collection of networked machines that use DNS are referred to as the *DNS namespace*. The DNS namespace can be divided into a hierarchy of *domains*. A DNS domain is a group of machines. Each domain is supported by two or more *name servers*, a principal server and one or more secondary servers. Each server implements DNS by running the `in.named` daemon. On the client's side, DNS is implemented through the "resolver." The resolver's function is to resolve users' queries. The resolver queries a name server, which then returns either the requested information or a referral to another server.

Description of the /etc Files Naming Service

The original host-based UNIX naming system was developed for standalone UNIX machines and then adapted for network use. Many old UNIX operating systems and machines still use this system, but the system is not well suited for large complex networks.

Description of the NIS Naming Service

The *Network Information Service* (NIS) was developed independently of DNS. DNS makes communication simpler by using machine names instead of numerical IP addresses. NIS focuses on making network administration more manageable by providing centralized control over a variety of network information. NIS stores information about the network, machine names and addresses, users, and network services. This collection of network information is referred to as the *NIS namespace*.

NIS namespace information is stored in NIS maps. NIS maps were designed to replace UNIX /etc files, as well as other configuration files. NIS maps store much more than names and addresses. As a result, the NIS namespace has a large set of maps. See "Working With NIS Maps" on page 97 for more information.

NIS uses a client-server arrangement which is similar to DNS. Replicated NIS servers provide services to NIS clients. The principal servers are called *master* servers, and for reliability, the servers have backup, or *slave* servers. Both master and slave servers use the NIS retrieval software and both store NIS maps. For more information on NIS Architecture and NIS Administration, see Chapter 5 and Chapter 6.

Description of the NIS+ Naming Service

The *Network Information Service Plus* (NIS+) is similar to NIS but with more features. However, NIS+ is not an extension of NIS.

The NIS+ naming service is designed to conform to the shape of the organization. Unlike NIS, the NIS+ namespace is dynamic because updates can occur and be put into effect at any time by any authorized user.

NIS+ enables you to store information about machine addresses, security information, mail information, Ethernet interfaces, and network services in one central location. This configuration of network information is referred to as the NIS+ *namespace*.

The NIS+ namespace is hierarchical. The NIS+ namespace is similar in structure to the UNIX directory file system. The hierarchical structure allows an NIS+ namespace to be configured to conform to the logical hierarchy of an organization. The namespace's layout of information is unrelated to its *physical* arrangement. Thus, an NIS+ namespace can be divided into multiple domains that can be administered autonomously. Clients might have access to information in domains other than their own if the clients have the appropriate permissions.

NIS+ uses a client-server model to store and have access to the information contained in an NIS+ namespace. Each domain is supported by a set of servers. The principal server is called the *primary* server. The backup servers are called *secondary servers*. The network information is stored in 16 standard NIS+ tables in an internal NIS+ database. Both primary and secondary servers run NIS+ server software and both maintain copies of NIS+ tables. Changes made to the NIS+ data on the master server are incrementally propagated automatically to the secondary servers.

NIS+ includes a sophisticated security system to protect the structure of the namespace and its information. NIS+ uses authentication and authorization to verify whether a client's request for information should be fulfilled. *Authentication* determines whether the information requester is a valid user on the network. *Authorization* determines whether a particular user is allowed to have or modify the information requested. See *System Administration Guide: Naming and Directory Services (NIS+)* for a more detailed description of NIS+ security.

For information on making the transition from NIS+ to LDAP, see Chapter 16.

Description of the LDAP Naming Services

Solaris 9 supports LDAP (Lightweight Directory Access Protocol) in conjunction with the Sun Java System Directory Server (formerly Sun ONE Directory Server), as well as other LDAP directory servers.

See Chapter 8 for more information about LDAP naming services.

For information about transitioning from NIS to LDAP or NIS+ to LDAP, see Chapter 15 or Chapter 16.

Naming Services: A Quick Comparison

	DNS	NIS	NIS+	LDAP
NAMESPACE	Hierarchical	Flat	Hierarchical	Hierarchical
DATA STORAGE	Files/ resource records	2 column maps	Multi-columned tables	Directories [varied]

	DNS	NIS	NIS+	LDAP
SERVER NAMES	Master/slave	Master/slave	Root master/non-root master primary/secondary cache/stub	Master/replica
SECURITY	None	None (root or nothing)	Secure RPC (AUTH_DH) Authentication	SSL, varied
TRANSPORT	TCP/IP	RPC	RPC	TCP/IP
SCALE	Global	LAN	LAN	Global

CHAPTER 2

The Name Service Switch (Overview)

This chapter describes the name service switch. You use the name service switch to coordinate usage of different naming services.

About the Name Service Switch

The name service switch is a file which is named, `nsswitch.conf`. The name service switch controls how a client machine or application obtains network information. The name service switch is used by client applications that call any of the `getXbyY()` interfaces such as the following.

- `gethostbyname()`
- `getpwuid()`
- `getpwnam()`
- `getaddrinfo()`

Each machine has a switch file in its `/etc` directory. Each line of that file identifies a particular type of network information, such as host, password, and group, followed by one or more locations of that information.

A client can obtain naming information from one or more of the switch's sources. For example, an NIS+ client could obtain its hosts information from an NIS+ table and its password information from a local `/etc` file. In addition, the client could specify the conditions under which the switch must use each source. See Table 2–1.

The Solaris system automatically loads an `nsswitch.conf` file into every machine's `/etc` directory as part of the installation process. Four alternate (template) versions of the switch file are also loaded into `/etc` for LDAP, NIS, NIS+, or files. See "The `nsswitch.conf` Template Files" on page 36.

These four files are alternate default switch files. Each file is designed for a different primary naming service: `/etc` files, NIS, NIS+, or LDAP. When the Solaris software is first installed on a machine, the installer selects the machine's default naming service: NIS+, NIS, local files, or LDAP. During installation, the corresponding template file is copied to `nsswitch.conf`. For example, for a machine client using LDAP, the installation process copies `nsswitch.ldap` to `nsswitch.conf`. Unless you have an unusual namespace, the default template file as copied to `nsswitch.conf` should be sufficient for normal operation.

No default file is provided for DNS, but you can edit any of these files to use DNS. For more information see "DNS and Internet Access" on page 42.

If you later change a machine's primary naming service, you copy the appropriate alternate switch file to `nsswitch.conf`. See "The `nsswitch.conf` Template Files" on page 36. You can also change the sources of particular types of network information used by the client by editing the appropriate lines of the `/etc/nsswitch.conf` file. The syntax is described below, and additional instructions are provided in "How to Modify the Name Service Switch" on page 41.

Format of the `nsswitch.conf` File

The `nsswitch.conf` file is essentially a list of 16 types of information and the sources that `getXXbyYY()` routines search for that information. The 16 types of information, not necessarily in this order, are the following.

- `aliases`
- `bootparams`
- `ethers`
- `group`
- `hosts`
- `ipnodes`
- `netgroup`
- `netmasks`
- `networks`
- `passwd`, which includes shadow information
- `protocols`
- `publickey`
- `rpc`
- `services`
- `automount`
- `sendmailvars`

The following table provides a description of the kind of sources that can be listed in the switch file for the information types above.

TABLE 2–1 Switch File Information Sources

Information Sources	Description
`files`	A file stored in the client's `/etc` directory. For example, `/etc/passwd`
`nisplus`	An NIS+ table. For example, the `hosts` table.
`nis`	An NIS map. For example, the `hosts` map.
`compat`	`compat` can be used for password and group information to support old-style + or - syntax in `/etc/passwd`, `/etc/shadow`, and `/etc/group` files.
`dns`	Can be used to specify that host information be obtained from DNS.
`ldap`	Can be used to specify entries be obtained from the LDAP directory.

Search Criteria

Single Source. If an information type has only one source, such as `nisplus` a routine using the switch searches for the information in that source *only*. If the routine finds the information, the routine returns a `success` status message. If the routine does not find the information, the routine stops searching and returns a different status message. What the routine does with the status message varies from routine to routine.

Multiple Sources. If a table contains multiple sources for a given information type, the switch directs the routine to search in the first listed source. If the routine finds the information, the routine returns a `success` status message. If the routine does not find the information in the first source, the routine tries the next source. The routine searches all sources until the routine has found the information, or until the routine is halted by a `return` specification. If all of the listed sources are searched without finding the information, the routine stops searching and returns a `non-success` status message.

Switch Status Messages

If a routine finds the information, the routine returns a `success` status message. If the routine does not find the information, the routine returns one of three error status messages. Possible status messages are listed in the following table.

TABLE 2–2 Switch Search Status Messages

Status Message	Meaning of Message
`SUCCESS`	The requested entry was found in the specified source.

TABLE 2–2 Switch Search Status Messages *(Continued)*

Status Message	Meaning of Message
`UNAVAIL`	The source is either unresponsive or unavailable. In other words, neither the NIS+ table, the NIS map, nor the `/etc` file could be found or be accessed.
`NOTFOUND`	The source responded with "No such entry." In other words, the table, map, or file was accessed but the needed information was not found.
`TRYAGAIN`	The source is busy. The source might respond next time. In other words, the table, map, or file was found, but could not respond to the query.

Switch Action Options

You can instruct the switch to respond to status messages with either of the two *actions* shown in the following table.

TABLE 2–3 Responses to Switch Status Messages

Action	Meaning
`return`	Stop looking for the information.
`continue`	Try the next source.

Default Search Criteria

The combination of `nsswitch.conf` file status message and action option determines what the routine does at each step. The combination of status and action make up the search *criteria*.

The switch's default search criteria are the same for every source. As described in terms of the status messages listed above, see the following.

- `SUCCESS=return`. Stop looking for the information. Proceed using the information that has been found.
- `UNAVAIL=continue`. Go to the next `nsswitch.conf` file source and continue searching. If this source is the last or only source, return with a `NOTFOUND` status.
- `NOTFOUND=continue`. Go to the next `nsswitch.conf` file source and continue searching. If this source is the last or only source, return with a `NOTFOUND` status.
- `TRYAGAIN=continue`. Go to the next `nsswitch.conf` file source and continue searching. If this source is the last or only source, return with a `NOTFOUND` status.

You can change default search criteria by explicitly specifying some other criteria by using the *STATUS=action* syntax shown above. For example, the default action for a `NOTFOUND` condition is to continue the search to the next source. For example, to specify for `networks`, the search should stop in a `NOTFOUND` condition, edit the `networks` line of the switch file. The line would read as follows.

```
networks: nis [NOTFOUND=return] files
```

The `networks: nis [NOTFOUND=return] files` line specifies a nondefault criterion for the `NOTFOUND` status. Nondefault criteria are delimited by square brackets.

In this example, the search routine behaves as follows:

- If the `networks` map is available, and contains the needed information, the routine returns with a `SUCCESS` status message.
- If the `networks` map is not available, the routine returns with an `UNAVAIL` status message. By default, the routine continues to search the appropriate `/etc` file.
- If the `networks` map is available and found, but the map does not contain the needed information, the routine returns with a `NOTFOUND` message. But, instead of continuing on to search the appropriate `/etc` file, which would be the default behavior, the routine stops searching.
- If the `networks` map is busy, the routine returns with an `TRYAGAIN` status message and by default continues on to search the appropriate `/etc` file.

Note – Lookups in the `nsswitch.conf` file are done in the order in which items are listed. However, password updates are done in reverse order, unless otherwise specified by using the `passwd -r` *repository* command. See "The Switch File and Password Information" on page 44 for more information.

What if the Syntax is Wrong?

Client library routines contain compiled-in default entries that are used if an entry in the `nsswitch.conf` file is either missing or syntactically incorrect. These entries are the same as the switch file's defaults.

The name service switch assumes that the table and source names are spelled correctly. If you misspell a table or source name, the switch uses default values.

`Auto_home` and `Auto_master`

The switch search criteria for the `auto_home` and `auto_master` tables and maps is combined into one category, which is called `automount`.

Timezone and the Switch File

The `timezone` table does not use the switch, so the table is not included in the switch file's list.

Comments in `nsswitch.conf` Files

Any `nsswitch.conf` file line beginning with a comment character (#) is interpreted as a comment line. A comment line is ignored by routines that search the file.

Characters preceding a comment mark *are* interpreted by routines that search the `nsswitch.conf` file. Characters to the right of the comment mark are interpreted as comments and ignored.

TABLE 2–4 Switch File Comment Examples

Type of Line	Example
Comment line.	# hosts: nisplus [NOTFOUND=return] files
Interpreted line.	hosts: nisplus [NOTFOUND=return] file
Partially interpreted line. The `files` element is not interpreted.	hosts: nisplus [NOTFOUND=return] # files

Keyserver and `publickey` Entry in the Switch File

Caution – You must restart the keyserver after you make a change to `nsswitch.conf`.

The keyserver reads the `publickey` entry in the name service switch configuration file only when the keyserver is started. If you change the switch configuration file, the keyserver does not register the changes until the keyserver is restarted.

The `nsswitch.conf` Template Files

Four switch template files are provided with the Solaris system to accommodate different naming services. Each file provides a different default set of information sources.

The four template files are the following.

- *LDAP template file*. The `nsswitch.ldap` configuration file specifies the LDAP directory as the primary source of information for the machine.

Note – In order to use LDAP naming services, you must also properly configure all LDAP client machines, in addition to modifying the `nsswitch.conf`. See Chapter 12 for more information.

- *NIS+ template file*. The `nsswitch.nisplus` configuration file specifies NIS+ as the primary source for all information except `passwd`, `group`, `automount`, and `aliases`. For those four files, the primary source is local `/etc` files. The secondary source is an NIS+ table. The `[NOTFOUND=return]` search criterion instructs the switch to stop searching the NIS+ tables if the switch gets a "No such entry" message. The switch searches through local files only if the NIS+ server is unavailable.
- *NIS template file*. The `nsswitch.nis` configuration file is almost identical to the NIS+ configuration file, except that NIS file specifies NIS maps in place of NIS+ tables. Because the search order for passwd and group is `files nis`, you don't need to place the + entry in the `/etc/passwd` and `/etc/group` files.
- *Files template file*. The `nsswitch.files` configuration file specifies local `/etc` files as the only source of information for the machine. There is no "files" source for `netgroup`, so the client does not use that entry in the switch file.

Copy the template file that most closely meets your requirements to the `nsswitch.conf` configuration file and then modify the file as needed.

For example, to use the LDAP template file, you would type the following command.

```
mymachine# cp /etc/nsswitch.ldap /etc/nsswitch.conf
```

The Default Switch Template Files

The following four switch files are supplied with the Solaris product.

EXAMPLE 2–1 NIS+ Switch File Template: `nsswitch.nisplus`

```
#
#
# /etc/nsswitch.nisplus:
#
#
# An example file that could be copied over to /etc/nsswitch.conf;
# it uses NIS+ (NIS Version 3) in conjunction with files.
#
# "hosts:" and "services:" in this file are used only if the
# /etc/netconfig file has a "-" for nametoaddr_libs of "inet"
# transports.

# the following two lines obviate the "+" entry in /etc/passwd
# and /etc/group.
```

EXAMPLE 2–1 NIS+ Switch File Template: `nsswitch.nisplus` *(Continued)*

```
passwd: files nisplus
group: files nisplus
# consult /etc "files" only if nisplus is down.
hosts: nisplus [NOTFOUND=return] files
# Uncomment the following line, and comment out the above, to use
# both DNS and NIS+. You must also set up the /etc/resolv.conf
# file for DNS name server lookup. See resolv.conf(4).
# hosts: nisplus dns [NOTFOUND=return] files
services: nisplus [NOTFOUND=return] files
networks: nisplus [NOTFOUND=return] files
protocols: nisplus [NOTFOUND=return] files
rpc: nisplus [NOTFOUND=return] files
ethers: nisplus [NOTFOUND=return] files
netmasks: nisplus [NOTFOUND=return] files
bootparams: nisplus [NOTFOUND=return] files
publickey: nisplus
netgroup: nisplus
automount: files nisplus
aliases: files nisplus
sendmailvars: files nisplus
```

EXAMPLE 2–2 NIS Switch File Template

```
#
# /etc/nsswitch.nis:
#
# An example file that could be copied over to /etc/nsswitch.conf;
# it uses NIS (YP) in conjunction with files.
#
# "hosts:" and "services:" in this file are used only if the
# /etc/netconfig file has a "-" for nametoaddr_libs of "inet"
# transports.
#
# the following two lines obviate the "+" entry in /etc/passwd
# and /etc/group.
passwd: files nis
group: files nis
# consult /etc "files" only if nis is down.
hosts: nis [NOTFOUND=return] files
networks: nis [NOTFOUND=return] files
protocols: nis [NOTFOUND=return] files
rpc: nis [NOTFOUND=return] files
ethers: nis [NOTFOUND=return] files
netmasks: nis [NOTFOUND=return] files
bootparams: nis [NOTFOUND=return] files
publickey: nis [NOTFOUND=return] files
netgroup: nis
automount: files nis
aliases: files nis
# for efficient getservbyname() avoid nis
services: files nis
sendmailvars: files
```

EXAMPLE 2–3 Files Switch File Template

```
#
# /etc/nsswitch.files:
#
# An example file that could be copied over to /etc/nsswitch.conf;
# it does not use any naming service.
#
# "hosts:" and "services:" in this file are used only if the
# /etc/netconfig file has a "-" for nametoaddr_libs of "inet"
# transports.
passwd: files
group: files
hosts: files
networks: files
protocols: files
rpc: files
ethers: files
netmasks: files
bootparams: files
publickey: files
# At present there isn't a 'files' backend for netgroup;
# the system will figure it out pretty quickly, and will notuse
# netgroups at all.
netgroup: files
automount: files
aliases: files
services: files
sendmailvars: files
```

EXAMPLE 2–4 LDAP Switch File Template

```
#
# /etc/nsswitch.ldap:
#
# An example file that could be copied over to /etc/nsswitch.conf; it
# uses LDAP in conjunction with files.
#
# "hosts:" and "services:" in this file are used only if the
# /etc/netconfig file has a "-" for nametoaddr_libs of "inet" transports.

# the following two lines obviate the "+" entry in /etc/passwd
and /etc/group.
passwd:     files ldap
group:      files ldap

hosts:      ldap [NOTFOUND=return] files

networks:   ldap [NOTFOUND=return] files
protocols:  ldap [NOTFOUND=return] files
rpc:        ldap [NOTFOUND=return] files
ethers:     ldap [NOTFOUND=return] files
netmasks:   ldap [NOTFOUND=return] files
bootparams: ldap [NOTFOUND=return] files
publickey:  ldap [NOTFOUND=return] files
```

EXAMPLE 2–4 LDAP Switch File Template *(Continued)*

```
netgroup:   ldap

automount:  files ldap
aliases:    files ldap

# for efficient getservbyname() avoid ldap
services:   files ldap
sendmailvars:   files
```

The `nsswitch.conf` File

The default `nsswitch.conf` file that is installed with the Solaris software is determined by which naming service you select during the installation process. Each line identifies a particular type of network information, such as host, password, and group, along with the information source, such as NIS+ tables, NIS maps, the DNS hosts table, or local `/etc`. When you chose a naming service, the switch template file for that service is copied to create the new `nsswitch.conf` file. For example, if you choose NIS+, the `nsswitch.nisplus` file is copied to create a new `nsswitch.conf` file.

An `nsswitch.conf` file is automatically loaded into every machine's `/etc` directory by the Solaris 9 release software, along with the following alternate (template) versions.

- `/etc/nsswitch.nisplus`
- `/etc/nsswitch.nis`
- `/etc/nsswitch.files`
- `/etc/nsswitch.ldap`

These alternate template files contain the default switch configurations used by the NIS+ and NIS services, local files, and LDAP. No default file is provided for DNS, but you can edit any of these files to use DNS. When the Solaris software is first installed on a machine, the installer selects the machine's default naming service. During installation, the corresponding template file is copied to `/etc/nsswitch.conf`. For example, for a machine client using NIS+, the installation process copies `nsswitch.nisplus` to `nsswitch.conf`.

If your network is connected to the Internet and users must access Internet hosts using DNS, you must enable DNS forwarding.

Unless you have an unusual namespace, the default template file as copied to `nsswitch.conf` should be sufficient for normal operation.

Selecting a Different Configuration File

When you change a machine's naming service, you need to modify that machine's switch file accordingly. For example, if you change a machine's naming service from NIS to NIS+, you need to install a switch file appropriate for NIS+. You change switch files by copying the appropriate template file to `nsswitch.conf`.

If you are installing NIS+ on a machine using the NIS+ installation scripts, the NIS+ template script is copied to `nsswitch.conf` for you. In this case, you do not have to configure the switch file unless you want to customize.

Before proceeding to change switch files, make sure the sources listed in the file are properly set up. In other words, if you are going to select the NIS+ version, the client must eventually have access to NIS+ service. If you select the local files version, those files must be properly set up on the client.

▼ How to Modify the Name Service Switch

To change to a switch file, follow these steps.

Note – In order to use LDAP naming services, you must also properly configure all LDAP client machines, in addition to modifying the `nsswitch.conf`. See Chapter 12 for more information.

---

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Copy the appropriate alternate file for the machine's naming service over the `nsswitch.conf` file.**

   NIS+ Version (done automatically for you by NIS+ scripts)

   ```
   client1# cd /etc
   client1# cp nsswitch.nisplus nsswitch.conf
   ```

   NIS Version

   ```
   client1# cd /etc
   client1# cp nsswitch.nis nsswitch.conf
   ```

   Local `/etc` Files Version

   ```
   client1# cd /etc
   client1# cp nsswitch.files nsswitch.conf
   ```

3. **Reboot the machine.**

   The `nscd` daemon caches switch information. See the `nscd`(1M) man page for information.

   Some library routines do not periodically check the `nsswitch.conf` file to see whether the file has been changed. You must reboot the machine to make sure that the daemon and those routines have the latest information in the file.

DNS and Internet Access

The `nsswitch.conf` file also controls DNS forwarding for clients as described in the following subsections. DNS forwarding grants Internet access to clients. For information on how to set DNS forwarding for NIS and NIS+, see *System Administration Guide: Naming and Directory Services (NIS+)*.

IPv6 and Solaris Naming Services

NIS, NIS+ and LDAP support storing IPv6 data, as well as using IPv6 transports for protocol traffic. Beginning with BIND version 8.3.3, DNS on Solaris supports the use of IPv6 transports on the client side. As of BIND version 8.4.2, DNS provides a complete client-server solution over IPv6 networks on Solaris.

The `nsswitch.conf` file controls search criteria for IPv6 addresses. IPv6 increases the IP address size from 32 bits to 128 bits to support more levels of addressing hierarchy. A larger address size provides a greater number of addressable nodes. For more information about IPv6, its configuration and implementation, see *System Administration Guide: IP Services*.

Use the new `ipnodes` source for IPv6 addresses. The `/etc/inet/ipnodes` file stores both IPv4 and IPv6 addresses. The `/etc/inet/ipnodes` file uses the same format convention as the `/etc/hosts` file.

IPv6 aware naming services use the new `ipnodes` source for its search forwarding. For instance, if LDAP is aware of IPv6 addresses, specify the following.

```
ipnodes: ldap [NOTFOUND=return] files
```

Caution – Potential delay issues:

- `ipnodes` defaults to `files`. During the transition from IPv4 to IPv6, where all naming services are not aware of IPv6 addresses, accept the `files` default. Otherwise, unnecessary delays, such as boot timing delays, might result during the resolution of addresses.
- An application searches all `ipnodes` databases for IPv4 addresses before searching for IPv4 addresses in the `hosts` databases. Before specifying `ipnodes`, consider the inherent delay of searching both databases for IPv4 addresses.

Ensuring Compatibility With +/- Syntax

If `+/-` is used in `/etc/passwd`, `/etc/shadow`, and `/etc/group` files, you need to modify the `nsswitch.conf` file to insure compatibility.

- *NIS+*. To provide `+/-` semantics with NIS+, change the `passwd` and `groups` sources to `compat`. Then, add a `passwd_compat: nisplus` entry to the `nsswitch.conf` file after the `passwd` or `group` entry as shown below.

  ```
  passwd: compat
  passwd_compat: nisplus
  group: compat
  group_compat: nisplus
  ```

  The above specifies that client routines obtain their network information from `/etc` files and NIS+ tables as indicated by the `+/-` entries in the files.

- *NIS*. To provide the same syntax as in the Solaris 4.x release, change the `passwd` and `groups` sources to `compat`.

  ```
  passwd: compat
  group: compat
  ```

  Specifies the `/etc` files and NIS maps as indicated by the `+/-` entries in the files.

Note – Users working on a client machine being served by an NIS+ server running in NIS compatibility mode cannot run `ypcat` on the `netgroup` table. Doing so gives you results as if the table were empty even if the table has entries.

The Switch File and Password Information

It is possible to include and access password information in multiple repositories, such as `files` and `nisplus`. You can use the `nsswitch.conf` file to establish the lookup order for that information.

Caution – `files` must be the first source in the `nsswitch.conf` file for `passwd` information.

In an NIS+ environment, the `passwd` line of the `nsswitch.conf` file should list the repositories in the following order.

```
passwd: files nisplus
```

In an NIS environment, the `passwd` line of the `nsswitch.conf` file should list the repositories in the following order.

```
passwd: files nis
```

Tip – Listing `files` first allows `root` to log in, under most circumstances, even when the system encounters some network or naming services issues.

Maintaining multiple repositories *for the same user* is not recommended. By maintaining centralized password management in a single repository for each user, you reduce the possibilities of confusion and error. If you choose to maintain multiple repositories per user, update password information by using the `passwd -r` command.

`passwd -r` *repository*
If no repository is specified with the `-r` option, `passwd` updates the repositories listed in `nsswitch.conf` in reverse order.

PART II DNS Setup and Administration

This part describes the configuration and administration of the BIND 9 DNS naming service in the Solaris OS.

CHAPTER 3

DNS Setup and Administration (Reference)

The Solaris 10 operating system ships with the BIND 9.x DNS name server. This chapter provides configuration and administration information related to using BIND 9 on the Solaris operating system. General BIND and DNS information is available from many other sources, including those listed in "Related Materials" on page 47.

This chapter covers the following topics.

Related Materials

For information about DNS and BIND administration, see the following documentation.

- BIND 9 Migration Notes documentation in `/usr/share/doc/bind/migration.txt`
- BIND 9 Administrator's Manual on the Internet Systems Consortium (ISC) web site at http://www.isc.org
- Listings of BIND features, known bugs and defects, and links to additional material on the ISC web site at http://www.isc.org
- *DNS and Bind*, by Paul Albitz and Cricket Liu, (4th Edition, O'Reilly, 2001)

Migrating From BIND 8 to BIND 9

BIND 9 is upwards compatible with most BIND 8 features. However, there are still a number of caveats you should be aware of when upgrading an existing BIND 8 installation to use BIND 9. Be sure to read the entire Migration Notes document before installing and using BIND 9. The Migration Notes are available at `/usr/share/doc/bind/migration.txt`. Also, the BIND package names have changed to SUNWbind and SUNWbindr. The SUNWbindr package contains the DNS server manifest.

The following list presents a brief overview of the differences between BIND 8 and BIND 9. Details are available in the Migration Notes.

- Configuration File Compatibility
  - Unimplemented options warning message
  - *transfer-format* option changes
  - Configuration file errors
  - Logging categories have changed
  - Notify message and refresh query changes
  - Multiple classes change
- Zone File Compatibility
  - Stricter rules for TTLs in zone file
  - SOA serial number changes
  - Unbalanced quotes cause errors
  - Line breaks, syntax change
  - Use \$ instead of $$ in domain names
- Interoperability Impact of New Protocol Features
  - EDNS0 new in BIND 9
  - Zone transfers default change
- Unrestricted Character Set
  - No restrictions on character set
  - Security issue, improper naming
- Server Administration Tools
  - The `rndc` program replaces `ndc`
  - `nsupdate`: changes in multiple updates
- No Information Leakage Between Zones
  - Glue NS records handled differently
- Umask Not Modified
  - Possible umask permissions issues

DNS and the Service Management Facility

The DNS/BIND `named` service can be managed by using the Sevice Management Facility (SMF). For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M), `svcs`(1), and `svccfg`(1M) man pages for more details. Also review the DNS server manifest, `server.xml`, in `/var/svc/manifest/network/dns`.

- Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command.

  Tip – Temporarily disabling a service by using the `-t` option provides some protection for the service configuration. If the service is disabled with the `-t` option, the original settings would be restored for the service after a reboot. If the service is disabled without `-t`, the service will remain disabled after reboot.

- The Fault Managed Resource Identifiers (FMRIs) for the DNS service are `svc:/network/dns/server:`<*instance*> and `svc:/network/dns/client:`<*instance*>.
- You can query the status of the DNS server and client by using the `svcs` command.
  - Example of the `svcs` command and output.

    ```
    # svcs \*dns\*
    STATE          STIME    FMRI
    online         Nov_16   svc:/network/dns/server:default
    online         Nov_16   svc:/network/dns/client:default
    ```

  - Example of `svcs -l` command and output.

    ```
    # svcs -l /network/dns/server
    fmri         svc:/network/dns/server:default
    name         Internet domain name server (DNS)
    enabled      true
    state        online
    next_state   none
    restarter    svc:/system/svc/restarter:default
    contract_id  25
    dependency   require_all/none svc:/system/filesystem/minimal (online)
    dependency   require_all/none file://localhost/etc/named.conf (online)
    dependency   require_any/error svc:/network/loopback (online)
    dependency   optional_all/error svc:/network/physical (online)
    ```

- If you need to start the DNS service with different options (for example with a configuration file other than `/etc/named.conf`), change the *start method* property of the DNS server manifest by using the `svccfg` command.

- Multiple SMF service instances are only needed if you want to run multiple copies of BIND 9 name service. Each additional instance can be specified in the DNS server manifest with a different start method.

While it is recommended that you use `svcadm` to administer the server, you can use `rndc` as well. SMF is aware of the state change of the BIND 9 named service, whether administered by using `svcadm` or `rndc`.

Note – SMF will not be aware of the BIND 9 `named` service if the service is manually executed from the command line.

Implementing `rndc`

The BIND 8 `ndc` and BIND 9 `rndc` name server control tools are *not* backward compatible. `rndc` can *not* talk to the BIND 8 name server and `ndc` can *not* talk to the BIND 9 name server. Features, options, default modes of operation, and configuration file requirements have changed. Therefore, using `ndc` on a BIND 9 server could result in loss of functionality or insecure operation. See the `rndc`(1M) man page for more information.

The `rndc.conf` Configuration File

The most significant difference between `ndc` in BIND 8 and `rndc` in BIND 9 is that `rndc` needs its own configration file, `rndc.conf`. This file can be generated by `rndc-confgen` commands. The `rndc.conf` file specifies which server controls and what algorithm the server should use.

EXAMPLE 3–1 Sample `rndc.conf` File

```
options {
             default-server localhost;
             default-key "rndc-key";
     };

     key "rndc-key" {
             algorithm hmac-md5;
             secret "qPWZ3Ndl81aBRY9AmJhVtU==";
     };
```

EXAMPLE 3–2 Sample `named.conf` File Entry for `rndc`

```
controls {
             inet * allow { any; } keys { "rndc-key"; };
     };
```

EXAMPLE 3–2 Sample `named.conf` File Entry for `rndc` *(Continued)*

```
key "rndc-key" {
        algorithm hmac-md5;
        secret "qPWZ3Ndl81aBRY9AmJhVtU==";
};
```

Differences in the Control Channels

Both the `ndc` and the `rndc` utilities use a control channel to send commands to and retrieve information from a name server. However, there are differences between the utilities.

- In BIND 8, `ndc` can use AF_UNIX domain sockets (UNIX control channel) or TCP/IP sockets (inet control channel). By default, `ndc` does not need any support in `/etc/named.conf`, because BIND 8 servers use a UNIX domain socket with a path (`/var/run/ndc.d/ndc`) compiled into `in.named`.

  For BIND 9, however, `rndc` only uses an authenticated TCP/IP inet control channel and so is not backward compatible with BIND 8. There is no UNIX domain socket support for control channels in BIND 9 servers.
- When using `rndc`, you need to specify a 'key' clause to communicate with the name server. It is mandatory that the BIND 9 server and the `rndc` client share the same key (defined both in `/etc/named.conf` and `/etc/rndc.conf`). Using the BIND 8 controls entry in BIND 9 will result in an error message.
- Some command options have changed from the `ndc` to the `rndc` implementation. This includes the `-c` option, which has a different syntax in BIND 9. Therefore, to specify the control channel in BIND 9, use `rndc -s` *<server>* `-p` *<port>*.

Commands of BIND 9 `rndc`

The following list describes the `rndc` commands.

reload	Reload configuration file and zones
reload zone [class [view]]	Reload a single zone
refresh zone [class [view]]	Schedule immediate maintenance for a zone
reconfig	Reload configuration file and new zones only
stats	Write server statistics to the statistics file
querylog	Toggle query logging
dumpdb	Dump cache(s) to the dump file (named_dump.db)
stop	Save pending updates to master files and stop the server

halt	Stop the server without saving pending updates
trace	Increment debugging level by one
trace level	Change the debugging level
notrace	Set debugging level to 0
flush	Flushes all of the server's caches
flush [view]	Flushes the server's cache for a view
status	Display status of the server
restart	Restart the server (not yet implemented)

BIND 9 Commands, Files, Tools, and Options

Some commands, files, tools, and options have remained the same in BIND 9 as they were in BIND 8. However, some have been modified and others have been added. This section describes many of the commands, files, tools, and options in BIND 9 and the new or modified behavior associated with each item.

BIND 9 Tools and Configuration Files

The following BIND 9.x tools are available with the Solaris operating system.

```
named
nsupdate
rndc
dnssec-keygen
nslookup
dig
dnssec-makekeyset
dnssec-signkey
dnssec-signzone
named-checkconf
named-checkzone
rndc-confgen
host
```

The following BIND 9.x configuration file is supported in Solaris 10.

/etc/rndc.conf

Comparison of BIND 8 and BIND 9 Commands and Files

The table below compares BIND 8 and BIND 9 commands and configuration files.

BIND 8 Command	BIND 9.x Replacement
`dnskeygen`(1M)	`dnssec-keygen`(1M)
`ndc`(1M)	`rndc`(1M)
`named-bootconf`(1M)	NONE NEEDED
`nsupdate`(1M)	`nsupdate`(1M)
`nslookup`(1M)	`nslookup`(1M)
`named-xfer`(1M)	NONE NEEDED
`in.named`(1M)	`named`(1M)
`named.conf`(4)	`named.conf`[1]
`dig`(1M)	`dig`(1M)

[1] A detailed `named.conf` man page is not included with BIND 9.2.4. "The `named.conf` Options" on page 54 includes a summary of the `named.conf` options that are supported in BIND 9.2.4.

Descriptions of Command and Option Changes

All incompatibles listed below are BIND 8 features and interfaces that are *not* supported in the equivalent BIND 9 binary. This is not intended to be an exhaustive list of the options, command line options, or features for any BIND 9.x binary.

Command	Option Changes
`in.named`(1M)	Some DNS name server `in.named` command line options are not supported. In the BIND 9.x name server, the `-g` *group_name*, `-q`, `-r` and `-w` *directory* options are not supported, and `-c` *config_file* replaces the BIND 8.x `-b` *config_file*. See the `named` man page for further details.

Command	Option Changes
`dnssec-keygen`(1M)	`dnskeygen` in BIND 8.x, used to generate keys, and `dnssec-keygen` from BIND 9.x, have no common options. See the `dnssec-keygen` man page for further details.
`rndc`(1M)	`ndc` in BIND 8.x and `rndc` in BIND 9.x are significantly different. They share no common options and unlike `ndc`, `rndc` needs a configuration file in `/etc/rndc.conf in order to run`. See man pages for `rndc`, `rndc.conf`, and `rndc-confgen` for further details.
`nsupdate`(1M)	In BIND 9.x, the syntax of the `-k` option changes in `nsupdate`. Instead of `-k` *keydir::keyname*, the syntax is now `k` *keyfile*. The only other difference is that whereas a blank line was used to signal sending the input to the server, an explicit `send` subcommand is now used to do the same. See the `nsupdate` man page for further details.
`nslookup`(1M)	The following options are unsupported in the 9.x version of BIND: `help`, `host server`, `set ignoretc`, `set noignoretc`, `set srch[list]=N1[/N2/.../N6]`, `set ro[ot]=host`, `root`, `finger [USER]`, `ls [opt] DOMAIN [> FILE]`
`named.conf`(4)	Several options are unsupported, not implemented or have changed defaults. For a list of the option changes and a summary of all `named.conf` options, see "The `named.conf` Options" on page 54.

The `named.conf` Options

The following list compares the `named.conf` options between BIND 8 and BIND 9. It also provides a brief description of the changes. An *OK* in the Changes column denotes the option works unchanged for the BIND 9 version of `named`.

Options {	Changes
[version version_string;]	OK

Options {	Changes
[directory path_name;]	OK
[named-xfer path_name;]	Obsolete[1]
[dump-file path_name;]	OK
[memstatistics-file path_name;]	Not Implemented
[pid-file path_name;]	OK
[statistics-file path_name;]	OK
[auth-nxdomain yes_or_no;]	OK[2]
[dialup yes_or_no;	OK
[fake-iquery yes_or_no;]	Obsolete
[fetch-glue yes_or_no;]	Obsolete
[has-old-clients yes_or_no;]	Obsolete
[host-statistics yes_or_no;]	Not Implemented
[host-statistics-max number;]	Not Implemented
[multiple-cnames yes_or_no;]	Obsolete
[notify yes_or_no | explicit;]	OK
[recursion yes_or_no;]	OK
[rfc2308-type1 yes_or_no;]	Not Implemented
[use-id-pool yes_or_no;]	Obsolete
[treat-cr-as-space yes_or_no;]	Obsolete
[also-notify yes_or_no;]	Syntax Changed[3]
[forward (only | first);]	OK[4]
[forwarders { [in_addr ; \ [in_addr ; ...]] };]	OK[5]
[check-names (master | slave | \ response) (warn | fail | ignore);]	Not Implemented
[allow-query { address_match_list };]	OK

[1] Obsolete due to architectural differences.

[2] Default set to *yes* in BIND 8, *no* in BIND 9.

[3] Needs an IP address for *yes*.

[4] Doesn't work if no forwarder specified; Gives an error of `no matching 'forwarders' statement` in that case.

[5] See [forward] clause.

Options {	Changes
[allow-recursion { address_match_list };]	OK
[allow-transfer { address_match_list };]	OK
[blackhole { address_match_list };]	OK
[listen-on [port ip_port] \ { address_match_list };]	OK
[query-source [address (ip_addr | *)] \	OK
[port (ip_port | *)] ;] [lame-ttl number;]	OK
[max-transfer-time-in number;]	OK
[max-ncache-ttl number;]	OK
[min-roots number;]	Not Implemented
[transfer-format (one-answer | \ many-answers);]	OK[6]
[transfers-in number;]	OK
[transfers-out number;]	OK
[transfers-per-ns number;]	OK
[transfer-source ip_addr;]	OK
[maintain-ixfr-base yes_or_no;]	Obsolete
[max-ixfr-log-size number;]	Obsolete[7]
[coresize size_spec ;]	OK
[datasize size_spec ;]	OK
[files size_spec ;]	OK
[stacksize size_spec ;]	OK
[cleaning-interval number;]	OK
[heartbeat-interval number;]	OK
[interface-interval number;]	OK
[statistics-interval number;]	Not Implemented
[topology { address_match_list };]	Not Implemented

[6] Default set to *one-answer* in BIND 8 and *many-answers* in BIND 9.

[7] No need for this option as BIND 9 trims the size of its log file automatically.

Options {	Changes
[sortlist { address_match_list };]	OK
[rrset-order { order_spec ; \ [order_spec ; ...] };]	Not Implemented
};	

Statements in BIND 9

This section describes any differences between BIND 8 and BIND 9 statements.

The `Controls` Statement

unix is the default for `ndc` and all of the arguments are compiled in. *inet* is the only option for `rndc` and nothing is compiled in.

```
Syntax
   controls {
     [ inet ip_addr
       port ip_port
       allow { address_match_list; }; ]    OK
     [ unix path_name
       perm number
       owner number
       group number; ]            Not Implemented
   };
```

Logging syntax has changed significantly. See "The `named.conf` Options" on page 54 for a list of `named.conf` options.

The `Zone` Statement

The syntax for the zone statement in the BIND 8 `named.conf` man page is.mostly supported for BIND 9 except for the following:

```
[ pubkey number number number string; ]    Obsolete
[ check-names ( warn | fail | ignore ); ]    Not Implemented
```

The `ACL` Statement

Works unchanged in BIND 9.

```
Syntax
   acl name {
     address_match_list
```

```
};
```

The `Key` Statement

Works unchanged in BIND 9.

```
Syntax
   key key_id {
     algorithm algorithm_id;
     secret secret_string;
   };
```

The `Trusted-Keys` Statement

Works unchanged, however the code to use this statement has been turned off in BIND 9.2.4.

```
Syntax
   trusted-keys {
     [ domain_name flags protocol algorithm key; ]
   };
```

The `Server` Statement

support-ixfr is obsolete, however all of the following options work unchanged in BIND 9. Note the default for *transfer-format* has changed.

```
Syntax
   server ip_addr {
     [ bogus yes_or_no; ]
     [ transfers number; ]
     [ transfer-format ( one-answer | many-answers ); ]
     [ keys { key_id [ key_id ... ] }; ]
     [ edns yes_or_no; ]
   };
```

The `Include` Statement

Works unchanged in BIND 9.

```
Syntax
   include path_name;
```

Summary of the `named.conf` Options

A detailed `named.conf` man page is not included with BIND 9.2.4. Following is a summary of the `named.conf` options that are supported in BIND 9.2.4.

```
options  {
        blackhole { <address_match_element>; ... };
        coresize <size>;
        datasize <size>;
        deallocate-on-exit <boolean>; // obsolete
        directory <quoted_string>;
        dump-file <quoted_string>;
        fake-iquery <boolean>; // obsolete
        files <size>;
        has-old-clients <boolean>; // obsolete
        heartbeat-interval <integer>;
        host-statistics <boolean>; // not implemented
        host-statistics-max <integer>; // not implemented
        interface-interval <integer>;
        listen-on [ port <integer> ] { <address_match_element>; ... };
        listen-on-v6 [ port <integer> ] { <address_match_element>; ... };
        match-mapped-addresses <boolean>;
        memstatistics-file <quoted_string>; // not implemented
        multiple-cnames <boolean>; // obsolete
        named-xfer <quoted_string>; // obsolete
        pid-file <quoted_string>;
        port <integer>;
        random-device <quoted_string>;
        recursive-clients <integer>;
        rrset-order { [ class <string> ] [ type <string> ] [ name
            <quoted_string> ] <string> <string>; ... }; // not implemented
        serial-queries <integer>; // obsolete
        serial-query-rate <integer>;
        stacksize <size>;
        statistics-file <quoted_string>;
        statistics-interval <integer>; // not yet implemented
        tcp-clients <integer>;
        tkey-dhkey <quoted_string> <integer>;
        tkey-gssapi-credential <quoted_string>;
        tkey-domain <quoted_string>;
        transfers-per-ns <integer>;
        transfers-in <integer>;
        transfers-out <integer>;
        treat-cr-as-space <boolean>; // obsolete
        use-id-pool <boolean>; // obsolete
        use-ixfr <boolean>;
        version <quoted_string>;
        allow-recursion { <address_match_element>; ... };
        allow-v6-synthesis { <address_match_element>; ... };
        sortlist { <address_match_element>; ... };
        topology { <address_match_element>; ... }; // not implemented
        auth-nxdomain <boolean>; // default changed
        minimal-responses <boolean>;
        recursion <boolean>;
        provide-ixfr <boolean>;
        request-ixfr <boolean>;
        fetch-glue <boolean>; // obsolete
        rfc2308-type1 <boolean>; // not yet implemented
        additional-from-auth <boolean>;
        additional-from-cache <boolean>;
```

```
        query-source <querysource4>;
        query-source-v6 <querysource6>;
        cleaning-interval <integer>;
        min-roots <integer>; // not implemented
        lame-ttl <integer>;
        max-ncache-ttl <integer>;
        max-cache-ttl <integer>;
        transfer-format ( many-answers | one-answer );
        max-cache-size <size_no_default>;
        check-names <string> <string>; // not implemented
        cache-file <quoted_string>;
        allow-query { <address_match_element>; ... };
        allow-transfer { <address_match_element>; ... };
        allow-update-forwarding { <address_match_element>; ... };
        allow-notify { <address_match_element>; ... };
        notify <notifytype>;
        notify-source ( <ipv4_address> | * ) [ port ( <integer> | * ) ];
        notify-source-v6 ( <ipv6_address> | * ) [ port ( <integer> | * ) ];
        also-notify [ port <integer> ] { ( <ipv4_address> | <ipv6_address>
            ) [ port <integer> ]; ... };
        dialup <dialuptype>;
        forward ( first | only );
        forwarders [ port <integer> ] { ( <ipv4_address> | <ipv6_address> )
            [ port <integer> ]; ... };
        maintain-ixfr-base <boolean>; // obsolete
        max-ixfr-log-size <size>; // obsolete
        transfer-source ( <ipv4_address> | * ) [ port ( <integer> | * ) ];
        transfer-source-v6 ( <ipv6_address> | * ) [ port ( <integer> | * ) ];
        max-transfer-time-in <integer>;
        max-transfer-time-out <integer>;
        max-transfer-idle-in <integer>;
        max-transfer-idle-out <integer>;
        max-retry-time <integer>;
        min-retry-time <integer>;
        max-refresh-time <integer>;
        min-refresh-time <integer>;
        sig-validity-interval <integer>;
        zone-statistics <boolean>;
};

controls {
        inet ( <ipv4_address> | <ipv6_address> | * ) [ port ( <integer> | *
            ) ] allow { <address_match_element>; ... } [ keys { <string>; ... } ];
        unix <unsupported>; // not implemented
};

acl <string> { <address_match_element>; ... };

logging {
        channel <string> {
                file <logfile>;
                syslog <optional_facility>;
                null;
                stderr;
                severity <logseverity>;
```

```
                print-time <boolean>;
                print-severity <boolean>;
                print-category <boolean>;
        };
        category <string> { <string>; ... };
};

view <string> <optional_class> {
        match-clients { <address_match_element>; ... };
        match-destinations { <address_match_element>; ... };
        match-recursive-only <boolean>;
        key <string> {
                algorithm <string>;
                secret <string>;
        };
        zone <string> <optional_class> {
                type ( master | slave | stub | hint | forward );
                allow-update { <address_match_element>; ... };
                file <quoted_string>;
                ixfr-base <quoted_string>; // obsolete
                ixfr-tmp-file <quoted_string>; // obsolete
                masters [ port <integer> ] { ( <ipv4_address> |
                    <ipv6_address> ) [ port <integer> ] [ key <string> ]; ... };
                pubkey <integer> <integer> <integer> <quoted_string>; //
                    obsolete
                update-policy { ( grant | deny ) <string> ( name |
                    subdomain | wildcard | self ) <string> <rrtypelist>; ... };
                database <string>;
                check-names <string>; // not implemented
                allow-query { <address_match_element>; ... };
                allow-transfer { <address_match_element>; ... };
                allow-update-forwarding { <address_match_element>; ... };
                allow-notify { <address_match_element>; ... };
                notify <notifytype>;
                notify-source ( <ipv4_address> | * ) [ port ( <integer> | *
                    ) ];
                notify-source-v6 ( <ipv6_address> | * ) [ port ( <integer>
                    | * ) ];
                also-notify [ port <integer> ] { ( <ipv4_address> |
                    <ipv6_address> ) [ port <integer> ]; ... };
                dialup <dialuptype>;
                forward ( first | only );
                forwarders [ port <integer> ] { ( <ipv4_address> |
                    <ipv6_address> ) [ port <integer> ]; ... };
                maintain-ixfr-base <boolean>; // obsolete
                max-ixfr-log-size <size>; // obsolete
                transfer-source ( <ipv4_address> | * ) [ port ( <integer> |
                    * ) ];
                transfer-source-v6 ( <ipv6_address> | * ) [ port (
                    <integer> | * ) ];
                max-transfer-time-in <integer>;
                max-transfer-time-out <integer>;
                max-transfer-idle-in <integer>;
                max-transfer-idle-out <integer>;
                max-retry-time <integer>;
```

```
        min-retry-time <integer>;
        max-refresh-time <integer>;
        min-refresh-time <integer>;
        sig-validity-interval <integer>;
        zone-statistics <boolean>;
};
server {
        bogus <boolean>;
        provide-ixfr <boolean>;
        request-ixfr <boolean>;
        support-ixfr <boolean>; // obsolete
        transfers <integer>;
        transfer-format ( many-answers | one-answer );
        keys <server_key>;
        edns <boolean>;
};
trusted-keys { <string> <integer> <integer> <integer>
    <quoted_string>; ... };
allow-recursion { <address_match_element>; ... };
allow-v6-synthesis { <address_match_element>; ... };
sortlist { <address_match_element>; ... };
topology { <address_match_element>; ... }; // not implemented
auth-nxdomain <boolean>; // default changed
minimal-responses <boolean>;
recursion <boolean>;
provide-ixfr <boolean>;
request-ixfr <boolean>;
fetch-glue <boolean>; // obsolete
rfc2308-type1 <boolean>; // not yet implemented
additional-from-auth <boolean>;
additional-from-cache <boolean>;
query-source <querysource4>;
query-source-v6 <querysource6>;
cleaning-interval <integer>;
min-roots <integer>; // not implemented
lame-ttl <integer>;
max-ncache-ttl <integer>;
max-cache-ttl <integer>;
transfer-format ( many-answers | one-answer );
max-cache-size <size_no_default>;
check-names <string> <string>; // not implemented
cache-file <quoted_string>;
allow-query { <address_match_element>; ... };
allow-transfer { <address_match_element>; ... };
allow-update-forwarding { <address_match_element>; ... };
allow-notify { <address_match_element>; ... };
notify <notifytype>;
notify-source ( <ipv4_address> | * ) [ port ( <integer> | * ) ];
notify-source-v6 ( <ipv6_address> | * ) [ port ( <integer> | * ) ];
also-notify [ port <integer> ] { ( <ipv4_address> | <ipv6_address>
    ) [ port <integer> ]; ... };
dialup <dialuptype>;
forward ( first | only );
forwarders [ port <integer> ] { ( <ipv4_address> | <ipv6_address> )
    [ port <integer> ]; ... };
```

```
        maintain-ixfr-base <boolean>; // obsolete
        max-ixfr-log-size <size>; // obsolete
        transfer-source ( <ipv4_address> | * ) [ port ( <integer> | * ) ];
        transfer-source-v6 ( <ipv6_address> | * ) [ port ( <integer> | * ) ];
        max-transfer-time-in <integer>;
        max-transfer-time-out <integer>;
        max-transfer-idle-in <integer>;
        max-transfer-idle-out <integer>;
        max-retry-time <integer>;
        min-retry-time <integer>;
        max-refresh-time <integer>;
        min-refresh-time <integer>;
        sig-validity-interval <integer>;
        zone-statistics <boolean>;
};

lwres {
        listen-on [ port <integer> ] { ( <ipv4_address> | <ipv6_address> )
            [ port <integer> ]; ... };
        view <string> <optional_class>;
        search { <string>; ... };
        ndots <integer>;
};

key <string> {
        algorithm <string>;
        secret <string>;
};

zone <string> <optional_class> {
        type ( master | slave | stub | hint | forward );
        allow-update { <address_match_element>; ... };
        file <quoted_string>;
        ixfr-base <quoted_string>; // obsolete
        ixfr-tmp-file <quoted_string>; // obsolete
        masters [ port <integer> ] { ( <ipv4_address> | <ipv6_address> ) [
            port <integer> ] [ key <string> ]; ... };
        pubkey <integer> <integer> <integer> <quoted_string>; // obsolete
        update-policy { ( grant | deny ) <string> ( name | subdomain |
            wildcard | self ) <string> <rrtypelist>; ... };
        database <string>;
        check-names <string>; // not implemented
        allow-query { <address_match_element>; ... };
        allow-transfer { <address_match_element>; ... };
        allow-update-forwarding { <address_match_element>; ... };
        allow-notify { <address_match_element>; ... };
        notify <notifytype>;
        notify-source ( <ipv4_address> | * ) [ port ( <integer> | * ) ];
        notify-source-v6 ( <ipv6_address> | * ) [ port ( <integer> | * ) ];
        also-notify [ port <integer> ] { ( <ipv4_address> | <ipv6_address>
            ) [ port <integer> ]; ... };
        dialup <dialuptype>;
        forward ( first | only );
        forwarders [ port <integer> ] { ( <ipv4_address> | <ipv6_address> )
            [ port <integer> ]; ... };
```

```
        maintain-ixfr-base <boolean>; // obsolete
        max-ixfr-log-size <size>; // obsolete
        transfer-source ( <ipv4_address> | * ) [ port ( <integer> | * ) ];
        transfer-source-v6 ( <ipv6_address> | * ) [ port ( <integer> | * ) ];
        max-transfer-time-in <integer>;
        max-transfer-time-out <integer>;
        max-transfer-idle-in <integer>;
        max-transfer-idle-out <integer>;
        max-retry-time <integer>;
        min-retry-time <integer>;
        max-refresh-time <integer>;
        min-refresh-time <integer>;
        sig-validity-interval <integer>;
        zone-statistics <boolean>;
};

server {
        bogus <boolean>;
        provide-ixfr <boolean>;
        request-ixfr <boolean>;
        support-ixfr <boolean>; // obsolete
        transfers <integer>;
        transfer-format ( many-answers | one-answer );
        keys <server_key>;
        edns <boolean>;
};

trusted-keys { <string> <integer> <integer> <integer> <quoted_string>; ... };
```

PART III NIS Setup and Administration

This part provides an overview of the NIS naming service, as well as the setup, administration and troubleshooting of NIS within the Solaris OS.

CHAPTER 4

Network Information Service (NIS) (Overview)

This chapter provides an overview of the Network Information Service (NIS).

NIS is a distributed naming service. It is a mechanism for identifying and locating network objects and resources. It provides a uniform storage and retrieval method for network-wide information in a transport-protocol and media-independent fashion.

This chapter covers the following topics.

NIS Introduction

By running NIS, the system administrator can distribute administrative databases, called *maps*, among a variety of servers (*master* and *slaves*). The administrator can update those databases from a centralized location in an automatic and reliable fashion to ensure that all clients share the same naming service information in a consistent manner throughout the network.

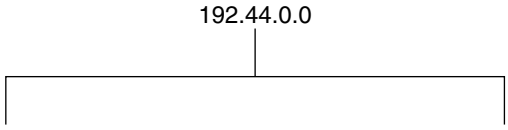
NIS was developed independently of DNS and has a slightly different focus. Whereas DNS focuses on making communication simpler by using machine names instead of numerical IP addresses, NIS focuses on making network administration more manageable by providing centralized control over a variety of network information. NIS stores information not only about machine names and addresses, but also about users, the network itself, and network services. This collection of network *information* is referred to as the NIS *namespace*.

Note – In some contexts *machine* names are referred to has *host* names or *machine* names. This discussion uses *machine*, but some screen messages or NIS map names might use *host* or *machine*.

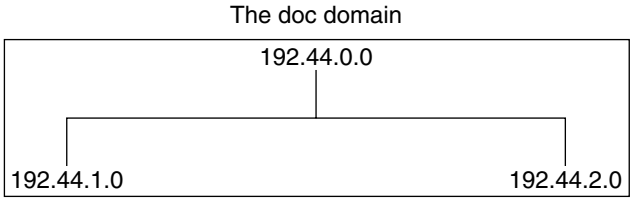
NIS Architecture

NIS uses a client-server arrangement. NIS servers provide services to NIS clients. The principal servers are called *master* servers, and for reliability, they have backup, or *slave* servers. Both master and slave servers use the NIS information retrieval software and both store NIS maps.

NIS uses domains to arrange the machines, users, and networks in its namespace. However, it does not use a domain hierarchy; an NIS namespace is flat.



Thus, this physical network would be arranged into one NIS domain.



An NIS domain cannot be connected directly to the Internet using just NIS. However, organizations that want to use NIS and also be connected to the Internet can combine NIS with DNS. You can use NIS to manage all local information and use DNS for Internet host lookup. NIS provides a forwarding service that forwards host lookups to DNS if the information cannot be found in an NIS map. The Solaris system also allows you to set up the `nsswitch.conf` file so that hosts lookup requests go only to DNS, or to DNS and then NIS if not found by DNS, or to NIS and then DNS if not found by NIS. See Chapter 2 for details.

NIS Machine Types

There are three types of NIS machines.

- Master server
- Slave servers
- Clients of NIS servers

Any machine can be an NIS client, but only machines with disks should be NIS servers, either master or slave. Servers are also clients, typically of themselves.

NIS Servers

The NIS server does not have to be the same machine as the NFS file server.

NIS servers come in two varieties, master and slave. The machine designated as master server contains the set of maps that the system administrator creates and updates as necessary. Each NIS domain must have one, and only one, master server, which can propagate NIS updates with the least performance degradation.

You can designate additional NIS servers in the domain as slave servers. A slave server has a complete copy of the master set of NIS maps. Whenever the master server maps are updated, the updates are propagated among the slave servers. Slave servers can handle any overflow of requests from the master server, minimizing "server unavailable" errors.

Normally, the system administrator designates one master server for all NIS maps. However, because each individual NIS map has the machine name of the master server encoded within it, you could designate different servers to act as master and slave servers for different maps. To minimize confusion, designate a single server as the master for all the maps you create within a single domain. The examples in this chapter assume that one server is the master for all maps in the domain.

NIS Clients

NIS clients run processes that request data from maps on the servers. Clients do not make a distinction between master and slave servers, since all NIS servers should have the same information.

Note – The Solaris operating system does not support a configuration in which a NIS client and a Native LDAP client co-exist on the same client machine.

NIS Elements

The NIS naming service is composed of the following elements:

- Domains (see "The NIS Domain" on page 70)
- Daemons (see "NIS Daemons" on page 70)
- Utilities (see "NIS Utilities" on page 71)
- Maps (see "NIS Maps" on page 71)
- NIS Command Set (see "NIS-Related Commands" on page 75)

The NIS Domain

An NIS *domain* is a collection of machines which share a common set of NIS maps. Each domain has a domain name and each machine sharing the common set of maps belongs to that domain.

Any machine can belong to a given domain, as long as there is a server for that domain's maps in the same network. An NIS client machine obtains its domain name and binds to an NIS server as part of its boot process.

NIS Daemons

NIS service is provided by five daemons as shown in Table 4–1. The NIS service is managed by the Service Management Facility. Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

TABLE 4–1 NIS Daemons

Daemon	Function
`ypserv`	Server process
`ypbind`	Binding process
`ypxfrd`	High speed map transfer
`rpc.yppasswdd`	NIS password update daemon
	** See NOTE below.**
`rpc.ypupdated`	Modifies other maps such as `publickey`

Note – `rpc.yppasswdd` considers all shells that begin with an `r` to be restricted. For example, if you are in `/bin/rksh`, you are not allowed to change from that shell to another one. If you have a shell that begins with `r` but is not intended to be restricted as such, refer to Chapter 7 for the workaround.

NIS Utilities

NIS service is supported by nine utilities as shown in Table 4–2.

TABLE 4–2 NIS Utilities

Utility	Function
`makedbm`	Creates `dbm` file for an NIS map
`ypcat`	Lists data in a map
`ypinit`	Builds and installs an NIS database and initializes NIS client's `ypservers` list.
`ypmatch`	Finds a specific entry in a map
`yppoll`	Gets a map order number from a server
`yppush`	Propagates data from NIS master to NIS slave server
`ypset`	Sets binding to a particular server
`ypwhich`	Lists name of the NIS server and nickname translation table
`ypxfr`	Transfers data from master to slave NIS server

NIS Maps

The information in NIS maps is stored in `ndbm` format. `ypfiles`(4) and `ndbm`(3C) explain the format of the map file.

NIS maps were designed to replace UNIX `/etc` files, as well as other configuration files, so they store much more than names and addresses. On a network running NIS, the NIS master server for each NIS domain maintains a set of NIS maps for other machines in the domain to query. NIS slave servers also maintain duplicates of the master server's maps. NIS client machines can obtain namespace information from either master or slave servers.

NIS maps are essentially two-column tables. One column is the *key* and the other column is information related to the key. NIS finds information for a client by searching through the keys. Some information is stored in several maps because each

map uses a different key. For example, the names and addresses of machines are stored in two maps: `hosts.byname` and `hosts.byaddr`. When a server has a machine's name and needs to find its address, it looks in the `hosts.byname` map. When it has the address and needs to find the name, it looks in the `hosts.byaddr` map.

An NIS `Makefile` is stored in the `/var/yp` directory of machines designated as an NIS server at installation time. Running `make` in that directory causes `makedbm` to create or modify the default NIS maps from the input files.

Note – Always create maps on the master server, as maps created on a slave will not automatically be pushed to the master server.

Default NIS Maps

A default set of NIS maps are provided in the Solaris system. You might want to use all these maps or only some of them. NIS can also use whatever maps you create or add when you install other software products.

Default maps for an NIS domain are located in each server's `/var/yp/`*domainname* directory. For example, the maps that belong to the domain `test.com` are located in each server's `/var/yp/test.com` directory.

Table 4–3 describes the default NIS maps, information they contain, and whether the software consults the corresponding administrative files when NIS is running.

TABLE 4–3 NIS Map Descriptions

Map Name	Corresponding NIS Admin File	Description
`audit_user`	`audit_user`	Contains user auditing preselection data.
`auth_attr`	`auth_attr`	Contains authorization names and descriptions.
`bootparams`	`bootparams`	Contains path names of files clients need during boot: root, swap, possibly others.
`ethers.byaddr`	`ethers`	Contains machine names and Ethernet addresses. The Ethernet address is the key in the map.
`ethers.byname`	`ethers`	Same as `ethers.byaddr`, except the key is machine name instead of the Ethernet address.
`exec_attr`	`exec_attr`	Contains profile execution attributes.

TABLE 4–3 NIS Map Descriptions *(Continued)*

Map Name	Corresponding NIS Admin File	Description
`group.bygid`	`group`	Contains group security information with group ID as key.
`group.byname`	`group`	Contains group security information with group name as key.
`hosts.byaddr`	`hosts`	Contains machine name, and IP address, with IP address as key.
`hosts.byname`	`hosts`	Contains machine name and IP address, with machine (host) name as key.
`mail.aliases`	`aliases`	Contains aliases and mail addresses, with aliases as key.
`mail.byaddr`	`aliases`	Contains mail address and alias, with mail address as key.
`netgroup.byhost`	`netgroup`	Contains group name, user name and machine name.
`netgroup.byuser`	`netgroup`	Same as `netgroup.byhost`, except that key is user name.
`netgroup`	`netgroup`	Same as `netgroup.byhost`, except that key is group name.
`netid.byname`	`passwd, hosts group`	Used for UNIX-style authentication. Contains machine name and mail address (including domain name). If there is a `netid` file available it is consulted in addition to the data available through the other files.
`netmasks.byaddr`	`netmasks`	Contains network mask to be used with IP submitting, with the address as key.
`networks.byaddr`	`networks`	Contains names of networks known to your system and their IP addresses, with the address as key.
`networks.byname`	`networks`	Same as `networks.byaddr`, except key is name of network.
`passwd.adjunct.byname`	`passwd` and `shadow`	Contains auditing information and the hidden password information for C2 clients.
`passwd.byname`	`passwd` and `shadow`	Contains password information with user name as key.

TABLE 4–3 NIS Map Descriptions *(Continued)*

Map Name	Corresponding NIS Admin File	Description
`passwd.byuid`	`passwd` and `shadow`	Same as `passwd.byname`, except that key is user ID.
`prof_attr`	`prof_attr`	Contains attributes for execution profiles.
`protocols.byname`	`protocols`	Contains network protocols known to your network.
`protocols.bynumber`	`protocols`	Same as `protocols.byname`, except that key is protocol number.
`rpc.bynumber`	`rpc`	Contains program number and name of RPCs known to your system. Key is RPC program number.
`services.byname`	`services`	Lists Internet services known to your network. Key is port or protocol.
`services.byservice`	`services`	Lists Internet services known to your network. Key is service name.
`user_attr`	`user_attr`	Contains extended attributes for users and roles.
`ypservers`	N/A	Lists NIS servers known to your network.

New `ipnodes` maps (`ipnodes.byaddr` and `ipnodes.byname`) are added to NIS. The maps store both IPv4 and IPv6 addresses. See the `ipnodes`(4) man page. NIS clients and servers can communicate using either IPv4 or IPv6 RPC transports.

The `ageing.byname` mapping contains information used by `yppasswdd` to read and write password aging information to the DIT when the NIS-to-LDAP transition is implemented. If password aging is not being used, then it can be commented out of the mapping file. For more information about the NIS-to-LDAP transition, see Chapter 15.

Using NIS Maps

NIS makes updating network databases much simpler than with the `/etc` files system. You no longer have to change the administrative `/etc` files on every machine each time you modify the network environment.

For example, when you add a new machine to a network running NIS, you only have to update the input file in the master server and run `make`. This automatically updates the `hosts.byname` and `hosts.byaddr` maps. These maps are then transferred to any slave servers and are made available to all of the domain's client machines and their programs. When a client machine or application requests a machine name or address, the NIS server refers to the `hosts.byname` or `hosts.byaddr` map as appropriate and sends the requested information to the client.

You can use the `ypcat` command to display the values in a map. The `ypcat` basic format is the following.

```
% ypcat mapname
```

where *mapname* is the name of the map you want to examine or its *nickname*. If a map is composed only of keys, as in the case of `ypservers`, use `ypcat -k`. Otherwise, `ypcat` prints blank lines. The `ypcat`(1) man page describes more options for `ypcat`.

You can use the `ypwhich` command to determine which server is the master of a particular map. Type the following.

```
% ypwhich -m mapname
```

where *mapname* is the name or the nickname of the map whose master you want to find. `ypwhich` responds by displaying the name of the master server. For complete information, refer to the `ypwhich`(1) man page.

NIS Map Nicknames

Nicknames are aliases for full map names. To obtain a list of available map nicknames, such as `passwd` for `passwd.byname`, type `ypcat -x` or `ypwhich -x`.

Nicknames are stored in the `/var/yp/nicknames` file, which contains a map nickname followed by the fully specified name for the map, separated by a space. This list might be added to or modified. Currently, there is a limit of 500 nicknames.

NIS-Related Commands

The NIS service includes specialized daemons, system programs, and commands, which are summarized in the following table.

TABLE 4–4 NIS Command Summary

Command	Description
`ypserv`	Services NIS clients' requests for information from an NIS map. `ypserv` is a daemon that runs on NIS servers with a complete set of maps. At least one `ypserv` daemon must be present on the network for NIS service to function.
`ypbind`	Provides NIS server binding information to clients. It provides binding by finding a `ypserv` process that serves maps within the domain of the requesting client. `ypbind` must run on all servers and clients.
`ypinit`	Automatically creates maps for an NIS server from the input files. It is also used to construct the initial `/var/yp/binding/`*domain*`/ypservers` file on the clients. Use `ypinit` to set up the master NIS server and the slave NIS servers for the first time.
`make`	Updates NIS maps by reading the `Makefile` (when run in the `/var/yp` directory). You can use `make` to update all maps based on the input files or to update individual maps. The `ypmake`(1M) man page describes the functionality of `make` for NIS.
`makedbm`	`makedbm` takes an input file and converts it into `dbm.dir` and `dbm.pag` files—valid `dbm` files that NIS can use as maps. You can also use `makedbm -u` to disassemble a map, so that you can see the key-value pairs that comprise it.
`ypxfr`	Pulls an NIS map from a remote server to the local `/var/yp/`*domain* directory, using NIS itself as the transport medium. You can run `ypxfr` interactively, or periodically from a `crontab` file. It is also called by `ypserv` to initiate a transfer.
`ypxfrd`	Provides map transfers service for `ypxfr` requests (generally slave servers). It is run only on the master server.
`yppush`	Copies a new version of an NIS map from the NIS master server to its slaves. You run it on the master NIS server.
`ypset`	Tells a `ypbind` process to bind to a named NIS server. This is not for casual use and its use is discouraged because of security implications. See the `ypset`(1M) and `ypbind`(1M) man pages for information about the `ypset` and `ypsetme` options to the `ypbind` process.
`yppoll`	Tells which version of an NIS map is running on a server that you specify. It also lists the master server for the map.
`ypcat`	Displays the contents of an NIS map.
`ypmatch`	Prints the value for one or more specified keys in an NIS map. You cannot specify which version of the NIS server map you are seeing.

TABLE 4–4 NIS Command Summary *(Continued)*

Command	Description
`ypwhich`	Shows which NIS server a client is using at the moment for NIS services, or, if invoked with the `-m` *mapname* option, which NIS server is master of each of the maps. If only `-m` is used, it displays the names of all the maps available and their respective master servers.

NIS Binding

NIS clients get information from an NIS server through the binding process, which can work in one of two modes: server-list or broadcast.

- Server-list. In the server-list mode, the `ypbind` process queries the `/var/yp/binding/`*domain*`/ypservers` list for the names of all of the NIS servers in the domain. The `ypbind` process binds only to servers in this file. The file is created by running `ypinit -c`.
- Broadcast. The `ypbind` process can also use an RPC broadcast to initiate a binding. Since broadcasts are only local subnet events that are not routed further, there must be at least one server (master or slave) on the same subnet as the client. The servers themselves might exist throughout different subnets since map propagation works across subnet boundaries. In a subnet environment, one common method is to make the subnet router an NIS server. This allows the domain server to serve clients on either subnet interface.

Server-List Mode

The binding process in server-list mode works as follows:

1. Any program, running on the NIS client machine that needs information provided by an NIS map, asks `ypbind` for the name of a server.
2. `ypbind` looks in the `/var/yp/binding/`*domainname*`/ypservers` file for a list of NIS servers for the domain.
3. `ypbind` initiates binding to the first server in the list. If the server does not respond, `ypbind` tries the second, and so on, until it finds a server or exhausts the list.
4. `ypbind` tells the client process which server to talk to. The client then sends the request directly to the server.
5. The `ypserv` daemon on the NIS server handles the request by consulting the appropriate map.
6. `ypserv` sends the requested information back to the client.

Broadcast Mode

The broadcast mode binding process works as follows:

1. `ypbind` must be started with the broadcast option set (`broadcast`).
2. `ypbind` issues an RPC broadcast in search of an NIS server.

Note – In order to support such clients, it is necessary to have an NIS server on each subnet requiring NIS service.

---

3. `ypbind` initiates binding to the first server that responds to the broadcast.
4. `ypbind` tells the client process which server to talk to. The client then sends the request directly to the server.
5. The `ypserv` daemon on the NIS server handles the request by consulting the appropriate map.
6. `ypserv` sends the requested information back to the client.

Normally, once a client is bound to a server it stays bound to that server until something causes it to change. For example, if a server goes out of service, the clients it served will then bind to new servers.

To find out which NIS server is currently providing service to a specific client, use the following command.

%**`ypwhich`** *machinename*

Where *machinename* is the name of the client. If no machine name is mentioned, `ypwhich` defaults to the local machine (that is, the machine on which the command is run).

CHAPTER 5

Setting Up and Configuring NIS Service

This chapter describes initial set up and configuration of the Network Information Service (NIS).

Note – In some contexts, *machine* names are referred to as *host* names or *machine* names. This discussion uses "machine," but some screen messages or NIS map names might use *host* or *machine*.

This chapter covers the following topics.

Configuring NIS — Task Map

Task	For Instructions, Go To
Prepare source files for conversion.	"Preparing Source Files for Conversion to NIS Maps" on page 83

Task	For Instructions, Go To
Set up master server using `ypinit`	"Setting Up the Master Server With `ypinit`" on page 85
Start NIS on master server.	"Starting and Stopping NIS Service on the Master Server" on page 87
Set up slave servers.	"Setting Up a Slave Server" on page 89
Set up NIS client.	"Setting Up NIS Clients" on page 91

Before You Begin Configuring NIS

Before configuring your NIS namespace, you must do the following.

- Install properly configured `nsswitch.conf` files on all the machines that will be using NIS. See Chapter 2 for details.
- Plan your NIS domain.

NIS and the Service Management Facility

The NIS service is managed by the Service Management Facility. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

- Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. However, `ypstart` and `ypstop` can also be used from the command line to start or stop NIS. See the `ypstart`(1M) and `ypstop`(1M) man pages for more information.

  Tip – Temporarily disabling a service by using the `-t` option provides some protection for the service configuration. If the service is disabled with the `-t` option, the original settings would be restored for the service after a reboot. If the service is disabled without `-t`, the service will remain disabled after reboot.

- The NIS Fault Managed Resource Identifiers (FMRIs) are `svc:/network/nis/server:`<*instance*> for the NIS server and `svc:/network/nis/client:`<*instance*> for the NIS client.

- You can query the status of NIS by using the `svcs` command.
  - Examples of `svcs` command and output.

```
# svcs network/nis/server
STATE        STIME    FMRI
online       Jan_10   svc:/network/nis/server:default
```

```
# svcs \*nis\*
STATE          STIME    FMRI
disabled       12:39:18 svc:/network/rpc/nisplus:default
disabled       12:39:18 svc:/network/nis/server:default
disabled       12:39:20 svc:/network/nis/passwd:default
disabled       12:39:20 svc:/network/nis/update:default
disabled       12:39:20 svc:/network/nis/xfr:default
online         12:42:16 svc:/network/nis/client:default
```

  - Example of `svcs -l` command and output.

```
# svcs -l /network/nis/client
fmri         svc:/network/nis/client:default
enabled      true
state        online
next_state   none
restarter    svc:/system/svc/restarter:default
contract_id  99
dependency   exclude_all/none svc:/network/nis/server (offline)
dependency   require_all/none svc:/system/identity:domain (online)
dependency   require_all/restart svc:/network/rpc/bind (online)
dependency   require_all/none svc:/system/filesystem/minimal (online)
```

  - You can use the `svccfg` utility to get more detailed information about a service. See the `svccfg`(1M) man page.
  - You can check a daemon's presence by using the `ps` command.

```
# ps -e | grep rpcbind
daemon 100806      1   0   Sep 01 ?       25:28   /usr/sbin/rpcbind
```

Note – Do not use the `-f` option with `ps` because this option attempts to translate user IDs to names, which causes more naming service lookups that might not succeed.

Planning Your NIS Domain

Before you configure machines as NIS servers or clients, you must plan the NIS domain.

Decide which machines will be in your NIS domain. An NIS domain does not have to be congruent with your network. A network can have more than one NIS domain, and there can be machines on your network that are outside of your NIS domain.

Choose an NIS domain name, which can be 256 characters long. A good practice is to limit domain names to no more than 32 characters. Domain names are case-sensitive. For convenience, you can use your Internet domain name as the basis for your NIS domain name. For example, if your Internet domain name is `doc.com`, you can name your NIS domain `doc.com`. If you wanted to divide `doc.com` into two NIS domains, one for the sales department and the other for the manufacturing department, you could name one `sales.doc.com` and the other `manf.doc.com`.

Before a machine can use NIS services, the correct NIS domain name and machine name must be set. A machine's name is set by the machine's `/etc/nodename` file and the machine's domain name is set by the machine's `/etc/defaultdomain` file. These files are read at boot time and the contents are used by the `uname -S` and `domainname` commands, respectively. Diskless machines read these files from their boot server.

Identify Your NIS Servers and Clients

Select one machine to be the master server. Decide which machines, if any, will be slave servers.

Decide which machines will be NIS clients. Typically all machines in your domain are set to be NIS clients, although this is not necessary.

Preparing the Master Server

The following sections describe how to prepare the source files and the `passwd` files for the master server.

Source Files Directory

The source files should be located in the `/etc` directory, on the master server or in some other directory. Having them in `/etc` is undesirable because the contents of the maps are then the same as the contents of the local files on the master server. This is a special problem for `passwd` and `shadow` files because all users have access to the master server maps and the root password would be passed to all NIS clients through the `passwd` map. See "`Passwd` Files and Namespace Security" on page 83 for additional information.

However, if you put the source files in some other directory, you must modify the `Makefile` in `/var/yp` by changing the `DIR=/etc` line to `DIR=/`*your-choice*, where *your-choice* is the name of the directory you will be using to store the source files. This allows you to treat the local files on the server as if they were those of a client. (It is good practice to first save a copy of the original `Makefile`.)

In addition, if `audit_user`, `auth_attr`, `exec_attr` and `prof_attr` are to be taken from a directory other than the default, you must amend the `RBACDIR =/etc/security` to *`RBACDIR=/your-choice`*.

`Passwd` Files and Namespace Security

The `passwd` map is a special case. In addition to the old Solaris 1 `passwd` file format, this implementation of NIS accepts the `/etc/passwd` and `/etc/shadow` file formats as input for building the NIS password maps.

For security reasons, the files used to build the NIS password maps should not contain an entry for `root`, to prevent unauthorized root access. Therefore, the password maps should not be built from the files located in the master server's `/etc` directory. The password files used to build the password maps should have the `root` entry removed from them and be located in a directory that can be protected from unauthorized access.

For example, the master server password input files should be stored in a directory such as `/var/yp`, or any directory of your choice, as long as the file itself is not a link to another file and its location is specified in the `Makefile`. The correct directory option is set automatically according to the configuration specified in your `Makefile`.

Caution – Be sure that the `passwd` file in the directory specified by `PWDDIR` does not contain an entry for root.

If your source files are in a directory other than `/etc`, you must alter the `PWDIR` password macro in the `Makefile` to refer to the directory where the `passwd` and `shadow` files reside, changing the line `PWDIR=/etc` to `PWDIR/`*`your-choice`*, where *your-choice* is the name of the directory you will be using to store the `passwd` map source files.

Preparing Source Files for Conversion to NIS Maps

Prepare the source files for conversion to NIS maps.

▼ How to Prepare Source Files for Conversion

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Check the source files on the master server to make sure they reflect an up-to-date picture of your system.**

   Check the following files:

   - `auto.home` or `auto_home`
   - `auto.master` or `auto_master`
   - `bootparams`
   - `ethers`
   - `group`
   - `hosts`
   - `ipnodes`
   - `netgroup`
   - `netmasks`
   - `networks`
   - `passwd`
   - `protocols`
   - `rpc`
   - `service`
   - `shadow`
   - `user_attr`

3. **Copy all of these source files, except `passwd`, to the `DIR` directory that you have selected.**

4. **Copy the `passwd` file to the `PWDIR` directory that you have selected.**

5. **Copy `audit_user`, `auth_attr`, `exec_attr`, and `prof_attr` to the selected `RBACDIR` directory.**

6. **Check the `/etc/mail/aliases` file.**

   Unlike other source files, the `/etc/mail/aliases` file cannot be moved to another directory. This file must reside in the `/etc/mail` directory. Make sure that the `/etc/mail/aliases` source file contains all the mail aliases that you want to have available throughout the domain. Refer to `aliases`(4) for more information.

7. **Clean all comments and other extraneous lines and information from the source files.**

   These operations can be done through a `sed` or `awk` script or with a text editor. The `Makefile` performs some file cleaning automatically for you, but it is good practice to examine and clean these files by hand before running.

8. **Make sure that the data in all the source files is correctly formatted.**

   Source file data needs to be in the correct format for that particular file. Check the man pages for the different files to make sure that each file is in the correct format.

Preparing the `Makefile`

After checking the source files and copying them into the source file directory, you now need to convert those source files into the `ndbm` format maps that the NIS service uses. This is done automatically for you by `ypinit` when called on the master server, as explained in "Setting Up the Master Server With `ypinit`" on page 85.

The `ypinit` script calls the program `make`, which uses the `Makefile` located in the `/var/yp` directory. A default `Makefile` is provided for you in the `/var/yp` directory and contains the commands needed to transform the source files into the desired `ndbm` format maps.

You can use the default `Makefile` as it is, or modify it if you want. (If you do modify the default `Makefile`, be sure to first copy and store the original default `Makefile` in case you need it for future use.) You might need to make one or more of the following modifications to the `Makefile`:

- *Nondefault maps*

  If you have created your own non-default source files and want to convert them to NIS maps, you must add those source files to the `Makefile`.

- `DIR` *value*

  If you want the `Makefile` to use source files stored in some directory other than `/etc`, as explained in "Source Files Directory" on page 82, you must change the value of `DIR` in the `Makefile` to the directory that you want to use. When changing this value in the `Makefile`, do not indent the line.

- `PWDIR` *value*

  If you want the `Makefile` to use `passwd`, `shadow`, and/or `adjunct` source files stored in some directory other than `/etc`, you must change the value of `PWDIR` in the `Makefile` to the directory that you want to use. When changing this value in the `Makefile`, do not indent the line.

- *Domain name resolver*

  If you want the NIS server to use the domain name resolver for machines not in the current domain, comment out the `Makefile` line `B=`, and uncomment (activate) the line `B=-b`.

The function of the `Makefile` is to create the appropriate NIS maps for each of the databases listed under `all`. After passing through `makedbm` the data is collected in two files, `mapname.dir` and `mapname.pag`. Both files are in the `/var/yp/`*domainname* directory on the master server.

The `Makefile` builds `passwd` maps from the `/PWDIR/passwd`, `/PWDIR/shadow`, and `/PWDIR/security/passwd.adjunct` files, as appropriate.

Setting Up the Master Server With `ypinit`

The `ypinit` script sets up master and slave servers and clients to use NIS. It also initially runs `make` to create the maps on the master server.

To use `ypinit` to build a fresh set of NIS maps on the master server, do the following.

▼ How to set up the master server using `ypinit`

1. **On the master server, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Copy the contents of the `nsswitch.files` file to the `nsswitch.conf` file.**

   ```
   # cp /etc/nsswitch.files /etc/nsswitch.conf
   ```

3. **Edit the `/etc/hosts` or `/etc/inet/ipnodes` file to add the name and IP address of each of the NIS servers.**

4. **Build new maps on the master server.**

   ```
   # /usr/sbin/ypinit -m
   ```

5. **When `ypinit` prompts for a list of other machines to become NIS slave servers, type the name of the server you are working on, along with the names of your NIS slave servers.**

6. **When `ypinit` asks whether you want the procedure to terminate at the first nonfatal error or continue despite nonfatal errors, type `y`.**

   When you choose `y`, `ypinit` exits upon encountering the first problem; you can then fix it and restart `ypinit`. This is recommended if you are running `ypinit` for the first time. If you prefer to continue, you can try to manually fix all problems that occur, and then restart `ypinit`.

   Note – A nonfatal error can appear when some of the map files are not present. This is not an error that affects the functionality of NIS. You might need to add maps manually if they were not created automatically. Refer to "Default NIS Maps" on page 72 for a description of all default NIS maps.

   ---

7. **`ypinit` asks whether the existing files in the `/var/yp/`*domainname* directory can be destroyed.**

   This message is displayed only if NIS has been previously installed.

8. **After `ypinit` has constructed the list of servers, it invokes `make`.**

   This program uses the instructions contained in the `Makefile` (either the default one or the one you modified) located in `/var/yp`. The `make` command cleans any remaining comment lines from the files you designated. It also runs `makedbm` on the files, creating the appropriate maps and establishing the name of the master server for each map.

If the map or maps being pushed by the `Makefile` correspond to a domain other than the one returned by the command `domainname` on the master, you can make sure that they are pushed to the correct domain by starting `make` in the `ypinit` shell script with a proper identification of the variable `DOM`, as follows:

```
# make DOM=domainname  password
```

This pushes the `password` map to the intended domain, instead of the domain to which the master belongs.

9. **To enable NIS as the naming service, type the following.**

```
# cp /etc/nsswitch.nis /etc/nsswitch.conf
```

This replaces the current switch file with the default NIS-oriented switch file. You can edit this file as necessary.

Master Supporting Multiple NIS Domains

Normally, an NIS master server supports only one NIS domain. However, if you are using a master server to support multiple domains, you must slightly modify the steps, as described in "Setting Up the Master Server With `ypinit`" on page 85, when setting up the server to serve the additional domains.

Run the `domainname` command on the server. The domain name returned by the command is the server's default domain. The steps described in "Setting Up the Master Server With `ypinit`" on page 85 will work properly for setting up service for that domain. To configure service for any *other* domain, you must modify the `ypinit` shell script as follows.

```
# make DOM=correct-domain passwd
```

correct-domain is the name of the other domain that you are setting up service for, and `passwd` is the `make` target. This command pushes the `passwd` map to the intended domain, instead of the domain to which the master belongs.

Starting and Stopping NIS Service on the Master Server

Now that the master maps are created, you can start the NIS daemons on the master server and begin service. When you enable the NIS service, `ypserv` and `ypbind` start on the server. When a client requests information from the server, `ypserv` is the daemon that answers information requests from clients after looking them up in the NIS maps. The `ypserv` and `ypbind` daemons are administered as a unit.

There are three ways that NIS service can be started or stopped on a server:

- By automatically invoking the `/usr/lib/netsvc/yp/ypstart` script during the boot process
- By using the Service Management Facility `svcadm enable` <*fmri*> and `svcadm disable` <*fmri*> commands from the command line

  See `svcadm`(1M) for more information about SMF.
- By using the `ypstart`(1M) and `ypstop`(1M) commands from the command line

Starting NIS Service Automatically

After the NIS master server has been configured by running `ypinit`, `ypstart` is automatically invoked to start up `ypserv` when the machine is booted. See "Setting Up the Master Server With `ypinit`" on page 85.

Starting and Stopping NIS From the Command Line

Use the Service Management Facility `svcadm` commands or the `ypstart/ypstop` commands to start and stop NIS from the command line. When using `svcadm`, the instance name is needed only if you are running more than one instance of the service. For more information, see "NIS and the Service Management Facility" on page 80, or see the `svcadm`(1M), `ypstart`(1M), and `ypstop`(1M) man pages.

To begin NIS service from the command line, run the `svcadm enable` command or the `ypstart` command.

```
# svcadm enable network/nis/server:<instance>
# svcadm enable network/nis/client:<instance>
or
# ypstart
```

Note – Because there is a slight delay before `ypserv` is ready to respond to calls after startup, you should issue a three to five second sleep after `svcadm` when calling it from inside a program or script.

To stop NIS service, run the `svcadm disable` command or the `ypstop`.

```
# svcadm disable network/nis/server:<instance>
# svcadm disable network/nis/client:<instance>
or
# ypstop
```

To stop and immediately restart an NIS service, use the `svcadm restart` command.

```
# svcadm restart network/nis/server:<instance>
# svcadm restart network/nis/client:<instance>
```

Setting Up NIS Slave Servers

Your network can have one or more slave servers. Having slave servers ensures the continuity of NIS services when the master server is not available.

Preparing a Slave Server

Before actually running `ypinit` to create the slave servers, you should run the `domainname` command on each NIS slave to make sure the domain name is consistent with the master server.

Note – Domain names are case-sensitive.

Make sure that the network is working properly before you configure an NIS slave server. In particular, check to be sure you can use `rcp` to send files from the master NIS server to NIS slaves.

Setting Up a Slave Server

The following procedure shows how to set up a slave server.

▼ How to Set Up a Slave Server

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Edit the `/etc/hosts` or `/etc/inet/ipnodes` file on the slave server to add the name and IP addresses of all the other NIS servers.**

3. **Change directory to `/var/yp` on the slave server.**

Note – You must first configure the new slave server as an NIS client so that it can get the NIS maps from the master for the first time. See "Setting Up NIS Clients" on page 91 for details.

4. **Initialize the slave server as a client.**

   ```
   # /usr/sbin/ypinit -c
   ```

   The `ypinit` command prompts you for a list of NIS servers. Enter the name of the local slave you are working on first, then the master server, followed by the other NIS slave servers in your domain in order from the physically closest to the furthest in network terms.

5. **Determine if the NIS client is running, then start the client service as needed.**

   ```
   # svcs network/nis/client
   STATE          STIME     FMRI
   online         20:32:56  svc:/network/nis/client:default
   ```

   If `svc:/network/nis/client` is displayed with an `online` state, then NIS is running. If the service state is disabled, then NIS is not running.

   a. **If the NIS client is running, restart the client service.**

      ```
      # svcadm restart network/nis/client
      ```

   b. **If the NIS client is not running, start the client service.**

      ```
      # svcadm enable network/nis/client
      ```

6. **Initialize this machine as a slave.**

   ```
   # /usr/sbin/ypinit -s master
   ```

   Where *master* is the machine name of the existing NIS master server.

   Repeat the procedures described in this section for each machine you want configured as an NIS slave server.

▼ How to Start NIS on a Slave Server

The following procedure shows how to start NIS on a slave server.

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Stop the client service and start all NIS server processes.**

   ```
   # svcadm disable network/nis/client
   # svcadm enable network/nis/server
   ```

Setting Up NIS Clients

The two methods for configuring a client machine to use NIS as its naming service are explained below.

Note – The Solaris operating system does not support a configuration in which a NIS client and a Native LDAP client co-exist on the same client machine.

- `ypinit`. The recommended method for configuring a client machine to use NIS is to login to the machine as `root` and run `ypinit -c`.

  ```
  # ypinit -c
  ```

  You will be asked to name NIS servers from which the client obtains naming service information. You can list as many master or slave servers as you want. The servers that you list can be located anywhere in the domain. It is a better practice to first list the servers closest (in network terms) to the machine, than those that are on more distant parts of the net.

- *Broadcast method*. An older method of configuring a client machine to use NIS to log in to the machine as `root`, set the domain name with the `domainname` command, then run `ypbind`.

  `ypstart` will automatically invoke the NIS client in broadcast mode (`ypbind -broadcast`), if the `/var/yp/binding/‘domainname‘/ypservers` file does not exist.

  ```
  # domainname doc.com
  # mv /var/yp/binding/‘domainname‘/ypservers /var/yp/binding/‘domainname‘\
  /ypservers.bak
  # ypstart
  ```

  When you run `ypbind`, it searches the local subnet for an NIS server. If it finds a subnet, `ypbind` binds to it. This search is referred to as *broadcasting*. If there is no NIS server on the client’s local subnet, `ypbind` fails to bind and the client machine is not able to obtain namespace data from the NIS service.

CHAPTER 6

Administering NIS (Tasks)

This chapter describes how to administer NIS. The following topics are covered.

Note – The NIS service is managed by the Service Management Facility. Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. See "NIS and the Service Management Facility" on page 80 for more information about using SMF with NIS. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the`svcadm`(1M) and `svcs`(1) man pages for more details.

NIS services can also be started and stopped by using the `ypstart` and `ypstop` commands. See the `ypstart`(1M) and `ypstop`(1M) man pages for more information.

Password Files and Namespace Security

For security reasons, follow these guidelines.

- It is best to limit access to the NIS maps on the master server.

- The files used to build the NIS password maps should not contain an entry for `root` to protect against unauthorized access. To accomplish this, the password files used to build the password maps should have the `root` entry removed from them and be located in a directory other than the master server's `/etc` directory. This directory should be secured against unauthorized access.

For example, the master server password input files could be stored in a directory such as `/var/yp`, or any directory of your choice, as long as the file itself is not a link to another file and is specified in the Makefile. When you use either the Service Management Facility or the `ypstart` script to start the NIS service, the correct directory option is set according to the configuration specified in your `Makefile`.

Note – In addition to the older Solaris 1 version `passwd` file format, this implementation of NIS accepts the Solaris 2 `passwd` and `shadow` file formats as input for building the NIS password maps.

Administering NIS Users

This section includes information about setting user passwords, adding new users to an NIS domain, and assigning users to `netgroups`.

▼ How to Add a New NIS User to an NIS Domain

1. **On the master NIS server, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Create the new user's login ID with the `useradd` command.**

   `# useradd` *userID*

   userID is the login ID of the new user. This command creates entries in the `/etc/passwd` and `/etc/shadow` files on the master NIS server.

3. **Create the new user's initial password.**

   To create an initial password that the new user can use to log in, run the `passwd` command.

   `# passwd` *userID*

   Where *userID* is the login ID of the new user. You will be prompted for the password to assign to this user.

This step is necessary because the password entry created by the `useradd` command is locked, which means that the new user cannot log in. By specifying an initial password, you unlock the entry.

4. **If necessary, copy the new entry into the server's `passwd` map input files.**

   The map source files on your master server should be in a directory other than `/etc`. Copy and paste the new lines from the `/etc/passwd` and `/etc/shadow` files into the `passwd` map input files on the server. See "Password Files and Namespace Security" on page 93 for additional information.

   For example, if you added the new user `brown`, the line from `/etc/passwd` that you would copy to your `passwd` input file would look like the following.

   ```
   brown:x:123:10:User brown:/home/brown:/bin/csh:
   ```

   The line for `brown` that you would copy from `/etc/shadow` would look like:

   ```
   brown:W12345GkHic:6445::::::
   ```

5. **Make sure that the `Makefile` correctly specifies the directory where the password input file resides.**

6. **If appropriate, delete the new user's entries from `/etc/passwd` and `/etc/shadow` input files.**

   For security reasons, do not keep user entries in the NIS master server `/etc/passwd` and `/etc/shadow` files. After copying the entries for the new user to the NIS map source files that are stored in some other directory, use the `userdel` command on the master server to delete the new user.

   For example, to delete the new user `brown` from the master server's `/etc` files, you would enter the following.

   ```
   # userdel brown
   ```

   For more information about `userdel`, see the `userdel` man page.

7. **Update the NIS `passwd` maps.**

   After you have updated the `passwd` input file on the master server, update the `passwd` maps by running `make` in the directory containing the source file.

   ```
   # userdel brown
   # cd /var/yp
   # /usr/ccs/bin/make passwd
   ```

8. **Tell the new user the initial password you have assigned to his or her login ID.**

   After logging in, the new user can run `passwd` at any time to establish a different password.

Setting User Passwords

Users run `passwd` to change their passwords.

% **`passwd`** *username*

Before users can change their passwords, you must start the `rpc.yppasswdd` daemon on the master server to update the password file.

The `rpc.yppasswdd` daemon starts automatically on the master server. Notice that when the `-m` option is given to `rpc.yppasswdd`, a `make` is forced in `/var/yp` immediately following a modification of the file. If you want to avoid having this `make` take place each time the `passwd` file is changed, remove the `-m` option from the `rpc.yppasswd` command in the `ypstart` script and control the pushing of the `passwd` maps through the `crontab` file.

Note – No arguments should follow the `rpc.yppasswd -m` command. Although you can edit the `ypstart` script file to achieve a different action, it is not recommended that you modify this file other than optionally removing the `-m` option. All commands and daemons invoked by this file with the proper set of command line parameters. If you choose to edit this file, be especially careful when editing the `rpc.yppasswdd` command. If you add an explicit call to the `passwd.adjunct` file, the exact `$PWDIR/security/passwd.adjunct` path must be used; otherwise, incorrect processing results.

NIS Netgroups

NIS netgroups are groups (sets) of users or machines that you define for your administrative purposes. For example, you can create netgroups that do the following.

- Define a set of users who can access a specific machine
- Define a set of NFS client machines to be given some specific file system access
- Define a set of users who are to have administrator privileges on all the machines in a particular NIS domain

Each netgroup is given a netgroup name. Netgroups do not directly set permissions or access rights. Instead, the netgroup names are used by other NIS maps in places where a user name or machine name would normally be used. For example, suppose you created a netgroup of network administrators called `netadmins`. To grant all members of the `netadmins` group access to a given machine, you need only add a `netadmin` entry to that machine's `/etc/passwd` file. Netgroup names can also be added to the `/etc/netgroup` file and propagated to the NIS `netgroup` map. See `netgroup`(4) for more detailed information on using netgroups.

On a network using NIS, the `netgroup` input file on the master NIS server is used for generating three maps: `netgroup`, `netgroup.byuser`, and `netgroup.byhost`. The `netgroup` map contains the basic information in the `netgroup` input file. The two other NIS maps contain information in a format that speeds lookups of netgroup information, given the machine or user.

Entries in the `netgroup` input file are in the format: *name ID*, where *name* is the name you give to a netgroup, and *ID* identifies a machine or user who belongs to the netgroup. You can specify as many IDs (members) to a netgroup as you want,

separated by commas. For example, to create a netgroup with three members, the `netgroup` input file entry would be in the format: *name ID*, *ID*, *ID*. The member IDs in a `netgroup` input file entry are in the following format.

```
([-|machine], [-|user], [domain])
```

Where *machine* is a machine name, *user* is a user ID, and *domain* is the machine or user's NIS domain. The *domain* element is optional and should only be used to identify machines or users in some other NIS domain. The *machine* and *user* element of each member's entry are required, but a dash (`-`) is used to denote a null. There is no necessary relationship between the machine and user elements in an entry.

The following are two sample `netgroup` input file entries, each of which create a netgroup named `admins` composed of the users `hauri` and `juanita` who is in the remote domain `sales` and the machines `altair` and `sirius`.

```
admins (altair, hauri), (sirius,juanita,sales)

admins (altair,-), (sirius,-), (-,hauri), (-,juanita,sales)
```

Various programs use the netgroup NIS maps for permission checking during login, remote mount, remote login, and remote shell creation. These programs include `mountd`, `login`, `rlogin`, and `rsh`. The `login` command consults the netgroup maps for user classifications if it encounters netgroup names in the `passwd` database. The `mountd` daemon consults the netgroup maps for machine classifications if it encounters netgroup names in the `/etc/dfs/dfstab` file. `rlogin` and `rsh` In fact, any program that uses the `ruserok` interface consults the netgroup maps for both machine and user classifications if they encounter netgroup names in the `/etc/hosts.equiv` or `.rhosts` files.

If you add a new NIS user or machine to your network, be sure to add them to appropriate netgroups in the `netgroup` input file. Then use the `make` and `yppush` commands to create the netgroup maps and push them to all of your NIS servers. See `netgroup`(4) for detailed information on using netgroups and netgroup input file syntax.

Working With NIS Maps

This section contains the following information:

Obtaining Map Information

Users can obtain information from and about the maps at any time by using the `ypcat`, `ypwhich`, and `ypmatch` commands. In the examples that follow, *mapname* refers both to the official name of a map and to its nickname, if any.

To list all the values in a map, type the following.

```
% ypcat mapname
```

To list both the keys and the values (if any) in a map, type the following.

```
% ypcat -k mapname
```

To list all the map nicknames, type any of the following commands.

```
% ypcat -x
% ypmatch -x
% ypwhich -x
```

To list all the available maps and their master(s), type the following.

```
% ypwhich -m
```

To list the master server for a particular map, type the following.

```
% ypwhich -m mapname
```

To match a key with an entry in a map, type the following.

```
% ypmatch key mapname
```

If the item you are looking for is not a key in a map, type the following.

```
% ypcat mapname | grep item
```

where *item* is the information for which you are searching. To obtain information about other domains, use the `-d domainname` options of these commands.

If the machine requesting information for a domain other than its default does not have a binding for the requested domain, `ypbind`consults the `/var/yp/binding/`*domainname*`/ypservers` file for a list of servers for that domain. If this file does not exist it issues an RPC broadcast for a server. In this case, there must be a server for the requested domain on the same subnet as the requesting machine.

Changing a Map's Master Server

To change the master server for a selected map, you first have to build the map on the new NIS master. Since the old master server name occurs as a key-value pair in the existing map (this pair is inserted automatically by `makedbm`), copying the map to the new master or transferring a copy to the new master with `ypxfr` is insufficient. You have to reassociate the key with the new master server name. If the map has an ASCII source file, you should copy this file to the new master.

▼ How to Change a Map's Master Server

1. **On the new master, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Change directories.**

   ```
   newmaster# cd /var/yp
   ```

3. **The `Makefile` must have an entry for the new map before you specify the map to make. If this is not the case, edit the `Makefile` now, using a map called `sites.byname`.**

4. **To update or remake the map, type the following.**

   ```
   newmaster# make sites.byname
   ```

5. **If the old master remains an NIS server, remote log in (`rlogin`) to the old master and edit `Makefile`. Make sure you comment out the section of the `Makefile` that made `sites.byname` so that it is no longer made there.**

6. **If `sites.byname` only exists as an `ndbm` file, remake it on the new master by disassembling a copy from any NIS server, then running the disassembled version through `makedbm`.**

   ```
   newmaster# cd /var/yp
   newmaster# ypcat sites.byname | makedbm -domain/sites.byname
   ```

   After making the map on the new master, you must send a copy of the new map to the other slave servers. Do not use `yppush`, because the other slaves will try to get new copies from the old master, rather than the new one. A typical method for circumventing this is to transfer a copy of the map from the new master back to the old master. To do this, become superuser, or assume an equivalent role, on the old master server and type the following.

   ```
   oldmaster# /usr/lib/netsvc/yp/ypxfr -h newmaster sites.byname
   ```

   Now it is safe to run `yppush`. Any remaining slave servers still believe that the old master is the current master and will attempt to get the current version of the map from the old master. When clients do so, they will get the new map, which names the new master as the current master.

   If this method fails, you can log in as root on each NIS server and execute the `ypxfr` command shown above.

Modifying Configuration Files

NIS intelligently parses the setup files. Although this makes NIS administration easier, it does make the behavior of NIS more sensitive to changes in the setup and configuration files.

Use the procedures in this section when modifying any of the following.

- `/var/yp/Makefile` to add or delete supported maps
- Adding or deleting `/etc/resolv.conf` to allow or deny DNS forwarding
- Adding or deleting `$PWDIR/security/passwd.adjunct` to allow or deny C2 security (`$PWDIR` is defined in `/var/yp/Makefile`)

▼ How to Modify Configuration Files

You do not have to stop and start NIS when changing NIS maps or the map source files.

Keep the following in mind.

- Deleting a map or source file from an NIS master server does not automatically result in corresponding deletions from slave servers. You must delete maps and source files from slave servers by hand.
- New maps do not automatically get pushed to existing slave servers. You must run `ypxfr` from the slaves.

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Stop the NIS server.**

   ```
   # svcadm disable network/nis/server
   ```

3. **Make the necessary changes to your files.**

4. **Start the NIS server.**

   ```
   # svcadm enable network/nis/server
   ```

Modifying and Using the `Makefile`

You can modify the `Makefile` provided by default in `/var/yp` to suit your needs. You can add or delete maps, and you can change the names of some of the directories.

Tip – Keep an unmodified copy of the original `Makefile` for future reference.

Working With the `Makefile`

To add a new NIS map, you must get copies of the `ndbm` files for the map into the `/var/yp/`*domainname* directory on each of the NIS servers in the domain. This is normally done for you by the `Makefile`. After deciding which NIS server is the

master of the map, modify the Makefile on the master server so that you can conveniently rebuild the map. Different servers can be masters of different maps, but in most cases this leads to administrative confusion. Try to set only one server as the master of all maps.

Typically a human-readable text file is filtered through awk, sed, or grep to make it suitable for input to makedbm. Refer to the default Makefile for examples. See the make(1S) for general information about the make command.

Use the mechanisms already in place in the Makefile when deciding how to create dependencies that make will recognize. Be aware that make is very sensitive to the presence or absence of tabs at the beginning of lines within the dependency rules. A missing tab can invalidate an entry that is otherwise well formed.

Adding an entry to the Makefile involves the following.

- Adding the name of the database to the all rule
- Writing the time rule
- Adding the rule for the database

For example, in order for the Makefile to work on automounter input files, you would have to add the auto_direct.time and auto_home.time maps to the NIS database.

To add these maps to the NIS database you need to modify the Makefile.

Changing Makefile Macros/Variables

You can change the settings of the variables defined at the top of the Makefile by changing the value to the right of the equal sign (=). For instance, if you do not want to use the files located in /etc as input for the maps, but you would rather use files located in another directory, such as /var/etc/domainname, you should change DIR from DIR=/etc to DIR=/var/etc/*domainname*. You should also change PWDIR from PWDIR=/etc to PWDIR=/var/etc/*domainname*.

The variables are the following.

- *DIR*= The directory containing all of the NIS input files except passwd and shadow. The default value is /etc. Since it is not good practice to use the files in the master server's /etc directory as NIS input files, you should change this value.
- *PWDIR*= The directory containing the passwd and shadow NIS input files. Since it is not good practice to use the files in the master server's /etc directory as NIS input files, you should change this value.
- *DOM*= The NIS domain name. The default value of DOM is set using the domainname command. However, most NIS commands use the current machine's domain which is set in the machine's /etc/defaultdomain file.

Modifying `Makefile` Entries

The following procedure describes how to add and delete databases from the `Makefile`.

▼ How to Modify the `Makefile` to Use Specific Databases

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Modify the line that starts with the word `all` by adding the name(s) of the database you want to add:**

```
all: passwd group hosts ethers networks rpc services protocols \
    netgroup bootparams aliases netid netmasks \
    auto_direct auto_home auto_direct.time auto_home.time
```

   The order of the entries is not relevant, but the blank space at the beginning of the continuation lines must be a Tab, not spaces.

3. **Add the following lines at the end of the `Makefile`:**

```
auto_direct: auto_direct.time
auto_home: auto_home.time
```

4. **Add an entry for `auto_direct.time` in the middle of the file.**

```
auto_direct.time: $(DIR)/auto_direct
 @(while read L; do echo $$L; done < $(DIR)/auto_direct
 $(CHKPIPE)) | \ (sed -e "/^#/d" -e "s/#.*$$//" -e "/^ *$$/d"
 $(CHKPIPE)) | \ $(MAKEDBM) - $(YPDBDIR)/$(DOM)/auto_direct;
 @touch auto_direct.time;
 @echo "updated auto_direct";
 @if [ ! $(NOPUSH) ]; then $(YPPUSH) auto_direct; fi
 @if [ ! $(NOPUSH) ]; then echo "pushed auto_direct"; fi
```

   where

   - `CHKPIPE` makes certain that the operations to the left of the pipe (`|`) are successfully completed before piping the results to next commands. If the operations to the left of the pipe do not successfully complete, the process is terminated with a `NIS make terminated` message.
   - `NOPUSH` prevents the `makefile` from calling `yppush` to transfer the new map to the slave servers. If `NOPUSH` is not set, the push is done automatically.

   The `while` loop at the beginning is designed to eliminate any backslash-extended lines in the input file. The `sed` script eliminates comment and empty lines.

   The same procedure should be followed for all other automounter maps, such as `auto_home`, or any other nondefault maps.

5. **Run `make`.**

   `# make` *mapname*

   Where *mapname* is the name of the map you want to make.

▼ How to Modify the `Makefile` to Delete Databases

If you do not want the `Makefile` to produce maps for a specific database, edit the `Makefile` as follows.

1. **Delete the name of the database from the `all` rule.**
2. **Delete or comment out the database rule for the database you want to delete.**

   For example, to delete the `hosts` database, the `hosts.time` entry should be removed.
3. **Remove the time rule.**

   For example, to delete the `hosts` database, the `hosts: hosts.time` entry should be removed.
4. **Remove the map from the master and slave servers.**

Updating and Modifying Existing Maps

After you have installed NIS, you might discover that some maps require frequent updating while others never need to change. For example, the `passwd.byname` map can change frequently on a large company's network, while the `auto_master` map changes little, if at all.

As mentioned in "Default NIS Maps" on page 72, the default location of the default NIS maps is on the master server in `/var/yp/`*domainname*, where *domainname* is the name of the NIS domain. When you need to update a map, you can use one of two updating procedures, depending on whether or not it is a default map.

- A default map is a map in the default set created by `ypinit` from the network databases.
- Nondefault maps can be any of the following.
  - Maps included with an application purchased from a vendor
  - Maps created specifically for your site
  - Maps created from a nontext file

The following sections explain how to use various updating tools. In practice, you might decide to only use them if you add nondefault maps or change the set of NIS servers after the system is already up and running.

▼ How to Update Maps Supplied With the Default Set

Use the following procedure for updating maps supplied with the default set.

1. **Become a superuser on the master server.**
   Always modify NIS maps only on the master server.
2. **Edit the source file for the map you want to change, whether that file resides in `/etc` or in some other directory of your choice.**
3. **Type the following.**

   ```
   # cd /var/yp
   # make mapname
   ```

   The `make` command then updates your map according to the changes you made in its corresponding file. It also propagates the changes among the other servers.

Propagating an NIS Map

After a map is changed, the `Makefile` uses `yppush` to propagate a new map to the slave servers (unless `NOPUSH` is set in the `Makefile`). It does this by informing the `ypserv` daemon and sending a map transfer request. The `ypserv` daemon on the slave then starts a `ypxfr` process, which in turn contacts the `ypxfrd` daemon on the master server. Some basic checks are made (for example did the map really change?) and then the map is transferred. `ypxfr` on the slave then sends a response to the `yppush` process indicating whether the transfer succeeded.

Note – The above procedure will *not* work for newly created maps that do not yet exist on the slave servers. New maps must be sent to the slave servers by running `ypxfr` on the slaves.

Occasionally, maps fail to propagate and you must to use `ypxfr` manually to send new map information. You can choose to use `ypxfr` in two different ways: periodically through the root `crontab` file, or interactively on the command line. These approaches are discussed in the following sections.

Using `cron` for Map Transfers

Maps have different rates of change. For instance, some might not change for months at a time, such as `protocols.byname` among the default maps and `auto_master` among the nondefault maps; but `passwd.byname` can change several times a day. Scheduling map transfer using the `crontab` command allows you to set specific propagation times for individual maps.

To periodically run `ypxfr` at a rate appropriate for the map, the root `crontab` file on each slave server should contain the appropriate `ypxfr` entries. `ypxfr` contacts the master server and transfers the map only if the copy on the master server is more recent than the local copy.

Note – If your master server runs `rpc.yppasswdd` with the default `-m` option, then each time someone changes their `yp` password, the `passwd` daemon runs `make`, which rebuilds the `passwd` maps.

Using Shell Scripts With `cron` and `ypxfr`

As an alternative to creating separate `crontab` entries for each map, you might prefer to have the root `crontab` command run a shell script that periodically updates all maps. Sample map-updating shell scripts are n the `/usr/lib/netsvc/yp` directory. The script names are `ypxfr_1perday`, `ypxfr_1perhour`, and `ypxfr_2perday`. You can modify or replace these shell scripts to fit your site requirements. Example 6–1 shows the default `ypxfr_1perday` shell script.

EXAMPLE 6–1 `ypxfr_1perday` Shell Script

```
#! /bin/sh
#
# ypxfr_1perday.sh - Do daily yp map check/updates
PATH=/bin:/usr/bin:/usr/lib/netsvc/yp:$PATH
export PATH
# set -xv
ypxfr group.byname
ypxfr group.bygid
ypxfr protocols.byname
ypxfr protocols.bynumber
ypxfr networks.byname
ypxfr networks.byaddr
ypxfr services.byname
ypxfr ypservers
```

This shell script updates the maps once per day, if the root `crontab` is executed daily. You can also have scripts that update maps once a week, once a month, once every hour, and so forth, but be aware of the performance degradation implied in frequently propagating the maps.

Run the same shell scripts as root on each slave server configured for the NIS domain. Alter the exact time of execution from one server to another to avoid bogging down the master.

If you want to transfer the map from a particular slave server, use the `-h` *machine* option of `ypxfr` within the shell script. Here is the syntax of the commands you put in the script.

```
# /usr/lib/netsvc/yp/ypxfr -h machine [ -c ] mapname
```

Where *machine* is the name of the server with the maps you want to transfer, and *mapname* is the name of the requested map. If you use the `-h` option without specifying a machine, `ypxfr` tries to get the map from the master server. If `ypserv` is not running locally at the time `ypxfr` is executed, you must use the `-c` flag so that `ypxfr` does not send a clear current map request to the local `ypserver`.

You can use the `-s` *domain* option to transfer maps from another domain to your local domain. These maps should be the same across domains. For example, two domains might share the same `services.byname` and `services.byaddr` maps. Alternatively, you can use `rcp`, or `rdist` for more control, to transfer files across domains.

Directly Invoking `ypxfr`

The second method of invoking `ypxfr` is to run it as a command. Typically, you do this only in exceptional situations—for example, when setting up a temporary NIS server to create a test environment or when trying to quickly get an NIS server that has been out of service consistent with the other servers.

Logging `ypxfr` Activity

The transfer attempts and results of `ypxfr` can be captured in a log file. If a file called `/var/yp/ypxfr.log` exists, results are appended to it. No attempt to limit the size of the log file is made. To prevent it from growing indefinitely, empty it from time to time by typing the following.

```
# cd /var/yp
# cp ypxfr.log ypxfr.log.old
# cat /dev/null > /var/yp/ypxfr.log
```

You can have `crontab` execute these commands once a week. To turn off logging, remove the log file.

Modifying Default Maps

To update a nondefault map, you must do the following.

1. Create or edit its corresponding text file.
2. Build (or rebuild) the new or updated map. There are two ways to build a map.
   - Use the Makefile. Using the Makefile is the preferred method of building a non-default map. If the map has an entry in the `Makefile`, run `make` *name* where *name* is the name of map you want to build. If the map does not have a `Makefile` entry, try to create one following the instructions in "Modifying and

Using the Makefile" on page 100.

- Use the /usr/sbin/makedbm program. makedbm(1M) fully describes this command.

Using makedbm to Modify a Non-Default Map

There are two different methods for using makedbm to modify maps if you do not have an input file:

- Redirect the makedbm -u output to a temporary file, modify the file, then use the modified file as input to makedbm.
- Have the output of makedbm -u operated on within a pipeline that feeds into makedbm. This is appropriate if you can update the disassembled map with either awk, sed, or a cat append.

Creating New Maps from Text Files

Assume that a text file /var/yp/mymap.asc was created with an editor or a shell script on the master. You want to create an NIS map from this file and locate it in the *homedomain* subdirectory. To do this, type the following on the master server.

```
# cd /var/yp
# makedbm mymap.asc homedomain/mymap
```

The *mymap* map now exists on the master server in the directory *homedomain*. To distribute the new map to slave servers run ypxfr.

Adding Entries to a File-Based Map

Adding entries to mymap is simple. First, you must modify the text file /var/yp/*mymap*.asc. If you modify the actual dbm files without modifying the corresponding text file, the modifications are lost. Then run makedbm as shown above.

Creating Maps From Standard Input

When no original text file exists, create the NIS map from the keyboard by typing input to makedbm, as shown below (end with Control-D).

```
ypmaster# cd /var/yp
ypmaster# makedbm -homedomain/mymapkey1 value1  key2 value2  key3 value3
```

Modifying Maps Made From Standard Input

If you later need to modify the map, you can use `makedbm` to disassemble the map and create a temporary text intermediate file. To disassemble the map and create a temporary file, type the following.

```
% cd /var/yp
% makedbm -u homedomain/mymap > mymap.temp
```

The resulting temporary file *mymap*`.temp` has one entry per line. You can edit this file as needed, using any text editor.

To update the map, give the name of the modified temporary file to `makedbm` by typing the following.

```
% makedbm mymap.temp homedomain/mymap
% rm mymap.temp
```

Then propagate the map to the slave servers, by becoming root and typing the following.

```
# yppush mymap
```

The preceding paragraphs explained how to use `makedbm` to create maps; however, almost everything you actually have to do can be done by `ypinit` and `Makefile` unless you add nondefault maps to the database or change the set of NIS servers after the system is already up and running.

Whether you use the `Makefile` in `/var/yp` or some other procedure the goal is the same. Anew pair of well-formed `dbm` files must end up in the maps directory on the master server.

Adding a Slave Server

After NIS is running, you might need to create an NIS slave server that you did not include in the initial list given to `ypinit`.

To add an NIS slave server:

▼ How to Add a Slave Server

1. **On the master server, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Change to the NIS domain directory.**

   # **cd /var/yp/***domainname*

3. **Disassemble the `ypservers` file.**

   ```
   # makedbm -u ypservers >/tmp/temp_file
   ```

   The `makedbm` command converts `ypservers` from `ndbm` format to a temporary ASCII file `/tmp/temp_file`.

4. **Edit the `/tmp/temp_file` file using a text editor. Add the name of the new slave server to the list of servers. Then save and close the file.**

5. **Run the `makedbm` command with `temp_file` as the input file and `ypservers` as the output file.**

   ```
   # makedbm /tmp/temp_file ypservers
   ```

   `makedbm` then converts `ypservers` back into `ndbm` format.

6. **Verify that the `ypservers` map is correct (since there is no ASCII file for `ypservers`) by typing the following on the slave.**

   ```
   slave3# makedbm -u ypservers
   ```

   The `makedbm` command displays each entry in `ypservers` on your screen.

Note – If a machine name is not in `ypservers`, it will not receive updates to the map files because `yppush` consults this map for the list of slave servers.

---

7. **On the new NIS slave, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

8. **Set up the new slave server's NIS domain directory.**

   Copy the NIS map set from the master server, then start the NIS client. When running the `ypinit` command, follow the prompts and list the NIS servers in order of preference.

   ```
   slave3# cd /var/yp
   slave3# ypinit -c
   slave3# svcadm enable network/nis/client
   ```

9. **Initialize this machine as a slave.**

   slave3# **/usr/sbin/ypinit -s** *ypmaster*

   where *ypmaster* is the machine name of the existing NIS master server.

10. **Stop the machine running as an NIS client.**

    ```
    # svcadm disable network/nis/client
    ```

11. **Start NIS slave service.**

```
# svcadm enable network/nis/server
```

Using NIS With C2 Security

If the `$PWDIR/security/passwd.adjunct` file is present, C2 security is started automatically. (`$PWDIR` is defined in `/var/yp/Makefile`.) The C2 security mode uses the `passwd.adjunct` file to create the `passwd.adjunct` NIS map. In this implementation, NIS allows you to use both the `passwd.adjunct` file and `shadow` file to manage security. The `passwd.adjunct` file is processed only when you type the following.

```
# make passwd.adjunct
```

The `make passwd` command processes the passwd map only, not the passwd.adjunct map when you run `make` manually in the C2 security mode.

Changing a Machine's NIS Domain

To change the NIS domain name of a machine, do the following.

▼ How to Change a Machine's NIS Domain Name

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Edit the machine's `/etc/defaultdomain` file, exchanging its present contents with the new domain name for the machine.**

   For example, if the current domain name is `sales.doc.com`, you might change it to `research.doc.com`.

3. **Run `domainname 'cat /etc/defaultdomain'`**

4. **Set the machine up as an NIS client, slave, or master server.**

   See for Chapter 5 for details.

Using NIS in Conjunction With DNS

Typically, NIS clients are configured with the `nsswitch.conf` file to use only NIS for machine name and address lookups. If this type of lookup fails, an NIS server can forward these lookups to DNS.

▼ How to Configure Machine Name and Address Lookup Through NIS and DNS

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **The two map files, `hosts.byname` and `hosts.byaddr` must include the `YP_INTERDOMAIN` key. To test this key, edit the `Makefile` and modify the following lines.**

   ```
   #B=-b
   B=
   ```

   to

   ```
   B=-b
   #B=
   ```

   `makedbm` will now start with the `-b` flag when it makes the maps, and the `YP_INTERDOMAIN` key will be inserted into the `ndbm` files.

3. **Run the `make` command to rebuild maps.**

   ```
   # /usr/ccs/bin/make hosts
   ```

4. **Check that all the NIS server's `/etc/resolv.conf` files point to valid nameservers.**

   Note – If you have NIS servers that are not running Solaris, Release 2, make sure `YP_INTERDOMAIN` exists in the hosts maps.

   ---

5. **To enable DNS forwarding, restart each server.**

   ```
   # svcadm restart network/nis/server:<instance>
   ```

   In this implementation of NIS, `ypserv` automatically starts with the `-d` option to forward requests to DNS.

Dealing with Mixed NIS Domains

If the master and slave servers are not both running Solaris 2, refer to the following table for how to avoid potential problems. The notation "4.0.3+" refers to that and later releases of SunOS. `makedm -b` is a reference to the "B" variable in the `Makefile`.

TABLE 6–1 NIS/DNS in Heterogeneous NIS Domains

	Master		
Slave	**4.0.3+**	**Solaris NIS**	
4.0.3+	Master: `makedbm -b`	Master: `makedbm -b`	Master: `ypserv -d`
	Slave: `ypxfr`	Slave: `ypxfr -b`	Slave: `ypxfr -b`
Solaris NIS	Master: `makedbm -b`	Master: `makedbm -b`	Master: `ypserv -d`
	Slave: `ypxfr`	Slave: `ypxfr`	Slave:`ypxfr` with `resolv.conf` or `ypxfr -b`

Turning Off NIS Services

If `ypserv` on the NIS master is disabled, you can no longer update any of the NIS maps.

- To disable NIS on a client, type the following.

  ```
  # svcadm disable network/nis/client
  ```

- To disable NIS on a specific slave or master server, type the following on the server.

  ```
  # svcadm disable network/nis/server
  ```

CHAPTER 7

NIS Troubleshooting

This chapter explains how to resolve problems encountered on networks running NIS. It covers problems seen on an NIS client and those seen on an NIS server.

Before trying to debug an NIS server or client, review Chapter 4 which explains the NIS environment. Then look for the subheading in this section that best describes your problem.

Note – The NIS service is managed by the Service Management Facility. Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. See "NIS and the Service Management Facility" on page 80 for more information about using SMF with NIS. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

NIS services can also be started and stopped by using the `ypstart` and `ypstop` commands. See the `ypstart`(1M) and `ypstop`(1M) man pages for more information.

NIS Binding Problems

Symptoms

Common symptoms of NIS binding problems include the following.

- Messages saying that `ypbind` can't find or communicate with a server
- Messages saying that server not responding

- Messages saying that NIS is unavailable
- Commands on a client limp along in background mode or function much slower than normal
- Commands on a client hang. Sometimes commands hang even though the system as a whole seems fine and you can run new commands
- Commands on a client crash with obscure messages, or no message at all

NIS Problems Affecting One Client

If only one or two clients are experiencing symptoms that indicate NIS binding difficulty, the problems probably are on those clients. If many NIS clients are failing to bind properly, the problem probably exists on one or more of the NIS servers. See "NIS Problems Affecting Many Clients" on page 117.

`ypbind` Not Running on Client

One client has problems, but other clients on the same subnet are operating normally. On the problem client, run `ls -l` on a directory, such as `/usr`, that contains files owned by many users, including some not in the client `/etc/passwd` file. If the resulting display lists file owners who are not in the local `/etc/passwd` as numbers, rather than names, this indicates that NIS service is not working on the client.

These symptoms usually mean that the client `ypbind` process is not running. Verify whether the NIS client service is running.

```
client# svcs network/nis/client
STATE          STIME    FMRI
disabled       Sep_01   svc:/network/nis/client:default
```

If the client is disabled, log in as superuser, or assume an equivalent role, and start the NIS client service.

```
client# svcadm enable network/nis/client
```

Missing or Incorrect Domain Name

One client has problems, the other clients are operating normally, but `ypbind` is running on the problem client. The client might have an incorrectly set domain.

On the client, run the `domainname` command to see which domain name is set.

```
client7# domainname neverland.com
```

Compare the output with the actual domain name in `/var/yp` on the NIS master server. The actual NIS domain is shown as a subdirectory in the `/var/yp` directory.

```
Client7# ls /var/yp...
-rwxr-xr-x 1 root Makefile
drwxr-xr-x 2 root binding
drwx------ 2 root doc.com ...
```

If the domain name returned by running `domainname` on a machine is not the same as the server domain name listed as a directory in `/var/yp`, the domain name specified in the machine's `/etc/defaultdomain` file is incorrect. Log in as superuser or assume an equivalent role, and correct the client's domain name in the machine's `/etc/defaultdomain` file. This assures that the domain name is correct every time the machine boots. Now reboot the machine.

Note – The domain name is case-sensitive.

Client Not Bound to Server

If your domain name is set correctly, `ypbind` is running, and commands still hang, then make sure that the client is bound to a server by running the `ypwhich` command. If you have just started `ypbind`, then run `ypwhich` several times (typically, the first one reports that the domain is not bound and the second succeeds normally).

No Server Available

If your domain name is set correctly, `ypbind` is running, and you get messages indicating that the client cannot communicate with a server, this might indicate a number of different problems:

- Does the client have a `/var/yp/binding/`*domainname*`/ypservers` file containing a list of servers to bind to? If not, run `ypinit -c` and specify in order of preference the servers that this client should bind to.
- If the client does have a `/var/yp/binding/`*domainname*`/ypservers` file, are there enough servers listed in it if one or two become unavailable? If not, add additional servers to the list by running `yppinit -c`.
- If none of the servers listed in the client's `ypservers` file are available, the client searches for an operating server using broadcast mode. If there is a functioning server on the client's subnet, the client will find it (though performance might be slowed during the search). If there are no functioning servers on the client's subnet can solve the problem in several ways:
  - If the client has no server on the subnet and no route to one, you can install a new slave server on that subnet.
  - You can make sure your routers are configured to pass broadcast packets so that the client can use broadcast to find a server on another subnet. You can use the `netstat -r` command to verify the route.

- If there should be a route, but it is not working, make sure that the route daemon `in.routed/in.rdisc` is running. If it is not running, start it.

Note – For reasons of security and administrative control it is preferable to specify the servers a client is to bind to in the client's `ypservers` file rather than have the client search for servers through broadcasting. Broadcasting slows down the network, slows the client, and prevents you from balancing server load by listing different servers for different clients.

- Do the servers listed in a clients `ypservers` file have entries in the `/etc/hosts` file? If not, add the servers to the NIS maps hosts input file and rebuild your maps by running `yppinit -c` or `ypinit -s` as described "Working With NIS Maps" on page 97.
- Is the `/etc/nsswitch.conf` file set up to consult the machine's local `hosts` file in addition to NIS? See Chapter 2 for more information on the switch.
- Is the `/etc/nsswitch.conf` file set up to consult `files` first for `services` and `rpc`? See Chapter 2 for more information on the switch.

`ypwhich` Displays Are Inconsistent

When you use `ypwhich` several times on the same client, the resulting display varies because the NIS server changes. This is normal. The binding of the NIS client to the NIS server changes over time when the network or the NIS servers are busy. Whenever possible, the network becomes stable at a point where all clients get acceptable response time from the NIS servers. As long as your client machine gets NIS service, it does not matter where the service comes from. For example, an NIS server machine can get its own NIS services from another NIS server on the network.

When Server Binding is Not Possible

In extreme cases where local server binding is not possible, use of the `ypset` command can temporarily allow binding to another server, if available, on another network or subnet. However, in order to use the `-ypset` option, `ypbind` must be started with either the `-ypset` or `-ypsetme` options.

Note – For security reasons, the use of the `-ypset` and `-ypsetme` options should be limited to debugging purposes under controlled circumstances. Use of the `-ypset` and `-ypsetme` options can result in serious security breaches because while the daemons are running, anyone can alter server bindings causing trouble for others and permitting unauthorized access to sensitive data. If you must start `ypbind` with these options, once you have fixed the problem you should kill `ypbind` and restart it again without those options.

`ypbind` Crashes

If `ypbind` crashes almost immediately each time it is started, look for a problem in some other part of the system. Check for the presence of the `rpcbind` daemon by typing the following.

```
% ps -e | grep rpcbind
```

If `rpcbind` is not present or does not stay up or behaves strangely, consult your RPC documentation.

You might be able to communicate with `rpcbind` on the problematic client from a machine operating normally. From the functioning machine, type the following.

```
% rpcinfo client
```

If `rpcbind` on the problematic machine is fine, `rpcinfo` produces the following output.

```
program    version    netid    address    service    owner
...
100007    2    udp    0.0.0.0.2.219    ypbind    superuser
100007    1    udp    0.0.0.0.2.219    ypbind    superuser
100007    1    tcp    0.0.0.0.2.220    ypbind    superuser
100007    2    tcp    0.0.0.0.128.4    ypbind    superuser
100007    2    ticotsord    \000\000\020H    ypbind    superuser
100007    2    ticots    \000\000\020K    ypbind    superuser
...
```

Your machine will have different addresses. If the addresses are not displayed, `ypbind` has been unable to register its services. Reboot the machine and run `rpcinfo` again. If the `ypbind` processes are there and they change each time you try to restart the NIS service, reboot the system, even if the `rpcbind` daemon is running.

NIS Problems Affecting Many Clients

If only one or two clients are experiencing symptoms that indicate NIS binding difficulty, the problems probably are on those clients. See "NIS Problems Affecting One Client" on page 114. If many NIS clients are failing to bind properly, the problem probably exists on one or more of the NIS servers.

`rpc.yppasswdd` Considers a Non-Restricted Shell That Begins With `r` to be Restricted

1. Create `/etc/default/yppasswdd` that contains a special string: `"check_restricted_shell_name=1"`.
2. If the `"check_restricted_shell_name=1"` string is commented out, the 'r' check will no occur.

Network or Servers Are Overloaded

NIS can hang if the network or NIS servers are so overloaded that `ypserv` cannot get a response back to the client `ypbind` process within the time-out period.

Under these circumstances, every client on the network experiences the same or similar problems. In most cases, the condition is temporary. The messages usually go away when the NIS server reboots and restarts `ypserv`, or when the load on the NIS servers or network itself decreases.

Server Malfunction

Make sure the servers are up and running. If you are not physically near the servers, use the `ping` command.

NIS Daemons Not Running

If the servers are up and running, try to find a client machine behaving normally, and run the `ypwhich` command. If `ypwhich` does not respond, kill it. Then log in as `root` on the NIS server and check if the NIS process is running by entering the following.

```
# ps -e | grep yp
```

Note – Do not use the `-f` option with `ps` because this option attempts to translate user IDs to names, which causes more naming service lookups that might not succeed.

If neither the NIS server (ypserv) nor the NIS client (ypbind) daemons are running, restart them by typing one of the following.

```
# svcadm restart network/nis/server
or
# /usr/lib/netsvc/yp/ypstop
# /usr/lib/netsvc/yp/ypstart
```

If both the `ypserv` and `ypbind` processes are running on the NIS server, then run `ypwhich`. If `ypwhich` does not respond, `ypserv` has probably hung and should be restarted. While logged in as `root` on the server, restart the NIS service by typing one of the following.

```
# svcadm restart network/nis/server
or
# /usr/lib/netsvc/yp/ypstop
# /usr/lib/netsvc/yp/ypstart
```

Servers Have Different Versions of an NIS Map

Because NIS propagates maps among servers, occasionally you might find different versions of the same map on various NIS servers on the network. This version discrepancy is normal add acceptable if the differences do not last for more than a short time.

The most common cause of map discrepancy is that something is preventing normal map propagation. For example, an NIS server or router between NIS servers is down. When all NIS servers and the routers between them are running, `ypxfr` should succeed.

If the servers and routers are functioning properly, check the following:

- Log `ypxfr` output (see "Logging `ypxfr` Output" on page 119).
- Check the control files (see "Check the `crontab` File and `ypxfr` Shell Script" on page 120).
- Check the `ypservers` map on the master. See "Check the `ypservers` Map" on page 120.

Logging `ypxfr` Output

If a particular slave server has problems updating maps, log in to that server and run `ypxfr` interactively. If `ypxfr` fails, it tells you why it failed, and you can fix the problem. If `ypxfr` succeeds, but you suspect it has occasionally failed, create a log file to enable logging of messages. To create a log file, enter the following on the slave.

```
ypslave# cd /var/yp
ypslave# touch ypxfr.log
```

This creates a `ypxfr.log` file that saves all output from `ypxfr`.

The output resembles the output `ypxfr` displays when run interactively, but each line in the log file is time stamped. (You might see unusual ordering in the time-stamps. That is okay—the time-stamp tells you when `ypxfr` started to run. If copies of `ypxfr` ran simultaneously but their work took differing amounts of time, they might actually write their summary status line to the log files in an order different from that which they were invoked.) Any pattern of intermittent failure shows up in the log.

Note – When you have fixed the problem, turn off logging by removing the log file. If you forget to remove it, it continues to grow without limit.

Check the `crontab` File and `ypxfr` Shell Script

Inspect the root `crontab` file, and check the `ypxfr` shell script it invokes. Typographical errors in these files can cause propagation problems. Failures to refer to a shell script within the `/var/spool/cron/crontabs/root` file, or failures to refer to a map within any shell script can also cause errors.

Check the `ypservers` Map

Also, make sure that the NIS slave server is listed in the `ypservers` map on the master server for the domain. If it is not, the slave server still operates perfectly as a server, but `yppush` does not propagate map changes to the slave server.

Work Around

If the NIS slave server problem is not obvious, you can work around it while you debug using `rcp` or `ftp` to copy a recent version of the inconsistent map from any healthy NIS server. The following shows how to transfer the problem map.

```
ypslave# rcp ypmaster:/var/yp/mydomain/map.\* /var/yp/mydomain
```

The * character has been escaped in the command line, so that it will be expanded on ypmaster, instead of locally on ypslave.

`ypserv` Crashes

When the `ypserv` process crashes almost immediately, and does not stay up even with repeated activations, the debug process is virtually identical to that described in "`ypbind` Crashes" on page 117. Check for the existence of the `rpcbind` daemon as follows.

```
ypserver% ps -e | grep rpcbind
```

Reboot the server if you do not find the daemon. Otherwise, if the daemon is running, type the following and look for similar output.

```
% rpcinfo -p ypserver

% program     vers     proto     port     service
100000    4    tcp    111    portmapper
100000    3    tcp    111    portmapper
100068    2    udp    32813    cmsd
...
100007    1    tcp    34900    ypbind
100004    2    udp    731    ypserv
100004    1    udp    731    ypserv
100004    1    tcp    732    ypserv
100004    2    tcp    32772    ypserv
```

Your machine might have different port numbers. The four entries representing the `ypserv` process are the following.

```
100004     2     udp     731     ypserv
100004     1     udp     731     ypserv
100004     1     tcp     732     ypserv
100004     2     tcp     32772     ypserv
```

If there are no entries, and `ypserv` is unable to register its services with `rpcbind`, reboot the machine. If there are entries, de-register the service from `rpcbind` before restarting `ypserv`. To de-register the service from `rpcbind`, on the server type the following.

```
# rpcinfo -d number 1
# rpcinfo -d number 2
```

where *number* is the ID number reported by `rpcinfo` (`100004`, in the example above).

PART IV LDAP Naming Services Setup and Administration

This part provides an overview of the LDAP naming services. Additionally, it covers the setup, configuration, administration, and troubleshooting of LDAP naming services in the Solaris OS, with a focus on the use of Sun Java™ System Directory Server (formerly Sun ONE Directory Server).

CHAPTER 8

Introduction to LDAP Naming Services (Overview/Reference)

The LDAP chapters describe how to set up a Solaris LDAP naming services client to work with Sun Java System Directory Server (formerly Sun ONE Directory Server). However, while using the Sun Java System Directory Server is recommended, it is not required. A brief description of generic directory server requirements appears in Chapter 14.

Note – A directory server is not necessarily an LDAP server. However, in the context of these chapters, the term "directory server" is synonymous with "LDAP server."

Audience Assumptions

The LDAP naming services chapters are written for system administrators who already have a working knowledge of LDAP. Following is a partial list of concepts with which you must be very familiar. Otherwise, you might have difficulty using this guide to deploy LDAP naming services in the Solaris system.

- LDAP Information Model (entries, object classes, attributes, types, values)
- LDAP Naming Model (Directory Information Tree (DIT) structure)
- LDAP Functional Model (search parameters: base object (DN), scope, size limit, time limit, filters (browsing indexes for the Sun Java System Directory Server), attribute list)
- LDAP Security Model (authentication methods, access control models)
- Overall planning and design of an LDAP directory service, including how to plan the data and how to design the DIT, topology, replication, and security

Suggested Background Reading

To learn more about any of the aforementioned concepts or to study LDAP and the deployment of directory services in general, refer to the following sources:

- *Understanding and Deploying LDAP Directory Services* by Timothy A. Howes, Ph.D. and Mark C. Smith

  In addition to providing a thorough treatment of LDAP directory services, this book includes useful case studies on deploying LDAP. Examples of deployments include a large university, a large multinational enterprise, and an enterprise with an extranet.
- Sun Java System Directory Server *Deployment Guide*, which is included with the Sun Java Enterprise System documentation

  This guide provides a foundation for planning your directory, including directory design, schema design, the directory tree, topology, replication, and security. The last chapter provides sample deployment scenarios to help you plan both simple, smaller-scale deployments and complex worldwide deployments.
- Sun Java System Directory Server *Administration Guide*, which is included with the Sun Java Enterprise System documentation

Additional Prerequisite

If you need to install Sun Java System Directory Server, refer to the *Installation Guide* for the version of Sun Java System Directory Server that you are using.

LDAP Naming Services Compared to Other Naming Services

The following table shows a comparison between the DNS, NIS, NIS+, and LDAP naming services.

	DNS	NIS	NIS+	LDAP
Namespace	Hierarchical	Flat	Hierarchical	Hierarchical
Data Storage	Files/resource records	2 column maps	Multi-columned tables	Directories (varied) Indexed database

	DNS	NIS	NIS+	LDAP
Servers	Master/slave	Master/slave	Root master/ non-root master; primary/ secondary; cache/stub	Master/replica Multi master replica
Security	None	None (root or nothing)	Secure RPC (AUTH_DH) Authentication	SSL, varied
Transport	TCP/IP	RPC	RPC	TCP/IP
Scale	Global	LAN	LAN	Global

Advantages of LDAP Naming Services

- LDAP enables you to consolidate information by replacing application-specific databases, which reduces the number of distinct databases to be managed.
- LDAP allows data to be shared by different naming services.
- LDAP provides a central repository for data.
- LDAP allows for more frequent data synchronization between masters and replicas.
- LDAP is multi-platform and multi-vendor compatible.

Restrictions of LDAP Naming Services

Following are some restrictions associated with LDAP naming services:

- Clients prior to Solaris 8 are not supported.
- An LDAP server cannot be its own client.
- Setting up and managing an LDAP naming services is more complex and requires careful planning.
- A NIS client and a Native LDAP client cannot co-exist on the same client machine.

Note – A directory server (an LDAP server) *cannot* be its own client. That is, you cannot configure the machine that is running the directory server software to become an LDAP naming services client.

LDAP Naming Services Setup (Task Map)

Task	For Instructions
Confirm that patch is installed	
Plan the network model	"Planning the LDAP Network Model" on page 154
Plan the DIT	Chapter 10
Set up replica servers	"LDAP and Replica Servers" on page 156
Plan the security model	"Planning the LDAP Security Model" on page 157
Choose client profiles and default attribute values	"Planning Client Profiles and Default Attribute Values for LDAP" on page 158
Plan the data population	"Planning the LDAP Data Population " on page 158
Configure Sun Java System Directory Server prior to using it with LDAP naming services	*Sun ONE Directory Server 5.2 (Solaris Edition)*
Set up Sun Java System Directory Server for use with LDAP naming clients	Chapter 11
Manage printer entries	"Managing Printer Entries" on page 172
Initialize an LDAP client	"Initializing an LDAP Client" on page 179
Initialize a client by using profiles	"Using Profiles to Initialize a Client" on page 180
Initialize a client manually	"Initializing a Client Manually" on page 181
Uninitialize a client	"Uninitializing a Client" on page 182
Use service search descriptors to modify client profiles	"Using Service Search Descriptors to Modify Client Access to Various Services" on page 165
Retrieve naming service information	"Retrieving LDAP Naming Services Information" on page 185
Customize a client environment	"Customizing the LDAP Client Environment" on page 186

CHAPTER 9

LDAP Basic Components and Concepts (Overview)

This chapter covers the following topics.

LDAP Data Interchange Format (LDIF)

LDIF is a text-based format for describing directory service entities and their attributes. Using LDIF format you can move information from one directory to another with commands such as `ldapadd` and `ldapmodify`. The following are examples of LDIF format for each service. Use `ldaplist`(1) with the `-l` option to display the following information.

```
% ldaplist -l hosts myhost
```

```
hosts

dn: cn=myhost+ipHostNumber=7.7.7.115,ou=Hosts,dc=mydc,dc=mycom,dc=com
cn: myhost
iphostnumber: 7.7.7.115
objectclass: top
objectclass: device
objectclass: ipHost
description: host 1 - floor 1 - Lab a - building b
```

```
% ldaplist -l passwd user1
```

```
passwd

dn: uid=user1,ou=People,dc=mydc,dc=mycom,dc=com
uid: user1
cn: user1
userpassword: {crypt}duTx91g7PoNzE
uidnumber: 199995
gidnumber: 20
gecos: Joe Smith [New York]
homedirectory: /home/user1
loginshell: /bin/csh
objectclass: top
objectclass: shadowAccount
objectclass: account
objectclass: posixAccount
```

```
% ldaplist -l services name
```

```
services

dn: cn=name+ipServiceProtocol=udp,ou=Services,dc=mydc,dc=mycom,dc=com
cn: name
cn: nameserver
ipserviceprotocol: udp
ipserviceport: 42
objectclass: top
objectclass: ipService
```

```
% ldaplist -l group mygroup
```

```
group

dn: cn=mygroup,ou=Group,dc=mydc,dc=mycom,dc=com
cn: mygroup
gidnumber: 4441
memberuid: user1
memberuid: user2
memberuid: user3
userpassword: {crypt}duTx91g7PoNzE
objectclass: top
objectclass: posixGroup
```

```
% ldaplist -lnetgroup mynetgroup
```

```
netgroup

cn=mynetgroup,ou=netgroup,dc=central,dc=sun,dc=com
objectclass=nisNetgroup
objectclass=top
cn=mynetgroup
nisnetgrouptriple=(user1..mydc.mycom.com,-,)
nisnetgrouptriple=(user1.,-,)
membernisnetgroup=mylab
```

```
% ldaplist -l networks 200.20.20.0
```

```
networks

dn: ipNetworkNumber=200.20.20.0,ou=Networks,dc=mydc,dc=mycom,dc=com
cn: mynet-200-20-20
ipnetworknumber: 200.20.20.0
objectclass: top
objectclass: ipNetwork
description: my Lab Network
ipnetmasknumber: 255.255.255.0
```

```
% ldaplist -l netmasks 201.20.20.0
```

```
netmasks

dn: ipNetworkNumber=201.20.20.0,ou=Networks,dc=mydc,dc=mycom,dc=com
cn: net-201
ipnetworknumber: 201.20.20.0
objectclass: top
objectclass: ipNetwork
description: my net 201
ipnetmasknumber: 255.255.255.0
```

```
% ldaplist -l rpc ypserv
```

```
rpc

dn: cn=ypserv,ou=Rpc,dc=mydc,dc=mycom,dc=com
cn: ypserv
cn: ypprog
oncrpcnumber: 100004
objectclass: top
objectclass: oncRpc
```

```
% ldaplist -l protocols tcp
```

```
protocols

dn: cn=tcp,ou=Protocols,dc=mydc,dc=mycom,dc=com
cn: tcp
ipprotocolnumber: 6
description: transmission control protocol
objectclass: top
objectclass: ipProtocol
```

```
% ldaplist -l bootparams myhost
```

```
bootparams

dn: cn=myhost,ou=Ethers,dc=mydc,dc=mycom,dc=com
bootparameter: root=boothost:/export/a/b/c/d/e
objectclass: top
objectclass: device
objectclass: bootableDevice
cn: myhost
```

```
% ldaplist -l ethers myhost
```

```
ethers

dn: cn=myhost,ou=Ethers,dc=mydc,dc=mycom,dc=com
macaddress: 8:1:21:71:31:c1
objectclass: top
objectclass: device
objectclass: ieee802Device
cn: myhost
```

```
% ldaplist -l publickey myhost
```

```
publickey

dn: cn=myhost+ipHostNumber=200.20.20.99,ou=Hosts,dc=mydc,dc=mycom,dc=com
cn: myhost
iphostnumber: 200.20.20.99
description: Joe Smith
nispublickey: 9cc01614d929848849add28d090acdaa1c78270aeec969c9
nissecretkey: 9999999998769c999c39e7a6ed4e7afd687d4b99908b4de99
objectclass: top
objectclass: NisKeyObject
objectclass: device
objectclass: ipHost
```

```
% ldaplist -l aliases myname
```

```
aliases

dn: mail=myname,ou=aliases,dc=mydc,dc=mycom,dc=com
cn: myname
mail: myname
objectclass: top
objectclass: mailgroup
mgrprfc822mailmember: my.name
```

Using Fully Qualified Domain Names With LDAP

Unlike NIS or NIS+ clients, an LDAP client always returns a fully qualified domain name (FQDN) for a host name. The LDAP FQDN is similar to the FQDN returned by DNS. For example, suppose your domain name is the following:

```
west.example.net
```

Both `gethostbyname()` and `getnameinfo()` return the FQDN version when looking up the host name *server*:

```
server.west.example.net
```

Also, if you use interface-specific aliases such as `server-#`, a long list of fully qualified host names are returned. If you are using host names to share file systems or have other such checks, you must account for the checks. For example, if you assume non-FQDNs for local hosts and FQDNs only for remote DNS-resolved hosts, you must account for the difference. If you set up LDAP with a different domain name from DNS, the same host might end up with two different FQDNs, depending on the lookup source.

Default Directory Information Tree (DIT)

By default, Solaris LDAP clients access the information assuming that the DIT has a given structure. For each domain supported by the LDAP server, there is a subtree with an assumed structure. This default structure, however, can be overridden by specifying Service Search Descriptors (SSDs). For a given domain, the default DIT will have a base container that holds a number of well known containers that hold entries for a specific information type. See the following table for the names of these subtrees. (This information can be found in RFC 2307 and others.)

TABLE 9–1 DIT Default Locations

Default Container	Information Type
`ou=Ethers`	bootparams(4), ethers(4)
`ou=Group`	group(4)
`ou=Hosts`	hosts(4), ipnodes(4), publickey for hosts
`ou=Aliases`	aliases(4)
`ou=Netgroup`	netgroup(4)
`ou=Networks`	networks(4), netmasks(4)
`ou=People`	passwd(1), shadow(4), user_attr(4), audit_user(4), publickey for users
`ou=printers`	printers(4)
`ou=Protocols`	protocols(4)
`ou=Rpc`	rpc(4)
`ou=Services`	services(4)
`ou=SolarisAuthAttr`	auth_attr(4)
`ou=SolarisProfAttr`	prof_attr(4), exec_attr(4)

TABLE 9–1 DIT Default Locations *(Continued)*

Default Container	Information Type
`ou=projects`	project
`automountMap=auto_*`	auto_*

Default LDAP Schema

Schemas are definitions describing what types of information can be stored as entries in an LDAP directory. To support LDAP naming clients, the directory server's schema might need to be extended. Detailed information about IETF and Solaris specific schemas is included in Chapter 14. The various RFCs can also be accessed on the IETF Web site `http://www.ietf.org`.

Service Search Descriptors (SSDs) and Schema Mapping

Note – If you use schema mapping, you must do so in a very careful and consistent manner. Make sure the syntax of the mapped attribute is consistent with the attribute it is mapped to. In other words, make sure that single-valued attributes map to single-valued attributes, that the attribute syntaxes are in agreement, and that mapped object classes have the correct mandatory (possibly mapped) attributes.

As previously discussed, LDAP naming services expect, by default, the DIT to be structured in a certain way. If you want, you can instruct the Solaris LDAP naming service to search in other locations than the default locations in the DIT. Additionally, you can specify that different attributes and object classes be used in place of those specified by the default schema. For a list of default filters, see "Default Filters Used by LDAP Naming Services" on page 222.

Description of SSDs

The `serviceSearchDescriptor` attribute defines how and where an LDAP naming service client should search for information for a particular service. The `serviceSearchDescriptor` contains a service name, followed by one or more

semicolon-separated base-scope-filter triples. These base-scope-filter triples are used to define searches only for the specific service and are searched in order. If multiple base-scope-filters are specified for a given service, then when that service looks for a particular entry, it will search in each base with the specified scope and filter.

Note – The default location is not searched for a service (database) with an SSD unless it is included in the SSD. Unpredictable behavior will result if multiple SSDs are given for a service.

In the following example, the Solaris LDAP naming service client performs a one-level search in `ou=west,dc=example,dc=com` followed by a one-level search in `ou=east,dc=example,dc=com` for the `passwd` service. To look up the `passwd` data for a user's `username`, the default LDAP filter `(&(objectClass=posixAccount)(uid=username))` is used for each `BaseDN`.

```
serviceSearchDescriptor: passwd:ou=west,dc=example,dc=com;ou=east,
dc=example,dc=com
```

In the following example, the Solaris LDAP naming service client would perform a subtree search in `ou=west,dc=example,dc=com` for the `passwd` service. To look up the `passwd` data for user `username`, the subtree `ou=west,dc=example,dc=com` would be searched with the LDAP filter `(&(fulltimeEmployee=TRUE)(uid=username))`.

```
serviceSearchDescriptor: passwd:ou=west,dc=example,
dc=com?sub?fulltimeEmployee=TRUE
```

It is also possible to associate multiple containers with a particular service type. In the following example, the service search descriptor specifies searching for the password entries in three containers.

```
ou=myuser,dc=example,dc=com
ou=newuser,dc=example,dc=com
ou=extuser,dc=example,dc=com
```

Note that a trailing ',' in the example implies that the `defaultSearchBase` is appended to the relative base in the SSD.

```
defaultSearchBase: dc=example,dc=com
serviceSearchDescriptor: \
passwd:ou=myuser,;ou=newuser,;ou=extuser,dc=example,dc=com
```

Attribute Map

The Solaris LDAP naming service allows one or more attribute names to be remapped for any of its services. (The Solaris LDAP client uses the well-known attributes documented in Chapter 14.) If you map an attribute, you must be sure that the attribute has the same meaning and syntax as the original attribute. Note that mapping the `userPassword` attribute might cause problems.

There are a couple of reasons you might want to use schema mappings.

- You want to map attributes in an existing directory server
- If you have user names that differ only in case, you must map the `uid` attribute, which ignores case, to an attribute that does not ignore case

The format for this attribute is `service:attribute-name=mapped-attribute-name`.

If you want to map more than one attribute for a given service, you can define multiple `attributeMap` attributes.

In the following example, the `employeeName` and `home` attributes would be used whenever the `uid` and `homeDirectory` attributes would be used for the `passwd` service.

```
attributeMap: passwd:uid=employeeName
attributeMap: passwd:homeDirectory=home
```

There exists one special case where you can map the `passwd` service's `gecos` attribute to several attributes. The following is an example.

```
attributemap: gecos=cn sn title
```

This maps the `gecos` values to a space separated list of the `cn`, `sn`, and `title` attribute values.

`objectClass` Map

The Solaris LDAP naming service allows object classes to be remapped for any of its services. If you want to map more than one object class for a given service, you can define multiple `objectclassMap` attributes. In the following example, the `myUnixAccount` object class is used whenever the `posixAccount` object class is used.

```
objectclassMap: passwd:posixAccount=myUnixAccount
```

LDAP Client Profiles

To simplify Solaris client setup, and avoid having to reenter the same information for each and every client, create a single client profile on the directory server. This way, a single profile defines the configuration for all clients configured to use it. Any subsequent change to the profile attributes is propagated to the clients at a rate defined by the refresh interval.

These client profiles should be stored in a well-known location on the LDAP server. The root DN for the given domain must have an object class of `nisDomainObject` and a `nisDomain` attribute containing the client's domain. All profiles are located in the `ou=profile` container relative to this container. These profiles should be readable anonymously.

Client Profile Attributes

The following table shows the Solaris LDAP client's profile attributes, which can be set automatically when you run `idsconfig`. See "Initializing a Client Manually" on page 181 and the `idsconfig`(1M) man page for information on how to set a client profile manually.

TABLE 9–2 Client Profile Attributes

Attribute	Description
`cn`	The profile name. The attribute has no default value. The value must be specified.
`preferredServerList`	The host addresses of the preferred servers is a space separated list of server addresses. (Do not use host names.) The servers in this list are tried in order *before* those in `defaultServerList` until a successful connection is made. This has no default value. At least one server must be specified in either `preferredServerList` or `defaultServerList`.

TABLE 9–2 Client Profile Attributes *(Continued)*

Attribute	Description
`defaultServerList`	The host addresses of the default servers is a space separated list of server addresses. (Do not use host names.) After the servers in `preferredServerlist` are tried, those default servers on the client's subnet are tried, followed by the remaining default servers, until a connection is made. At least one server must be specified in either `preferredServerList` or `defaultServerList`. The servers in this list are tried only after those on the preferred server list. This attribute has no default value.
`defaultSearchBase`	The DN relative to which to locate the well-known containers. There is no default for this value. However, this can be overridden for a given service by the `serviceSearchDescriptor` attribute.
`defaultSearchScope`	Defines the scope of a database search by a client. It can be overridden by the `serviceSearchDescriptor` attribute. The possible values are `one` or `sub`. The default value is a `one` level search.
`authenticationMethod`	Identifies the method of authentication used by the client. The default is none (anonymous). See "Choosing Authentication Methods" on page 144 for more information.
`credentialLevel`	Identifies the type of credentials a client should use to authenticate. The choices are `anonymous` or `proxy`. The default is `anonymous`.
`serviceSearchDescriptor`	Defines how and where a client should search for a naming database, for example, if the client should look in one or more points in the DIT. By default no SSDs are defined.
`serviceAuthenticationMethod`	Authentication method used by a client for the specified service. By default, no service authentication methods are defined. If a service does not have `serviceAuthenticationMethod` defined, it will default to the value of `authenticationMethod`.
`attributeMap`	Attribute mappings used by client. By default no `attributeMap` is defined.

TABLE 9–2 Client Profile Attributes *(Continued)*

Attribute	Description
`objectclassMap`	Object class mappings used by client. By default no `objectclassMap` is defined.
`searchTimeLimit`	Maximum time [in seconds] a client should allow for a search to complete before timing out. This does not affect the time the LDAP server will allow for a search to complete. The default value is `30` seconds.
`bindTimeLimit`	Maximum time in seconds a client should allow to bind with a server before timing out. Default value is `30` seconds.
`followReferrals`	Specifies whether a client should follow an LDAP referral. Possible values `TRUE` or `FALSE`. The default value is `TRUE`.
`profileTTL`	Time between refreshes of the client profile from the LDAP server by the `ldap_cachemgr`(1M). Default is `43200` seconds or 12 hours. If given a value of 0, the profile will never be refreshed.

Local Client Attributes

The following table lists the client attributes that can be set locally using `ldapclient`. See the `ldapclient`(1M) man page for more information.

TABLE 9–3 Local Client Attributes

Attribute	Description
`domainName`	Specifies the client's domain name (which becomes the default domain for the client machine). This attribute has no default value and must be specified.
`proxyDN`	The proxy's distinguished name. If the client machine is configured with `credentialLevel` of `proxy`, the `proxyDN` must be specified.
`proxyPassword`	The proxy's password. If the client machine is configured with `credentialLevel` of proxy, `proxyPassword` must be defined.

TABLE 9–3 Local Client Attributes *(Continued)*

Attribute	Description
`certificatePath`	The directory on the local file system containing the certificate databases. If a client machine is configured with `authenticationMethod` or `serviceAuthenticationMethod` using TLS, then this attribute is used. The default value is `/var/ldap`.

Note – If the `BaseDN` in an SSD *contains a trailing comma*, it is treated as a relative value of the `defaultSearchBase`. The values of the `defaultSearchBase` are appended to the `BaseDN` before a search is performed.

`ldap_cachemgr` Daemon

`ldap_cachemgr` is a daemon that runs on LDAP client machines. When you start the LDAP client, the `ldap_cachemgr` daemon is invoked. The daemon performs the following key functions.

- Gains access to the configuration files, running as root
- Refreshes the client configuration information stored in the profiles on the server and pulls this data from the clients
- Maintains a sorted list of active LDAP servers to use
- Improves lookup efficiency by caching some common lookup requests submitted by various clients
- Improves the efficiency of host lookups

Note – `ldap_cachemgr` must be running at all times for LDAP naming services to work.

Refer to the `ldap_cachemgr`(1M) man page for detailed information.

LDAP Naming Services Security Model

Introduction

Solaris LDAP naming services use the LDAP repository as a source of both a naming service and an authentication service. This section discusses the concepts of client identity, authentication methods, `pam_ldap`(5) and `pam_unix` modules, and account management.

Note – After you enable `pam_ldap` account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as `rsh`, `rlogin`, or `ssh` will fail.

To access the information in the LDAP repository, clients can first establish identity with the directory server. This identity can be either anonymous or as an object recognized by the LDAP server. Based on the client's identity and the server's access control information (ACI), the LDAP server will allow the client to read or write directory information. For more information on ACIs, consult the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

If the client is connecting as anything other than anonymous for any given request, the client must prove its identity to the server using an authentication method supported by both the client and the server. Once the client has established its identity, it can then make the various LDAP requests.

There is a distinction between how the naming service and the authentication service (`pam_ldap`) access the directory. The naming service reads various entries and their attributes from the directory based on predefined identity. The authentication service establishes whether the user has entered the correct password by using that user's name and password to authenticate to the LDAP server. See the `pam_ldap`(5) man page for more information about the authentication service.

Transport Layer Security (TLS)

Note – In order to use TLS for Solaris LDAP naming services, the directory server must use the default ports, 389 and 636, for LDAP and SSL, respectively. If your directory server does not use these ports, you cannot use TLS at this time.

TLS can be used to secure communication between an LDAP client and the directory server, providing both privacy and data integrity. The TLS protocol is a superset of the Secure Sockets Layer (SSL) protocol. Solaris LDAP naming services support TLS connections. Be aware that using SSL adds load to the directory server and the client.

You will need to set up your directory server for SSL. For more information about setting up Sun Java System Directory Server for SSL, see the Administration Guide for the version of Sun Java System Directory Server that you are using. You will also need to set up your LDAP client for SSL.

If using TLS, the necessary security databases must be installed. In particular, the certificate and key database files are needed. For example, if you adopt an older database format from Netscape Communicator, two files, `cert7.db` and `key3.db`, are required. Or if you use a new database format from Mozilla, three files, `cert8.db`, `key3.db`, and `secmod.db` are needed. The `cert7.db` or `cert8.db`file contains trusted certificates. The `key3.db`file contains the client's keys. Even if the LDAP naming service client does not use client keys, this file must be present. The `secmod.db` file contains the security modules such as the `PKCS#11` module. This file is not required if the older format is used.

See "Setting Up TLS Security" on page 183 for more information.

Assigning Client Credential Levels

LDAP naming services clients authenticate to the LDAP server according to a client's credential level. LDAP clients can be assigned three possible credential levels with which to authenticate to a directory server.

- `anonymous`
- `proxy`
- `proxy anonymous`

Anonymous

If you use `anonymous` access, you can access only the data that is available to everyone. Also, you should consider the security implications. Allowing `anonymous` access for certain parts of the directory implies that anyone with access to the directory has read access. If you use an `anonymous` credential level, you need to allow read access to all the LDAP naming entries and attributes.

Caution – Allowing `anonymous` write to a directory should never be done, as anyone could change information in the DIT to which they have write access, including another user's password, or their own identity.

Note – Sun Java System Directory Server allows you to restrict access based on IP addresses, DNS name, authentication method, and time-of-day. You might want to limit access with further restrictions. For more information, see "Managing Access Control" in the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

Proxy

The client authenticates or binds to the directory using a proxy account. This proxy account can be any entry that is allowed to bind to the directory. This proxy account needs sufficient access to perform the naming service functions on the LDAP server. You need to configure the `proxyDN` and `proxyPassword` on every client using the `proxy` credential level. The encrypted `proxyPassword` is stored locally on the client. You can set up different proxies for different groups of clients. For example, you can configure a proxy for all the sales clients to access both the company-wide-accessible and sales directories, while preventing sales clients from accessing human resource directories with payroll information. Or, in the most extreme cases, you can either assign different proxies to each client or assign just one proxy to all clients. A typical LDAP deployment would probably lie between the two extremes. Consider the choices carefully. Too few proxy agents might limit your ability to control user access to resources. However, having too many proxies complicates the setup and maintenance of the system. You need to grant the appropriate rights to the proxy user, depending on your environment. See "Credential Storage" on page 144 for information on how to determine which authentication method makes the most sense for your configuration.

If the password changes for a proxy user, you need to update it on every client that uses that proxy user. If you use password aging on LDAP accounts, be sure to turn it off for proxy users.

Note – Be aware that the proxy credential level applies to all users and processes on any given machine. If two users need to use different naming policies, they must use different machines.

In addition, if clients are using a `proxy` credential to authenticate, the `proxyDN` must have the same `proxyPassword` on all of the servers.

proxy anonymous

`proxy anonymous` is a multi-valued entry, in that more than one credential level is defined. A client assigned the `proxy anonymous` level will first attempt to authenticate with its proxy identity. If the client is unable to authenticate as the proxy user for whatever reason (user lockout, password expired, for example), then the client will use anonymous access. This might lead to a different level of service, depending on how the directory is configured.

Credential Storage

If you configure a client to use a proxy identity, the client saves its `proxyDN` and `proxyPassword` in `/var/ldap/ldap_client_cred`. For the sake of increased security, this file is restricted to root access only, and the value of `proxyPassword` is encrypted. While past LDAP implementations have stored proxy credentials in a client's profile, Solaris 9 LDAP naming services do not. Any proxy credentials set using `ldapclient` during initialization are stored locally. This results in improved security surrounding a proxy's DN and password information. See Chapter 12 for more information on setting up client profiles.

Choosing Authentication Methods

When you assign the `proxy` or `proxy-anonymous` credential level to a client, you also need to select a method by which the proxy authenticates to the directory server. By default, the authentication method is `none`, which implies anonymous access. The authentication method may also have a transport security option associated with it.

The authentication method, like the credential level, may be multivalued. For example, in the client profile you could specify that the client first tries to bind using the `simple` method secured by TLS. If unsuccessful, the client would try to bind with the `sasl/digest-MD5` method. The `authenticationMethod` would then be `tls:simple;sasl/digest-MD5`.

LDAP naming services support some Simple Authentication and Security Layer (SASL) mechanisms. These mechanisms allow for a secure password exchange without requiring TLS. However, these mechanisms do not provide data integrity or privacy. See RFC 2222 for information on SASL.

The following authentication mechanisms are supported.

- `none`

  The client does not authenticate to the directory. This is equivalent to the `anonymous` credential level.

- `simple`

  If the client machine uses the `simple` authentication method, it binds to the server by sending the user's password in the clear. The password is thus subject to snooping unless the session is protected by `ipsec`(7). The primary advantages of using the `simple` authentication method are that all directory servers support it

and that it is easy to set up.

- `sasl/digest-MD5`

  The client's password is protected during authentication, but the session is not encrypted. Some directory servers, including Sun Java System Directory Server, also support the `sasl/digest-MD5` authentication method. The primary advantage of `digest-MD5` is that the password does not go over the wire in the clear during authentication and therefore is more secure than the `simple` authentication method. See RFC 2831 for information on `digest-MD5`. `digest-MD5` is considered an improvement over `cram-MD5` for its improved security.

  When using `sasl/digest-MD5`, the authentication is secure, but the session is not protected.

Note – If you are using Sun Java System Directory Server, the password *must be stored in the clear* in the directory.

- `sasl/cram-MD5`

  In this case, the LDAP session is not encrypted, but the client's password is protected during authentication, as authentication is performed by using `sasl/cram-MD5`.

  See RFC 2195 for information on the `cram-MD5` authentication method. `cram-MD5` is only supported by some directory servers. For instance, Sun Java System Directory Server does not support `cram-MD5`.

- `tls:simple`

  The client binds using the `simple` method and the session is encrypted. The password is protected.

- `tls:sasl/cram-MD5`

  The LDAP session is encrypted and the client authenticates to the directory server using `sasl/cram-MD5`.

- `tls:sasl/digest-MD5`

  The LDAP session is encrypted and the client authenticates to the directory server using `sasl/digest-MD5`.

Caution – Sun Java System Directory Server requires passwords to be stored in the clear in order to use `digest-MD5`. If the authentication method is set to `sasl/digest-MD5` or `tls:sasl/digest-MD5`, then the passwords for the proxy user will need to be stored in the clear. Be especially careful that the `userPassword` attribute has the proper ACIs if it is stored in the clear, so that it is not readable.

The following table summarizes the various authentication methods and their respective characteristics.

TABLE 9–4 Authentication Methods

	Bind	Password on wire	Password on Sun Java System Directory Server	Session
`none`	No	N/A	N/A	No encryption
`simple`	Yes	Clear	Any	No encryption
`sasl/digest-MD5`	Yes	Encryption	Clear	No encryption
`sasl/cram-MD5`	Yes	Encryption	N/A	No encryption
`tls:simple`	Yes	Encryption	Any	Encryption
`tls:sasl/cram-MD5`	Yes	Encryption	N/A	Encryption
`tls:sasl/digest-MD5`	Yes	Encryption	Clear	Encryption

Authentication and Services

The authentication method can be specified for a given service in the `serviceAuthenticationMethod` attribute. The following services currently support this.

- `passwd-cmd`

  This service is used by `passwd`(1) to change the login password and password attributes.

- `keyserv`

  This service is used by the `chkey`(1) and `newkey`(1M) utilities to create and change a user's Diffie-Hellman key pair.

- `pam_ldap`

  This service is used for authenticating users with `pam_ldap`(5).

  `pam_ldap` supports account management.

Note – If the service does not have a `serviceAuthenticationMethod` set, it will default to the value of the `authenticationMethod` attribute.

The following example shows a section of a client profile in which the users will use `sasl/digest-MD5` to authenticate to the directory server, but will use an SSL session to change their password.

```
serviceAuthenticationMethod=pam_ldap:sasl/digest-MD5
serviceAuthenticationMethod=passwd-cmd:tls:simple
```

Pluggable Authentication Methods

By using the PAM framework, you can choose among several authentication services. You can use either pam_unix or pam_ldap in conjunction with LDAP.

Because of its increased flexibility, support of stronger authentication methods, and ability to use account management, the use of pam_ldap is recommended.

pam_unix

If you have not changed the pam.conf(4) file, pam_unix functionality is enabled by default.

Note – The pam_unix module has been removed and is no longer supported with Solaris. A set of other service modules provides equivalent or greater functionality. Therefore, in this guide, pam_unix refers to the equivalent functionality, not to the pam_unix module itself.

Following is a list of the modules that provide the equivalent pam_unix functionality.

pam_authtok_check(5)
pam_authtok_get(5)
pam_authtok_store(5)
pam_dhkeys(5)
pam_passwd_auth(5)
pam_unix_account(5)
pam_unix_auth(5)
pam_unix_cred(5)
pam_unix_session(5)

pam_unix follows the traditional model of UNIX authentication, as described in the following list.

1. The client retrieves the user's encrypted password from the name service.
2. The user is prompted for his password.
3. The user's password is encrypted.
4. The client compares the two encrypted passwords to determine whether the user should be authenticated.

Additionally, there are two restrictions when using pam_unix.

- The password must be stored in UNIX crypt format and not in any other encryption methods, including clear.
- The userPassword attribute must be readable by the name service.

For example, if you set the credential level to `anonymous`, then anyone must be able to read the `userPassword` attribute. Similarly, If you set the credential level to `proxy`, then the proxy user must be able to read the `userPassword` attribute.

Note – `pam_unix` is not compatible with the `sasl` authentication method `digest-MD5`, since Sun Java System Directory Server requires passwords to be stored in the clear in order to use `digest-MD5`. `pam_unix` requires the password be stored in `crypt` format.

---

pam_ldap

When implementing `pam_ldap`, the user binds to the LDAP server by using the authentication method defined in `pam_ldap`'s `serviceAuthenticationMethod` parameter, if one exists. Otherwise, `authenticationMethod` is used.

If `pam_ldap` is able to bind to the server with the user's identity and supplied password, it authenticates the user.

Note – After you enable `pam_ldap` account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as `rsh`, `rlogin`, or `ssh` will fail.

`pam_ldap` does not read the `userPassword` attribute. Therefore, there is no need to grant access to read the `userPassword` attribute unless there are other clients using `pam_unix`. Also, `pam_ldap` does not support the `none` authentication method. Thus, you must define the `serviceAuthenticationMethod` or the `authenticationMethod` attributes so clients can use `pam_ldap`. See the `pam_ldap`(5) man page for more information.

Caution – If the `simple` authentication method is used, the `userPassword` attribute can be read on the wire by third parties.

See "Example `pam.conf` File for `pam_ldap`" on page 199.

The following table summarizes the main differences between `pam_unix` and `pam_ldap`.

TABLE 9–5 pam_unix versus pam_ldap

	pam_unix	pam_ldap
Password Sent	Uses passwd service authentication method	Uses passwd service authentication method
New Password Sent	Encrypted	No encryption (unless TLS is used)
New Password Stored	crypt format	Password storage scheme defined on Sun Java System Directory Server
Requires password read?	Yes	No
sasl/digest-MD5 compatibility after changing password	No. Password is not stored in clear. User cannot authenticate.	Yes. As long as default storage scheme is set to clear, user can authenticate.

PAM and Changing Passwords

Use passwd(1) to change a password. In order to change the password, the userPassword attribute must be writable by the user. Remember that the serviceAuthenticationMethod for passwd-cmd overrides the authenticationMethod for this operation. Depending on the authentication used, the current password might be unencrypted on the wire.

In the case of pam_unix, the new userPassword attribute is encrypted using UNIX crypt format and tagged before being written to LDAP. Therefore, the new password is encrypted on the wire, regardless of the authentication method used to bind to the server. See the pam_authtok_store(5) man page for more information.

As of the Solaris 10 software release, pam_ldap no longer supports password update. The previously recommended use of pam_authtok_store with the server_policy option now replaces the pam_ldap password update capability. When you use pam_authtok_store, the new password is sent to the LDAP server in the clear. Therefore, to ensure privacy, use TLS. If TLS is not used, the new userPassword is subject to snooping. If you set an untagged password with Sun Java System Directory Server, the software encrypts the password by using the passwordStorageScheme attribute. For more information about the passwordStorageScheme, see the section on user account management in the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

Note – You need to consider the following configuration issues when setting the `passwordStorageScheme` attribute. If a NIS, NIS+, or another client using `pam_unix` is using LDAP as a repository, then `passwordStorageScheme` needs to be `crypt`. Also, if using `pam_ldap` with `sasl/digest-MD5` with Sun Java System Directory Server, `passwordStorageScheme` must be set to clear.

Account Management

LDAP naming services take advantage of the password and account lockout policy support in Sun Java System Directory Server. You can configure `pam_ldap`(5) to support user account management. `passwd`(1) enforces password syntax rules set by the Sun Java System Directory Server password policy, when used with the proper PAM configuration.

The following account management features are supported through `pam_ldap`(5). These features depend on Sun Java System Directory Server's password and account lockout policy configuration. You can enable as many or as few of the features as you want.

- Password aging and expiration notification

  Users must change their passwords according to a schedule. A password expires if it is not changed within the time configured. An expired password causes user authentication to fail.

  Users see a warning message whenever they log in within the expiration warning period. The message specifies the number of hours or days until the password expires.

- Password syntax checking

  New passwords must meet the minimum password length requirements. In addition, a password cannot match the value of the `uid`, `cn`, `sn`, or `mail` attributes in the user's directory entry.

- Password in history checking

  Users cannot reuse passwords. If a user attempts to change the password to one that was previously used, `passwd`(1) fails. LDAP administrators can configure the number of passwords kept in the server's history list.

- User account lockout

  A user account can be locked out after a given number of repeated authentication failures. A user can also be locked out if his account is inactivated by an administrator. Authentication will continue to fail until the account lockout time is passed or the administrator reactivates the account.

Note – The preceding account management features only work with the Sun Java System Directory Server. For information about configuring the password and account lockout policy on the server, see the "User Account Management" chapter in the Administration Guide for the version of Sun Java System Directory Server that you are using. Also see "Example `pam_conf` file for `pam_ldap` Configured for Account Management" on page 201. Do not enable account management for `proxy` accounts.

Before configuring the password and account lockout policy on Sun Java System Directory Server, make sure all hosts use the "newest" LDAP client with `pam_ldap` account management.

In addition, make sure the clients have a properly configured `pam.conf`(4) file. Otherwise, LDAP naming services will not work when `proxy` or user passwords expire.

Note – After you enable `pam_ldap` account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as `rsh`, `rlogin`, or `ssh` will fail.

CHAPTER 10

Planning Requirements for LDAP Naming Services (Tasks)

This chapter discusses the high-level planning you should do before beginning the server and client setup and installation processes.

This chapter covers the following topics.

LDAP Planning Overview

The LDAP client profile is a collection of configuration information an LDAP client uses to access LDAP naming services information about the supporting LDAP server. This chapter discusses the planning of the various aspects of the LDAP naming services. These include the network model, the directory information tree, the security model, the default values of the various profile attributes, and finally, the preparation for data population.

Planning the LDAP Network Model

For availability and performance considerations, each subnet of the company-wide network should have its own LDAP server to service all the LDAP clients in the subnet. Only one of the servers needs to be a master LDAP server. The rest could all be replicas of the master server.

To plan for the network configuration, consider how many servers are available, how a client would be able to get to the servers, and in what order the servers should be accessed. If there is one per subnet, you could use the `defaultServerList` attribute to list all the servers and have the LDAP client sort and manipulate the access order. If the servers need to be accessed in a certain order due to speed or data management reasons, you should use the `preferredServerList` attribute to define the fixed order of accessing the servers. Note that you might not want to put the master server on either of these lists to reduce the load on the master server.

In addition, you might find three more attributes worth consideration when planning for the server and network configuration. The `bindTimeLimit` attribute can be used to set the time-out value for a TCP connect request. The `searchTimeLimit` attribute can be used to set the time-out value for an LDAP search operation. The `profileTTL` attribute can be used to control how often the LDAP client should download its profile from the servers. For a slow or unstable network, the `bindTimeLimit` and `searchTimeLimit` attributes might need a larger value than the defaults. For early stage testing of the deployment, you might want to reduce the value of the `profileTTL` attribute to have the clients pick up the frequent changes made to the profile stored in the LDAP servers.

Planning the Directory Information Tree (DIT)

LDAP naming services have a default directory information tree (DIT) and an associated default schema. For example, the `ou=people` container contains the user account, password, and shadow information. The `ou=hosts` container contains information about systems in the network. Each entry in the `ou=people` container would be of `objectclass` `posixAccount` and `shadowAccount`.

The default DIT is a well designed directory structure and is based on open standards. It should be sufficient for most of naming service needs, and is recommended to be used without changes. If you choose to use the default DIT, the only thing you need to decide is from which node (base DN) in the directory tree the naming services

information will be searched for a given domain. This node is specified with the `defaultSearchBase` attribute. Additionally, you might want to set the `defaultSearchScope` attribute to tell the clients the scope of search a naming service lookup should perform. Is it just searching one level under the DN (one), or the entire subtree under the DN (sub)?

There are times, however, that more flexibility is needed for the LDAP naming service to either work with an existing DIT or handle a more complicated DIT with naming service data scattered around the directory tree. For example, user account entries may exist in different part of the tree. The `serviceSearchDescriptor`, `attributeMap`, and `objectclassMap` attributes in the client profile are designed to handle these situations.

A service search descriptor can be used to override the default search base, search scope, and search filter for a particular service. See "Service Search Descriptors (SSDs) and Schema Mapping" on page 134.

The `AttributeMap` and `ObjectclassMap` attributes provide a way for schema mapping. They make it possible for the LDAP naming services to work with an existing DIT. You can map the `posixAccount` object class to an existing object class, `myAccount`, for example. You can map an attribute in the `posixAccount` object class to an attribute in the `myAccount` object class.

Multiple Directory Servers

Multiple LDAP servers can serve one DIT. For example, some subtrees of the DIT reside on other LDAP servers. In this case, an LDAP server may refer the LDAP client to a different server for the naming data it knows about but is not in its own database. If you plan such a DIT configuration, you should set the clients' profile attribute `followReferrals` to indicate to the LDAP naming service to follow server referrals to continue naming service lookups. However, it is best to have all naming data for a given domain reside on a single directory server, if at all possible.

Referrals can be useful if you want to have clients access read-only replicas most of the time and follow referrals to a read/write master server only when necessary. In this way, the master server does not get overloaded with requests that could be handled by replicas.

Data Sharing With Other Applications

To make best use of LDAP, you should have a single LDAP entry for each logical entry. For example, for a user you can have not only company white-page information, but also Solaris account information, and possibly application-specific data. Since `posixAccount` and `shadowAccount` are auxiliary object classes, they can be added to any entry in the directory. This will require careful planning, setup, and administration.

Choosing the Directory Suffix

See the Sun Java System Directory Server (formerly Sun ONE Directory Server) documentation for information about how to choose an appropriate directory suffix.

LDAP and Replica Servers

There are three different strategies to employ when setting up replica servers.

- Single-master replication
- Floating-master replication
- Multi-master replication

Single-master

With single-master replication, only one master server for any given partition or non-partitioned network holds writable copies of directory entries. Any replica servers have read-only copies of the directory entries. While both replicas and masters can perform searches, compares, and bind operations, only the master server can perform write operations.

The potential disadvantage to the single-master replication strategy is that the master server is a single point of failure. If the master server goes down, none of the replicas can process write operations.

Floating-master

The floating-master strategy is similar to the single-master strategy in that there is only one master server with write capabilities at any given time for a given partitioned or non-partitioned network. However, when implementing the floating-master strategy, when the master server goes down, a replica is automatically transformed into a master server by way of an algorithm.

One potential disadvantage to the floating-master replication strategy is that if your network becomes partitioned and replicas on either side of the partition become masters, the process of reconciling the new masters can be very complicated if the network is rejoined.

Multi-master

With multi-master replication, there are multiple master servers with their own read-write copies of the directory entry data. While the multi-master strategy eliminates the problem of having a single point of failure, update conflicts can occur between servers. In other words, if an entry's attribute is modified around the same time on two masters, an update conflict resolution policy, such as "last writer wins," must be in place.

For information about how to set up replica servers, refer to the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

Planning the LDAP Security Model

To plan for the security model, you should first consider what identity the LDAP client should be using to talk to the LDAP server. For example, you must decide if you want strong authentication to protect the user password flow across the wire, and/or if it is needed to encrypt the session between the LDAP client and the LDAP server to protect the LDAP data transmitted.

The `credentialLevel` and `authenticationMethod` attributes in the profile are used for this. There are three possible credential levels for `credentialLevel`: `anonymous`, `proxy`, and `proxy anonymous`. See "LDAP Naming Services Security Model" on page 141 for a detailed discussion of LDAP naming service security concepts.

Note – If you enable `pam_ldap` account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as `rsh`, `rlogin`, or `ssh` will fail if used with `pam_ldap`.

The main decisions you need to make when planning your security model are the following.

- What credential level and authentication methods will LDAP clients use?
- Will you use TLS?
- Do you need to be backward compatible with NIS or NIS+? In other words, will clients use `pam_unix` or `pam_ldap`?
- What will the servers' `passwordStorageScheme` attribute settings be?
- How will you set up the Access Control Information?

  For more information about ACIs, consult the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

Planning Client Profiles and Default Attribute Values for LDAP

By going through the previous planning steps (network model, DIT, and security model), you should have some idea of the values for the following profile attributes.

- `cn`
- `defaultServerList`
- `preferredServerList`
- `bindTimeLimit`
- `searchTimeLimit`
- `profileTTL`
- `defaultSearchBase`
- `defaultSearchScope`
- `serviceSearchDescriptor`
- `attributeMap`
- `objectclassMap`
- `followReferrals`
- `credentialLevel`
- `authenticationMethod`
- `serviceCredentialLevel`
- `serviceAuthenticationMethod`

Of the preceding attributes, only `cn`, `defaultServerList`, and `defaultSearchBase` are required. They have no default values. The rest are optional, and some have default values.

See Chapter 12 for more information about setting up LDAP clients.

Planning the LDAP Data Population

To populate the LDAP server with data, after the LDAP server has been configured with the proper DIT and schema. Use the new `ldapaddent` tool. This tool will create entries in LDAP containers from their corresponding `/etc` files. It can be used to populate data into the containers for the following types of data: `aliases`, `auto_*`, `bootparams`, `ethers`, `group`, `hosts` (including IPv6 addresses), `netgroup`, `netmasks`, `networks`, `passwd`, `shadow`, `protocols`, `publickey`, `rpc`, and `services`.

By default, `ldapaddent` reads from the standard input and adds this data to the LDAP container associated with the database specified on the command line. But an input file from which data should be read can be specified using the `-f` option.

Because the entries are stored in the directory based on the client's configuration, the client must be configured to use the LDAP naming services.

For better performance, load the databases in this order:

1. `passwd` database followed by `shadow` database
2. `networks` database followed by `netmasks` database
3. `bootparams` database followed by `ethers` database

Note that when adding automounter entries, the database name is in the form of `auto_*` (for example, `auto_home`).

If you have `/etc` files from different hosts to add to the LDAP server, you can either merge all of them into the same `/etc` file and then use `ldapaddent` on one host to add the files, or perform `ldapaddent` on the different hosts one by one, with the expectation that each host is already configured as a LDAP client.

If your naming service data is already in an NIS server, and you want to move the data to the LDAP server for LDAP naming services, use the `ypcat` (or `niscat`) command to dump the NIS map into files. Then, run `ldapaddent` against these files to add the data to the LDAP server.

Note – `ldapaddent` can only be run on an LDAP client.

The following procedure assumes that the tables are to be extracted from a `yp` client.

▼ How to Populate a Server With `host` Entries Using `ldapaddent`

1. **Make sure that Sun Java System Directory Server was set up using `idsconfig`.**
2. **On a client machine, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.
3. **Make the machine an LDAP client.**

   ```
   # ldapclient init -a profileName=new -a domainName=west.example.com \
   192.168.0.1
   ```
4. **Populate the server with data.**

   ```
   # ldapaddent -D "cn=directory manager" -f /etc/hosts hosts
   ```

   You will be prompted for a password.

   In this example, `ldapaddent` will use the authentication method that has been configured in the profile "new". Selecting "simple" will cause the password to be

sent in the clear. For more information, refer to the `ldapaddent`(1M) man page.

CHAPTER 11

Setting Up Sun Java System Directory Server With LDAP Clients (Tasks)

This chapter describes how to configure Sun Java System Directory Server (formerly Sun ONE Directory Server) to support a network of Solaris LDAP naming services clients. The information is specific to the Sun Java System Directory Server. For information about installing and configuring the directory server, see the Sun Java System Directory Server documentation, that is included with the Sun Java Enterprise System.

Note – You must have already performed all the procedures described in the installation and configuration documentation that shipped with your Sun Java System Directory Server before you can configure Sun Java System Directory Server to work with Solaris LDAP clients.

Note – A directory server (an LDAP server) *cannot* be its own client.

This chapter covers the following topics.

Configuring Sun Java System Directory Server Using `idsconfig`

Creating a Checklist Based on Your Server Installation

During the server installation process, you will have defined crucial variables, with which you should create a checklist similar to the one below before launching `idsconfig`. You can use the blank checklist provided in "Blank Checklists" on page 195.

Note – The information included below will serve as the basis for all examples that follow in the LDAP related chapters. The example domain is of an widget company, Example, Inc. with stores nationwide. The examples will deal with the West Coast Division, with the domain west.example.com

---

TABLE 11–1 Server Variables Defined

Variable	Definition for Example Network
Port number at which an instance of the directory server is installed	389 (default)
Name of server	**`myserver`** (from the FQDN myserver.west.example.com or 192.168.0.1)
Replica server(s) (IPnumber:port number)	**`192.168.0.2`** [for myreplica.west.example.com]
Directory manager	cn=directory manager (default)
Domain name to be served	**`west.example.com`**
Maximum time (in seconds) to process client requests before timing out	**`-1`**
Maximum number of entries returned for each search request	**`-1`**

Note – If you are using hostnames in defining `defaultServerList` or `preferredServerList`, you MUST ensure LDAP is not used for hosts lookup. This means `ldap` must not be in `/etc/nsswitch.conf` `hosts` line.

TABLE 11–2 Client Profile Variables Defined

Variable	Definition for Example Network
Profile name (the default name is "default")	**`WestUserProfile`**
Server list (defaults to the local subnet)	**`192.168.0.1`**
Preferred server list (listed in order of which server to try first, second, and so on)	**`none`**
Search scope (number of levels down through the directory tree. '`One`', the default, or '`Sub`')	**`one`** (default)
Credential used to gain access to server. Default is `anonymous`	**`proxy`**
Follow Referrals? (a pointer to another server if the main server is unavailable) Default is `no`.	**`Y`**
Search time limit (default is 30 seconds) for waiting for server to return information.	**`default`**
Bind time limit (default is 10 seconds) for contacting the server.	**`default`**
Authentication method Default is `none`.	**`simple`**

Note – Client profiles are defined per domain. At least one profile must be defined for a given domain.

Attribute Indexes

`idsconfig` indexes the following list of attributes for improved performance.

```
membernisnetgroup    pres,eq,sub
nisnetgrouptriple    pres,eq,sub
ipHostNumber         pres,eq,sub
uidNumber            pres,eq
gidNumber            pres,eq
```

```
ipNetworkNumber      pres,eq
automountkey         pres,eq
oncRpcNumber         pres,eq
```

Schema Definitions

`idsconfig`(1M) automatically adds the necessary schema definitions. Unless you are very experienced in LDAP administration, do not manually modify the server schema. See Chapter 14 for an extended list of schemas used by the LDAP naming service.

Using Browsing Indexes

The browsing index functionality of the Sun Java System Directory Server, otherwise known as the virtual list view (VLV), provides a way in which a client can view a select group or number of entries from very long list, thus making the search process less time consuming for each client. Browsing indexes provide optimized, predefined search parameters with which the Solaris LDAP naming client can access specific information from the various services more quickly. Keep in mind that if you do not create browsing indexes, the clients may not get all the entries of a given type because the server limits for search time or number of entries might be enforced.

VLV indexes are configured on the directory server and the proxy user has read access to these indexes.

Before configuring browsing indexes on the Sun Java System Directory Server, consider the performance cost associated with using these indexes. For more information, refer to the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

`idsconfig` creates entries for several VLV indexes. Use the `directoryserver` script to stop the server and to create the actual VLV indexes. See the `idsconfig`(1M) and the `directoryserver`(1M) man pages for more information. Refer to the output of the `idsconfig` command to determine the VLV entries created by `idsconfig` and the syntax of the corresponding `directoryserver` commands that you need to run. See "Example `idsconfig` Setup" on page 167 for sample `idsconfig` output.

Using Service Search Descriptors to Modify Client Access to Various Services

A service search descriptor (SSD) changes the default search request for a given operation in LDAP to a search you define. SSDs are particularly useful if, for example, you have been using LDAP with customized container definitions or another operating system and are now transitional to the latest Solaris release. Using SSDs, you can configure Solaris LDAP naming services without having to change your existing LDAP database and data.

Setting Up SSDs Using `idsconfig`

Assume your predecessor at Example, Inc. had configured LDAP, storing users in `ou=Users` container. You are now upgrading to the latest Solaris release. By definition, Solaris LDAP client assumes that user entries are stored in `ou=People` container. Thus, when it comes to searching the `passwd` service, LDAP client will search the `ou=people` level of the DIT and not find the correct values.

One laborious solution to the above problem would be to completely overwrite Example, Inc.'s existing DIT and to rewrite all the exiting applications on Example, Inc.'s network so that they are compatible with the new LDAP naming service. A second, far preferable solution would be to use an SSD that would tell LDAP client to look for user info in an `ou=Users` container instead the default `ou=people` container.

You would define the necessary SSD during the configuration of the Sun Java System Directory Server using `idsconfig`. The prompt line appears as follows.

```
Do you wish to setup Service Search Descriptors (y/n/h? y
  A  Add a Service Search Descriptor
  D  Delete a SSD
  M  Modify a SSD
  P  Display all SSD's
  H  Help
  X  Clear all SSD's

  Q  Exit menu
Enter menu choice: [Quit] a
Enter the service id: passwd
Enter the base: service ou=user,dc=west,dc=example,dc=com
Enter the scope: one[default]
  A  Add a Service Search Descriptor
  D  Delete a SSD
  M  Modify a SSD
  P  Display all SSD's
  H  Help
```

```
  X  Clear all SSD's

  Q  Exit menu
Enter menu choice: [Quit] p

Current Service Search Descriptors:
==================================
Passwd:ou=Users,ou=west,ou=example,ou=com?

Hit return to continue.

  A  Add a Service Search Descriptor
  D  Delete a SSD
  M  Modify a SSD
  P  Display all SSD's
  H  Help
  X  Clear all SSD's

  Q  Exit menu
Enter menu choice: [Quit] q
```

Running `idsconfig`

Note – You do not need special rights to run `idsconfig`, nor do you need to be an LDAP naming client. Remember to create a checklist as mentioned in "Creating a Checklist Based on Your Server Installation" on page 162 in preparation for running `idsconfig`. You do not have to run `idsconfig` from a server or an LDAP naming service client machine. You can run `idsconfig` from any Solaris machine on the network.

Caution – `idsconfig` sends the Directory Manager's password in the clear. If you do not want this to happen, you must run `idsconfig` on the directory server itself, not on a client.

▼ How to Configure Sun Java System Directory Server Using `idsconfig`

1. **Make sure the target Sun Java System Directory Server is up and running.**
2. **Run `idsconfig`.**

   ```
   # /usr/lib/ldap/idsconfig
   ```

   Refer to Example 11–1 for an example run of `idsconfig` using the definitions listed in the server and client checklists at the beginning of this chapter in "Creating a Checklist Based on Your Server Installation" on page 162.
3. **Answer the questions when prompted.**

   Note that 'no' [n] is the default user input. If you need clarification on any given question, type

   ```
   h
   ```

   and a brief help paragraph will appear.

   After `idsconfig` has completed the setup of the directory, you need to run the specified commands on the server before the server setup is complete and the server is ready to serve clients.

Example `idsconfig` Setup

This section provides an example of a simple `idsconfig` setup, without modifying many of the defaults. The most complicated method of modifying client profiles is by creating SSDs. Refer to "Using Service Search Descriptors to Modify Client Access to Various Services" on page 165 for a detailed discussion.

A carriage return sign after the prompt means that you are accepting the [default] by hitting enter.

Note – Any parameters left blank in the summary screen will not be set up.

After `idsconfig` has completed the setup of the directory, you need to run the specified commands on the server before the server setup is complete and the server is ready to serve clients.

EXAMPLE 11–1 Running `idsconfig` for the Example, Inc. Network

```
# usr/lib/ldap/idsconfig
It is strongly recommended that you BACKUP the directory server
before running idsconfig.
```

EXAMPLE 11–1 Running `idsconfig` for the Example, Inc. Network *(Continued)*

```
Hit Ctrl-C at any time before the final confirmation to exit.

Do you wish to continue with server setup (y/n/h)? [n] Y

Enter the directory server's hostname to setup: myserver

Enter the Directory Server's port number (h=help): [389]
Enter the directory manager DN: [cn=Directory Manager]
Enter passwd for cn=Directory Manager :
Enter the domainname to be served (h=help): [west.example.com]
Enter LDAP Base DN (h=help): [dc=west,dc=example,dc=com]
Enter the profile name (h=help): [default] WestUserProfile
Default server list (h=help): [192.168.0.1]
Preferred server list (h=help):
Choose desired search scope (one, sub, h=help):  [one]
The following are the supported credential levels:
  1  anonymous
  2  proxy
  3  proxy anonymous
Choose Credential level [h=help]: [1] 2

The following are the supported Authentication Methods:
  1  none
  2  simple
  3  sasl/DIGEST-MD5
  4  tls:simple
  5  tls:sasl/DIGEST-MD5
Choose Authentication Method (h=help): [1] 2

Current authenticationMethod: simple

Do you want to add another Authentication Method? N

Do you want the clients to follow referrals (y/n/h)? [n] N

Do you want to modify the server timelimit value (y/n/h)? [n] Y

Enter the server time limit (current=3600): [-1]

Do you want to modify the server sizelimit value (y/n/h)? [n] Y

Enter the server size limit (current=2000): [-1]

Do you want to store passwords in "crypt" format (y/n/h)? [n] Y

Do you want to setup a Service Authentication Methods (y/n/h)? [n]
Client search time limit in seconds (h=help): [30]
Profile Time To Live in seconds (h=help): [43200]

Bind time limit in seconds (h=help): [10]

Do you wish to setup Service Search Descriptors (y/n/h)? [n]

              Summary of Configuration
```

EXAMPLE 11–1 Running `idsconfig` for the Example, Inc. Network *(Continued)*

```
  1  Domain to serve               : west.example.com
  2  Base DN to setup              : dc=west,dc=example,dc=com
  3  Profile name to create        : WestUserProfile
  4  Default Server List           : 192.168.0.1
  5  Preferred Server List         :
  6  Default Search Scope          : one
  7  Credential Level              : proxy
  8  Authentication Method         : simple
  9  Enable Follow Referrals       : FALSE
 10  Server Time Limit             : -1
 11  Server Size Limit             : -1
 12  Enable crypt password storage : TRUE
 13  Service Auth Method pam_ldap  :
 14  Service Auth Method keyserv   :
 15  Service Auth Method passwd-cmd:
 16  Search Time Limit             : 30
 17  Profile Time to Live          : 43200
 18  Bind Limit                    : 10
 19  Service Search Descriptors Menu

Enter config value to change: (1-19 0=commit changes) [0]
Enter DN for proxy agent:[cn=proxyagent,ou=profile,dc=west,dc=example,dc=com]
Enter passwd for proxyagent:
Re-enter passwd:


WARNING: About to start committing changes. (y=continue, n=EXIT) Y

1. Changed timelimit to -1 in cn=config.
2. Changed sizelimit to -1 in cn=config.
3. Changed passwordstoragescheme to "crypt" in cn=config.
4. Schema attributes have been updated.
5. Schema objectclass definitions have been added.
6. Created DN component dc=west.
7. NisDomainObject added to dc=west,dc=example,dc=com.
8. Top level "ou" containers complete.
9. automount maps: auto_home auto_direct auto_master auto_shared processed.
10. ACI for dc=west,dc=example,dc=com modified to disable self modify.
11. Add of VLV Access Control Information (ACI).
12. Proxy Agent cn=proxyagent,ou=profile,dc=west,dc=example,dc=com added.
13. Give cn=proxyagent,ou=profile,dc=west,dc=example,dc=com read permission for
password.
14. Generated client profile and loaded on server.
15. Processing eq,pres indexes:
      uidNumber (eq,pres)   Finished indexing.
      ipNetworkNumber (eq,pres)   Finished indexing.
      gidnumber (eq,pres)   Finished indexing.
      oncrpcnumber (eq,pres)   Finished indexing.
      automountKey (eq,pres)   Finished indexing.
16. Processing eq,pres,sub indexes:
      ipHostNumber (eq,pres,sub)   Finished indexing.
      membernisnetgroup (eq,pres,sub)   Finished indexing.
```

EXAMPLE 11–1 Running `idsconfig` for the Example, Inc. Network *(Continued)*

```
      nisnetgrouptriple (eq,pres,sub)   Finished indexing.
17. Processing VLV indexes:
      west.example.com.getgrent vlv_index     Entry created
      west.example.com.gethostent vlv_index   Entry created
      west.example.com.getnetent vlv_index    Entry created
      west.example.com.getpwent vlv_index     Entry created
      west.example.com.getrpcent vlv_index    Entry created
      west.example.com.getspent vlv_index     Entry created
      west.example.com.getauhoent vlv_index   Entry created
      west.example.com.getsoluent vlv_index   Entry created
      west.example.com.getauduent vlv_index   Entry created
      west.example.com.getauthent vlv_index   Entry created
      west.example.com.getexecent vlv_index   Entry created
      west.example.com.getprofent vlv_index   Entry created
      west.example.com.getmailent vlv_index   Entry created
      west.example.com.getbootent vlv_index   Entry created
      west.example.com.getethent vlv_index    Entry created
      west.example.com.getngrpent vlv_index   Entry created
      west.example.com.getipnent vlv_index    Entry created
      west.example.com.getmaskent vlv_index   Entry created
      west.example.com.getprent vlv_index     Entry created
      west.example.com.getip4ent vlv_index    Entry created
      west.example.com.getip6ent vlv_index    Entry created

idsconfig: Setup of myserver is complete.

Note: idsconfig has created entries for VLV indexes.  Use the
      directoryserver(1m) script on myserver to stop
      the server and then enter the following vlvindex
      sub-commands to create the actual VLV indexes:

  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getgrent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.gethostent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getnetent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getpwent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getrpcent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getspent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getauhoent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getsoluent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getauduent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getauthent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getexecent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getprofent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getmailent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getbootent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getethent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getngrpent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getipnent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getmaskent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getprent
  directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getip4ent
```

EXAMPLE 11–1 Running `idsconfig` for the Example, Inc. Network *(Continued)*

```
directoryserver -s myserver vlvindex -n userRoot -T west.example.com.getip6ent
```

Populating the Directory Server Using `ldapaddent`

Note – Before populating the directory server with data, you must configure the server to store passwords in UNIX `Crypt` format if you are using `pam_unix`. If you are using `pam_ldap`, you can store passwords in any format. For more information about setting the password in UNIX `crypt` format, see the Sun Java System Directory Server documents.

`ldapaddent` reads from the standard input (that being an `/etc/filename` like `passwd`) and places this data to the container associated with the service. Client configuration determines how the data will be written by default.

Note – `ldapaddent`(1M) can only run on an LDAP client. Chapter 12 describes how to configure a client for the LDAP naming service.

▼ How to Populate Sun Java System Directory Server With User Password Data Using `ldapaddent`

See `ldapaddent`(1M). See Chapter 9 for information about LDAP security and write-access to the directory server.

- **Use the `ldapaddent` command to add `/etc/passwd` entries to the server.**

```
# ldapaddent -D "cn=directory manager" -f /etc/passwd passwd
```

Managing Printer Entries

Adding Printers

To add printer entries to the LDAP directory, use either the `printmgr` configuration tool or the `lpset -n ldap` command-line utility. See `lpset`(1M). Note that the printer objects added to the directory only define the connection parameter, required by print system clients, of printers. Local print server configuration data is still held in files. A typical printer entry would look like the following:

```
printer-uri=myprinter,ou=printers,dc=mkg,dc=example,dc=com
objectclass=top
objectclass=printerService
objectclass=printerAbstract
objectclass=sunPrinter
printer-name=myprinter
sun-printer-bsdaddr=printsvr.example.com,myprinter,Solaris
sun-printer-kvp=description=HP LaserJet (PS)
printer-uri=myprinter
```

Using `lpget`

`lpget`(1M) can be used to list all printer entries known by the LDAP client's LDAP directory. If the LDAP client's LDAP server is a replica server, then printers listed might not be the same as that in the master LDAP server depending on the update replication agreement. See `lpget`(1M) for more information.

For example, to list all printers for a given base DN, type the following:

```
# lpget -n ldap list
myprinter:
    dn=myprinter,ou=printers,dc=mkt,dc=example,dc=com
    bsdaddr=printsvr.example.com,myprinter,Solaris
    description=HP LaserJet (PS)
```

Populating the Directory Server With Additional Profiles

Use `ldapclient` with the `genprofile` option to create an LDIF representation of a configuration profile, based on the attributes specified. The profile you create can then be loaded into an LDAP server to be used as the client profile. The client profile can be downloaded by the client by using `ldapclient init`.

Refer to `ldapclient`(1M) for information about using `ldapclient genprofile`.

▼ How to Populate the Directory Server With Additional Profiles Using `ldapclient`

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Use `ldapclient` with the `genprofile` command.**

```
# ldapclient genprofile \
-a profileName=myprofile \
-a defaultSearchBase=dc=west,dc=example,dc=com \
-a "defaultServerList=192.168.0.1 192.168.0.2:386" \
> myprofile.ldif
```

3. **Upload the new profile to the server.**

```
# ldapadd -h 192.168.0.1 -D "cn=directory manager" -f myprofile.ldif
```

Configuring the Directory Server to Enable Account Management

In order for `pam_ldap` to work properly, the password and account lockout policy must be properly configured on the server. You can use the Directory Server Console or `ldapmodify` to configure the account management policy for the LDAP directory. For procedures and more information, see the "User Account Management" chapter in the *Administration Guide* for the version of Sun Java System Directory Server that you are using.

Note – After you enable `pam_ldap` account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as `rsh`, `rlogin`, or `ssh` will fail.

Passwords for `proxy` users should *never* be allowed to expire. If proxy passwords expire, clients using the `proxy` credential level cannot retrieve naming service information from the server. To ensure that proxy users have passwords that do not expire, modify the proxy accounts with the following script.

```
# ldapmodify -h ldapserver -D administrator DN \
-w  administrator password <<EOF
dn: proxy user DN
DNchangetype: modify
replace: passwordexpiriationtime
passwordexpirationtime: 20380119031407Z
EOF
```

Note – `pam_ldap` account management relies on Sun Java System Directory Server to maintain and provide password aging and account expiration information for users. The directory server does not interpret the corresponding data from shadow entries to validate user accounts. `pam_unix`, however, examines the shadow data to determine if accounts are locked or if passwords are aged. Since the shadow data is not kept up to date by the LDAP naming services or the directory server, `pam_unix` should not grant access based on the shadow data. The shadow data is retrieved using the `proxy` identity. Therefore, do not allow `proxy` users to have read access to the `userPassword` attribute. Denying `proxy` users read access to `userPassword` prevents `pam_unix` from making an invalid account validation.

Migrating Your Sun Java System Directory Server

Schema changes were implemented between the release of Sun Java System Directory Server 5.1 (formerly Sun ONE Directory Server) and the release of Sun Java System Directory Server 5.2. The `ldapaddent` command now adds `objectclass: device` to the entries of `ethers/bootparams`. Therefore, if you choose to use the LDAP commands to migrate directory data from Sun Java System Directory Server 5.1 to 5.2, you must use `ldapaddent -d` to export data and `ldapaddent` to import data. Otherwise, if you use the Sun Java System Directory Server tools `db2ldif` and `ldif2db` to migrate data, you must apply Sun Java System Directory Server 5.2 with all patches before migrating the data, or the data import could fail.

For information about configuring the Sun Java System Directory Server 5.2, see the Sun Java System Directory Server documentation, that is included with the Sun Java Enterprise System.

CHAPTER 12

Setting Up LDAP Clients (Tasks)

This chapter describes how to set up a Solaris LDAP naming services client.

This chapter covers the following topics.

Prerequisites to LDAP Client Setup

In order for a Solaris client to use LDAP as a naming service the following needs to be in place.

- The client's domain name must be served by the LDAP server
- The `nsswitch.conf` file needs to point to LDAP for the required services
- The client needs to be configured with all the given parameters that define its behavior
- `ldap_cachemgr` needs to be running on the client
- At least one server for which a client is configured must be up and running

The `ldapclient` utility is the key to setting up an LDAP client, as it performs all of the above steps, except for starting the server. The rest of this chapter will show examples of how to use the `ldapclient` utility to set up an LDAP client and use the various other LDAP utilities to get information about, and check the status of, an LDAP client.

LDAP and the Service Management Facility

The LDAP client service is managed by using the Service Management Facility. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the`svcadm`(1M) and `svcs`(1) man pages for more details.

- Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command.

  Tip – Temporarily disabling a service by using the `-t` option provides some protection for the service configuration. If the service is disabled with the `-t` option, the original settings would be restored for the service after a reboot. If the service is disabled without `-t`, the service will remain disabled after reboot.

- The Fault Managed Resource Identifier (FMRI) for the LDAP client service is `svc:/network/ldap/client:`<*instance*>.
- You can query the status of the LDAP client and `ldap_cachemgr` by using the `svcs` command.
  - Example of `svcs` command and output.

    ```
    # svcs \*ldap\*
    STATE          STIME     FMRI
    online         15:43:46  svc:/network/ldap/client:default
    ```

  - Example of `svcs -l` command and output. To get the output shown below, you must use the instance name in the FMRI.

    ```
    # svcs -l network/ldap/client:default
    fmri         svc:/network/ldap/client:default
    enabled      true
    state        online
    next_state   none
    restarter    svc:/system/svc/restarter:default
    contract_id  1598
    dependency   require_all/none file://localhost/var/ldap/ldap_client_file (-)
    dependency   require_all/none svc:/network/initial (online)
    ```

```
    dependency   require_all/none svc:/system/filesystem/minimal (online)
```

- You can check a daemon's presence by using the `ps` command.

```
# ps -e | grep slapd
  root 23320     1   0   Aug 27 ?       16:30 ./ns-slapd -D \
  /usr/iplanet/ds5/slapd-lastrev -i /usr/iplanet/ds5/slapd-lastrev/
  root 25367 25353   0 15:35:19 pts/1     0:00 grep slapd
```

Note – Do not use the `-f` option with `ps` because this option attempts to translate user IDs to names, which causes more naming service lookups that might not succeed.

Initializing an LDAP Client

`ldapclient`(1M) is a utility used to set up LDAP clients in the Solaris system. `ldapclient` assumes the server has already been configured with the appropriate client profiles. You must install and configure the server with the appropriate profiles before you can set up clients.

Note – The Solaris operating system does not support a configuration in which a NIS client and a Native LDAP client co-exist on the same client machine.

There are two main ways to set up a client by using `ldapclient`.

- *Profile*

  At a minimum, you need to specify the server address containing the profile and domain you want to use. If no profile is specified, then the "default" profile is assumed. The server will provide the rest of the required information, except for proxy and certificate database information. If a client's credential level is `proxy` or `proxy anonymous`, you must supply the proxy bind DN and password. See "Assigning Client Credential Levels" on page 142 for more information.

- *Manual*

  You configure the profile on the client itself, which means defining all parameters from the command line. Thus, the profile information is stored in cache files and is never refreshed by the server.

Note – Though you can manually configure clients, it is not recommended. Using the configuration profiles decreases the complexity and cost of managing clients.

Using Profiles to Initialize a Client

▼ How to Initialize a Client Using Profiles

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Run `ldapclient` with `init`.**

```
# ldapclient init \
-a profileName=new \
-a domainName=west.example.com 192.168.0.1
System successfully configured
```

Using Proxy Credentials

▼ How to Initialize a Client Using Proxy Credentials

Note – *Do not* edit either of the client configuration files directly. Use `ldapclient` to create or modify the content of these files.

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Run `ldapclient` (defining proxy values).**

```
# ldapclient init \
-a proxyDN=cn=proxyagent,ou=profile,dc=west,dc=example,dc=com \
-a domainName=west.example.com \
-a profileName=pit1 \
-a proxyPassword=test1234 192.168.0.1
```

```
System successfully configured
```

The `-a` proxyDN and `-a` proxyPassword are *required* if the profile to be used is set up for `proxy`. As the credentials are not stored in the profile saved on the server, you must supply the information when you initialize the client. This method is more secure than the older method of storing the proxy credentials on the server.

The proxy information is used to create `/var/ldap/ldap_client_cred`. The rest of the information is put in `/var/ldap/ldap_client_file`.

Initializing a Client Manually

Superusers. or administrators with an equivalent role, can perform manual client configurations. However, many of the checks are bypassed during the process, so it is relatively easy to misconfigure your system. In addition, you must change settings *on every machine*, instead of in one central place, as is done when using profiles.

▼ How to Initialize a Client Manually

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Use `ldapclient manual` to initialize the client.**

```
# ldapclient manual \
-a domainName=dc=west.example.com \
-a credentialLevel=proxy \
-a defaultSearchBase=dc=west,dc=example,dc=com \
-a proxyDN=cn=proxyagent,ou=profile,dc=west,dc=example,dc=com \
-a proxyPassword=testtest 192.168.0.1
```

3. **Use `ldapclient list` to verify.**

```
NS_LDAP_FILE_VERSION= 2.0
NS_LDAP_BINDDN= cn=proxyagent,ou=profile,dc=west,dc=example,dc=com
NS_LDAP_BINDPASSWD= {NS1}4a3788e8c053424f
NS_LDAP_SERVERS= 192.168.0.1
NS_LDAP_SEARCH_BASEDN= dc=west,dc=example,dc=com
NS_LDAP_CREDENTIAL_LEVEL= proxy
```

Modifying a Manual Client Configuration

▼ How to Modify a Manual Configuration

1. **Become superuser or assume an equivalent role.**

Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Use the `ldapclient mod` command to change the authentication method to `simple`.**

```
# ldapclient mod -a authenticationMethod=simple
```

3. **Use `ldapclient list` to verify the change was made.**

```
# ldapclient list
NS_LDAP_FILE_VERSION= 2.0
NS_LDAP_BINDDN= cn=proxyagent,ou=profile,dc=west,dc=example,dc=com
NS_LDAP_BINDPASSWD= {NS1}4a3788e8c053424f
NS_LDAP_SERVERS= 192.168.0.1
NS_LDAP_SEARCH_BASEDN= dc=west,dc=example,dc=com
NS_LDAP_AUTH= simple
NS_LDAP_CREDENTIAL_LEVEL= proxy
```

Uninitializing a Client

`ldapclient uninit` restores the client name service to what it was prior to the most recent `init`, `modify`, or `manual` operation. In other words, it performs an "undo" on the last step taken. For example, if the client was configured to use `profile1` and was then changed to use `profile2`, using `ldapclient uninit` would revert the client back to using `profile1`.

▼ How to Uninitialize a Client

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Use `ldapclient uninit`.**

```
# ldapclient uninit
System successfully recovered
```

Setting Up TLS Security

Note – The security database files must be readable by everyone. Do not include any private keys in the `key3.db`.

If using TLS, the necessary security databases must be installed. In particular, the certificate and key database files are needed. For example, if you adopt an older database format from Netscape Communicator, two files, `cert7.db` and `key3.db`, are required. Or if you use a new database format from Mozilla, three files, `cert8.db`, `key3.db` and `secmod.db` are needed. The `cert7.db` or `cert8.db` file contains trusted certificates. The `key3.db` file contains the client's keys. Even if the LDAP naming service client does not use client keys, this file must be present. The `secmod.db` file contains the security modules such as `PKCS#11` module. This file is not required if the older format is used.

Note – Before running `ldapclient`, you should set up and install the needed security database files described in this section.

See the section about configuring LDAP clients to use SSL in the "Managing SSL" chapter of the Administrator's Guide for the version of Sun Java System Directory Server you are using. For information on how to create and manage these files. Once configured, these files must be stored in the location expected by the LDAP naming services client. The attribute `certificatePath` is used to determine this location. This is by default `/var/ldap`.

For example, after setting up the necessary `cert7.db` and `key3.db` files using Netscape Communicator™, copy the files to the default location.

```
# cp $HOME/.netscape/cert7.db /var/ldap
# cp $HOME/.netscape/key3.db /var/ldap
```

Next, give everyone read access.

```
# chmod 444 /var/ldap/cert7.db
# chmod 444 /var/ldap/key3.db
```

Note – While Netscape manages the `cert7.db` and `key3.db` files in the `$HOME/.netscape` directory, Mozilla has its `cert8.db`, `key3.db` and `secmod.db` files managed in a sub-direcotry under `$HOME/.mozilla`. Copies of these security databases must be stored on a local file system if you are using them for an LDAP naming services client.

Configuring PAM

`pam_ldap` is the authentication and account management PAM module for LDAP. See the `pam_ldap`(5) man page and Appendix A for more information about the features currently supported with `pam_ldap`.

Configuring PAM to Use UNIX `policy`

To configure PAM to use UNIX `policy`, follow the sample in "Example `pam.conf` File for `pam_ldap`" on page 199. Add the lines that contain `pam_ldap.so.1` to the client's `/etc/pam.conf` file. For details, see the `pam.conf`(4) man page.

Configuring PAM to Use LDAP `server_policy`

To configure PAM to use LDAP `server_policy`, follow the sample in "Example `pam_conf` file for `pam_ldap` Configured for Account Management" on page 201. Add the lines that contain `pam_ldap.so.1` to the client's `/etc/pam.conf` file. In addition, if any PAM module in the sample `pam.conf` file specifies the `binding` flag and the `server_policy` option, use the same flag and option for the corresponding module in the client's `/etc/pam.conf` file. Also, add the `server_policy` option to the line that contains the service module `pam_authtok_store.so.1`.

Note – After you enable `pam_ldap` account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as `rsh`, `rlogin`, or `ssh` will fail.

- The `binding` control flag

  Using the `binding` control flag allows a local password override of a remote (LDAP) password. For example, if a user account is found on both the local files and the LDAP namespace, the password associated with the local account takes precedence over the remote password. Thus, if the local password expires, authentication fails even if the remote LDAP password is still valid.

- The `server_policy` option

  The `server_policy` option instructs `pam_unix_auth`, `pam_unix_account`, and `pam_passwd_auth` to ignore a user found in the LDAP namespace and to allow `pam_ldap` to perform authentication or account validation. In the case of `pam_authtok_store`, a new password is passed to the LDAP server without encryption. The password is thereby stored in the directory according to the password encryption scheme configured on the server. For more information, see `pam.conf`(4) and `pam_ldap`(5).

Retrieving LDAP Naming Services Information

You can retrieve information about LDAP naming services by using the `ldaplist` utility. This LDAP utility lists the naming information from the LDAP servers in LDIF format. It can be useful for troubleshooting. See `ldaplist`(1) for further information.

Listing All LDAP Containers

`ldaplist` displays its output with a blank line separating records, which is helpful for big multiline records.

Note – The output of `ldaplist` depends upon the client configuration. For example, if the value of `ns_ldap_search` is `sub` rather than `one`, `ldaplist` lists all the entries under the current search `baseDN`.

The following is an example of `ldaplist` output.

```
# ldaplist
dn: ou=people,dc=west,dc=example,dc=com

dn: ou=group,dc=west,dc=example,dc=com

dn: ou=rpc,dc=west,dc=example,dc=com

dn: ou=protocols,dc=west,dc=example,dc=com

dn: ou=networks,dc=west,dc=example,dc=com

dn: ou=netgroup,dc=west,dc=example,dc=com

dn: ou=aliases,dc=west,dc=example,dc=com

dn: ou=hosts,dc=west,dc=example,dc=com

dn: ou=services,dc=west,dc=example,dc=com

dn: ou=ethers,dc=west,dc=example,dc=com

dn: ou=profile,dc=west,dc=example,dc=com

dn: automountmap=auto_home,dc=west,dc=example,dc=com

dn: automountmap=auto_direct,dc=west,dc=example,dc=com
```

```
dn: automountmap=auto_master,dc=west,dc=example,dc=com

dn: automountmap=auto_shared,dc=west,dc=example,dc=com
```

Listing All User Entry Attributes

To list specific information such as a user's `passwd` entry, use `getent` as follows:

```
# getent passwd user1
user1::30641:10:Joe Q. User:/home/user1:/bin/csh
```

If you want to list all attributes, use `ldaplist` with the `-l` option.

```
# ldaplist -l passwd user1dn: uid=user1,ou=People,dc=west,dc=example,dc=com
        uid: user1
        cn: user1
        uidNumber: 30641
        gidNumber: 10
        gecos: Joe Q. User
        homeDirectory: /home/user1
        loginShell: /bin/csh
        objectClass: top
        objectClass: shadowAccount
        objectClass: account
        objectClass: posixAccount
        shadowLastChange: 6445
```

Customizing the LDAP Client Environment

The following sections describe how you can customize the client environment.

You can change any of the services, but be careful, because if the data is not populated on the server for the service specified, things will stop working. Also, in some cases files may not be set up by default.

Modifying the `nsswitch.conf` File for LDAP

You can modify your `/etc/nsswitch.conf` file to customize where each service gets its information. The default settings are stored in `/etc/nsswitch.ldap` and `ldapclient` uses this file to create your `/etc/nsswitch.conf` file when the client is initialized.

Enabling DNS With LDAP

If you want to enable DNS by setting up a `/etc/resolv.conf` file, add DNS to your hosts lines as shown below.

```
hosts:      ldap dns [NOTFOUND=return] files
```

CHAPTER 13

LDAP Troubleshooting (Reference)

This chapter describes configuration problems and suggests solutions for resolving them.

Note – The LDAP service is managed by the Service Management Facility. Administrative actions on this service, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. See "LDAP and the Service Management Facility" on page 178 for more information about using the Facility with LDAP. For an overview of the Facility, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

Monitoring LDAP Client Status

The following sections show various commands to help determine the state of the LDAP client environment. Also see the man pages for additional information about the options that can be used.

For an overview of the Service Management Facility, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

Verifying `ldap_cachemgr` Is Running

The `ldap_cachemgr` daemon must be running and functioning correctly at all times. Otherwise, the system doesn't work. When you start the LDAP client, the client starts `ldap_cachemgr` daemon automatically. So, if the `ldap_cachemgr` is not running, the LDAP client will be disabled. Following are two methods for determining if the LDAP client is online.

- Use the `svcs` command.

```
# svcs \*ldap\*
STATE          STIME    FMRI
disabled       Aug_24   svc:/network/ldap/client:default
```

or

```
# svcs -l network/ldap/client:default
fmri         svc:/network/ldap/client:default
enabled      true
state        online
next_state   none
restarter    svc:/system/svc/restarter:default
contract_id  1598
dependency   require_all/none file://localhost/var/ldap/ldap_client_file (-)
dependency   require_all/none svc:/network/initial (online)
dependency   require_all/none svc:/system/filesystem/minimal (online)
```

- Pass the `-g` option to `ldap_cachemgr`.

  This option provides more extensive status information, which is useful when you diagnose a problem.

```
# /usr/lib/ldap/ldap_cachemgr -g
cachemgr configuration:
server debug level          0
server log file "/var/ldap/cachemgr.log"
number of calls to ldapcachemgr         19

cachemgr cache data statistics:
Configuration refresh information:
  Previous refresh time: 2001/11/16 18:33:28
  Next refresh time:     2001/11/16 18:43:28
Server information:
  Previous refresh time: 2001/11/16 18:33:28
  Next refresh time:     2001/11/16 18:36:08
  server: 192.168.0.0, status: UP
  server: 192.168.0.1, status: ERROR
    error message: Can't connect to the LDAP server
Cache data information:
  Maximum cache entries:          256
  Number of cache entries:          2
```

For more information about the `ldap_cachemgr` daemon, see the `ldap_cachemgr`(1M) man page.

Checking the Current Profile Information

Become superuser or assume an equivalent role, and run `ldapclient` with the `list` option.

```
# ldapclient list
NS_LDAP_FILE_VERSION= 2.0
NS_LDAP_BINDDN= cn=proxyagent,ou=profile,dc=west,dc=example,dc=com
NS_LDAP_BINDPASSWD= {NS1}4a3788e8c053424f
NS_LDAP_SERVERS= 192.168.0.1, 192.168.0.10
NS_LDAP_SEARCH_BASEDN= dc=west,dc=example,dc=com
NS_LDAP_AUTH= simple
NS_LDAP_SEARCH_REF= TRUE
NS_LDAP_SEARCH_SCOPE= one
NS_LDAP_SEARCH_TIME= 30
NS_LDAP_SERVER_PREF= 192.168.0.1
NS_LDAP_PROFILE= pit1
NS_LDAP_CREDENTIAL_LEVEL= proxy
NS_LDAP_SERVICE_SEARCH_DESC= passwd:ou=people,?sub
NS_LDAP_SERVICE_SEARCH_DESC= group:ou=group,dc=west,dc=example,dc=com?one
NS_LDAP_BIND_TIME= 5
```

Currently the `/var/ldap` files are in ASCII format. Because the files could change to binary at some time, concatenating the files would cause problems. `ldapclient list` is the supported method for accessing this information. See the `ldapclient`(1M) man page for more information.

Verifying Basic Client-Server Communication

The best way to show that your client is talking to the LDAP server is with the `ldaplist` command. Using `ldaplist` with no arguments dumps all the containers on the server. This works as long as the containers exist, and do not have to be populated. See the `ldaplist`(1) man page for more information.

If the first step works, you can try `ldaplist passwd` *username* or `ldaplist hosts` *hostname* but if they contain lots of data you might want to pick a less populated service, or pipe them to `head` or `more`.

Checking Server Data From a Non-Client Machine

Most of the commands in the previous sections assume you already have created an LDAP client. If you have not created a client and want to check the data on the server, use the `ldapsearch` command. The following example lists all of the containers.

```
# ldapsearch -h server1 -b "dc=west,dc=example,dc=com" -s one "objectclass=*"
```

In Solaris 9 and earlier releases, the `ldapsearch` command, by default, produced output in a nonstandard textual representation. The default output for `ldapsearch` in later Solaris releases is the industry standardized LDIF format that is defined by RFC-2849. All versions of `ldapsearch` can output LDIF format using the `-L` option.

LDAP Configuration Problems and Solutions

The following sections describe LDAP configuration problems and suggests solutions to the problems.

Unresolved Hostname

The Solaris platform LDAP client back end returns fully qualified host names for host lookups, such as host names returned by `gethostbyname()` and `getaddrinfo()`. If the name stored is qualified, that is, contains at least one dot, the client returns the name as is. For example, if the name stored is `hostB.eng`, the returned name is `hostB.eng`.

If the name stored in the LDAP directory is not qualified (it does not contain a dot), the client back end appends the domain part to the name. For example, if the name stored is `hostA`, the returned name is `hostA.domainname`.

Unable to Reach Systems in the LDAP Domain Remotely

If the DNS domain name is different from the LDAP domain name, then the LDAP naming service cannot be used to serve host names unless the host names are stored fully qualified.

Login Does Not Work

LDAP clients use the PAM modules for user authentication during login. When using the standard UNIX PAM module, the password is read from the server and checked on the client side. This can fail due to one of the following reasons:

1. `ldap` is not used by the `passwd` service in the `/etc/nsswitch.conf` file.
2. The user's `userPassword` attribute on the server list is not readable by the proxy agent. You need to allow at least the proxy agent to read the password because the proxy agent returns it to the client for comparison. `pam_ldap` does not require read access to the password.
3. The proxy agent might not have the correct password.
4. The entry does not have the `shadowAccount` object class.

5. No password is defined for the user.

   When you use `ldapaddent`, you must use the `-p` option to ensure that the password is added to the user entry. If you use `ldapaddent` without the `-p` option, the user's password is not stored in the directory unless you also add the `/etc/shadow` file by using `ldapaddent`.

6. No LDAP servers are reachable.

   Check the status of the servers.

   ```
   # /usr/lib/ldap/ldap_cachemgr -g
   ```

7. `pam.conf` is configured incorrectly.
8. The user is not defined in the LDAP namespace.
9. `NS_LDAP_CREDENTIAL_LEVEL` is set to `anonymous` for `pam_unix`, and `userPassword` is not available to anonymous users.
10. The password is not stored in `crypt` format.
11. If `pam_ldap` is configured to support account management, login failure could be the result of one of the following:
    - The user's password has expired.
    - The user's account is locked out due to too many failed login attempts.
    - The user's account has been deactivated by the administrator.
    - The user tried to log in using a nonpassword-based program, such as `rsh`, `rlogin`, `ssh`, or `sftp`.

Lookup Too Slow

The LDAP database relies on indexes to improve search performance. A major performance degradation occurs when indexes are improperly configured. The documentation includes a common set of attributes that should be indexed. You can also add your own indexes to improve performance at your site.

`ldapclient` Cannot Bind to Server

`ldapclient` failed to initialize the client when using the `init` option with the `profileName` attribute specified. Possible reasons for failure include the following:

1. The incorrect domain name was specified on the command line.
2. The `nisDomain` attribute is not set in the DIT to represent the entry point for the specified client domain.
3. Access control information is not set up properly on the server, thus disallowing anonymous search in the LDAP database.
4. An incorrect server address passed to the `ldapclient` command. Use `ldapsearch` to verify the server address.

5. An incorrect profile name passed to the `ldapclient` command. Use `ldapsearch` to verify the profile name in the DIT.
6. Use `snoop` on the client's network interface to see what sort of traffic is going out, and determine to which server it is talking.

Using `ldap_cachemgr` for Debugging

Using `ldap_cachemgr` with the `-g` option can be a useful way to debug, as you can view the current client configuration and statistics. For example,

```
# ldap_cachemgr -g
```

would print current configuration and statistics to standard output, including the status of all LDAP servers, as mentioned previously. Note that you do *not* need to become super user to execute this command.

`ldapclient` Hangs During Setup

If the `ldapclient` command hangs, pressing Ctrl-C will exit after restoring the previous environment. If this happens, check with the server administrator to ensure that the server is running.

Also check the server list attributes in either the profile or from the command line and make sure that the server information is correct.

CHAPTER 14

LDAP General Reference (Reference)

This chapter covers the following topics.

Blank Checklists

TABLE 14–1 Server Variable Definitions

Variable	Definition for _____ Network
Port number at which an instance of the directory server is installed (389)	
Name of server	
Replica server(s) (IP number:port number)	
Directory manager [`dn: cn=directory manager`]	

TABLE 14–1 Server Variable Definitions *(Continued)*

Variable	Definition for _____ Network
Domain name to be served	
Maximum time (in seconds) to process client requests before timing out	
Maximum number of entries returned for each search request	

TABLE 14–2 Client Profile Variable Definitions

Variable	Definition for _____ Network
Profile name	
Server list (defaults to the local subnet)	
Preferred server list (listed in order of which server to try first, second, and so on)	
Search scope (number of levels down through the directory tree. 'One' or 'Sub')	
Credential used to gain access to server. The default is anonymous	
Follow Referrals? (a pointer to another server if the main server is unavailable) The default is no.	
Search time limit (in seconds, default 30) for waiting for server to return information.	
Bind time limit (in seconds, default 30) for contacting server. The default is seconds.	
Authentication method Default is none.	

LDAP Upgrade Information

This section provides information to consider when upgrading from the Solaris 8 release to a Solaris 9 or later release.

Compatibility

Clients configured on Solaris 9 or later Solaris software releases are fully compatible with directory servers set up to serve Solaris 8 clients, which only support version 1 profiles. However, to take advantage of newer features built into Solaris 9 and later releases, and to use the newer security model, you must use version 2 profiles.

Servers can serve a mix of both old and new clients. Clients see the same results from the server as long as schema mapping is not enabled and version 2 profiles are not configured to use special filters with the `serviceSearchDescriptors` attribute. Obviously if the server is not using the default schema, older clients cannot use that server as Solaris 8 clients cannot arbitrarily map nondefault schema.

Running the `ldap_cachemgr` Daemon

Beginning with the Solaris 9 release, the `ldap_cachemgr` daemon *must* be running at all times. The daemon is *required* for the client to function properly. When you use the Service Management Facility's `svcadm` command to start the LDAP client, the `ldap_cachemgr` daemon is automatically invoked. See the `ldap_cachemgr`(1M) man page for more information.

New `automount` Schema

Beginning with the Solaris 9 release, by default the Solaris software uses a new schema for `automount` entries. This new schema replaces the generic NIS map schema that Solaris 8 clients used. This means that if you set up a server with Solaris 9 or later software tools, Solaris 8 clients cannot see the `automount` entries. For sites where the server being set up is to serve both Solaris 8 and later Solaris software clients, a profile can be created to map the schema to the old one before adding automounter entries. This would ensure that `ldapaddent`(1M) adds the entries using the old schema. However, note that this would also mean that all clients based on Solaris 9 or later software must use a profile where the schema for `automount` is mapped.

You need to add the following mapping attributes to your profile for this mapping to take effect.

```
attributeMap:         automount:automountMapName=nisMapName
attributeMap:         automount:automountKey=cn
attributeMap:         automount:automountInformation=nisMapEntry
objectclassMap:       automount:automountMap=nisMap
objectclassMap:       automount:automount=nisObject
```

pam_ldap Changes

The Solaris 10 OS release introduced several changes to pam_ldap, identified in the following list. Also, see the pam_ldap(5) man page for more information.

- The previously supported use_first_pass and try_first_pass options are obsolete as of the Solaris 10 software release. These options are no longer needed, may safely be removed from pam.conf, and are silently ignored. They may be removed in a future release.
- Password prompting must be provided for by stacking pam_authtok_get before pam_ldap in the authentication and password module stacks, and by including pam_passwd_auth in the passwd service auth stack.
- The previously supported password update function is replaced in this release by the previously recommended use of pam_authtok_store with the server_policy option.

An upgrade to this release will not automatically update the existing pam.conf file to reflect the above changes. If the existing pam.conf file contains a pam_ldap configuration, you will be notified after the upgrade via the CLEANUP file. You will need to examine the pam.conf file and modify it, as needed.

It is not possible to provide a clean automatic update for the changes listed above, primarily password prompting and password update, due to the relevance of other modules used in the same stack and also due to the existence of third party modules.

See pam_passwd_auth(5), pam_authtok_get(5), pam_authtok_store(5), and pam.conf(4) man pages for more information.

LDAP Commands

There are two sets of LDAP-related commands in the Solaris system. One set is the general LDAP tools, which do not require the client to be configured with LDAP naming services. The second set uses the common LDAP configuration on the client and therefore can only be used if the client is configured to use LDAP as its naming service.

General LDAP Tools

LDAP command line tools support a common set of options, including authentication and bind parameters. The following tools support a common text-based format for representing directory information called the LDAP Data Interchange Format (LDIF). These commands can be used to manipulate directory entries directly.

`ldapsearch`(1)
`ldapmodify`(1)
`ldapadd`(1)
`ldapdelete`(1)

LDAP Tools Requiring LDAP Naming Services

TABLE 14–3 LDAP Tools

Tool	Function
`ldapaddent`(1M)	Used to create entries in LDAP containers from the corresponding `/etc` files. This tool allows populating the directory from files. For example, it reads `/etc/passwd` format file and populates `passwd` entries in the directory.
`ldaplist`(1)	Used to list contents of various services from the directory.
`idsconfig`(1M)	Used to set up Sun Java System Directory Server to serve LDAP naming service clients.

Example `pam.conf` File for `pam_ldap`

```
#
# Authentication management
#
# login service (explicit because of pam_dial_auth)
#
login    auth requisite        pam_authtok_get.so.1
login    auth required        pam_dhkeys.so.1
login    auth required        pam_dial_auth.so.1
login    auth required        pam_unix_cred.so.1
login    auth sufficient        pam_unix_auth.so.1
login    auth required        pam_ldap.so.1
#
```

```
# rlogin service (explicit because of pam_rhost_auth)
#
rlogin    auth sufficient        pam_rhosts_auth.so.1
rlogin    auth requisite        pam_authtok_get.so.1
rlogin    auth required        pam_dhkeys.so.1
rlogin    auth required        pam_unix_cred.so.1
rlogin    auth sufficient        pam_unix_auth.so.1
rlogin    auth required        pam_ldap.so.1
#
# rsh service (explicit because of pam_rhost_auth,
# and pam_unix_auth for meaningful pam_setcred)
#
rsh    auth sufficient        pam_rhosts_auth.so.1
rsh    auth required        pam_unix_cred.so.1
#
# PPP service (explicit because of pam_dial_auth)
#
ppp    auth requisite        pam_authtok_get.so.1
ppp    auth required        pam_dhkeys.so.1
ppp    auth required        pam_dial_auth.so.1
ppp    auth sufficient        pam_unix_auth.so.1
ppp    auth required        pam_ldap.so.1
#
# Default definitions for Authentication management
# Used when service name is not explicitly mentioned for authentication
#
other    auth requisite        pam_authtok_get.so.1
other    auth required        pam_dhkeys.so.1
other    auth required        pam_unix_cred.so.1
other    auth sufficient        pam_unix_auth.so.1
other    auth required        pam_ldap.so.1
#
# passwd command (explicit because of a different authentication module)
#
passwd    auth sufficient        pam_passwd_auth.so.1
passwd    auth required        pam_ldap.so.1
#
# cron service (explicit because of non-usage of pam_roles.so.1)
#
cron    account required    pam_unix_account.so.1
#
# Default definition for Account management
# Used when service name is not explicitly mentioned for account management
#
other    account requisite    pam_roles.so.1
other    account required    pam_unix_account.so.1
#
# Default definition for Session management
# Used when service name is not explicitly mentioned for session management
#
other    session required    pam_unix_session.so.1
#
# Default definition for  Password management
# Used when service name is not explicitly mentioned for password management
#
```

```
other    password required    pam_dhkeys.so.1
other    password requisite    pam_authtok_get.so.1
other    password requisite    pam_authtok_check.so.1
other    password required    pam_authtok_store.so.1
#
# Support for Kerberos V5 authentication and example configurations can
# be found in the pam_krb5(5) man page under the "EXAMPLES" section.
#
```

Example pam_conf file for pam_ldap Configured for Account Management

Note – After you enable pam_ldap account management, all users must provide a password any time they log in to the system. A login password is required for authentication. Therefore, nonpassword-based logins using tools such as rsh, rlogin, or ssh will fail.

```
#
# Authentication management
#
# login service (explicit because of pam_dial_auth)
#
login   auth requisite        pam_authtok_get.so.1
login   auth required         pam_dhkeys.so.1
login   auth required         pam_unix_cred.so.1
login   auth required         pam_dial_auth.so.1
login   auth binding          pam_unix_auth.so.1 server_policy
login   auth required         pam_ldap.so.1
#
# rlogin service (explicit because of pam_rhost_auth)
#
rlogin  auth sufficient       pam_rhosts_auth.so.1
rlogin  auth requisite        pam_authtok_get.so.1
rlogin  auth required         pam_dhkeys.so.1
rlogin  auth required         pam_unix_cred.so.1
rlogin  auth binding          pam_unix_auth.so.1 server_policy
rlogin  auth required         pam_ldap.so.1
#
# rsh service (explicit because of pam_rhost_auth,
# and pam_unix_auth for meaningful pam_setcred)
#
rsh     auth sufficient       pam_rhosts_auth.so.1
rsh     auth required         pam_unix_cred.so.1
rsh     auth binding          pam_unix_auth.so.1 server_policy
rsh     auth required         pam_ldap.so.1
```

```
#
# PPP service (explicit because of pam_dial_auth)
#
ppp     auth requisite        pam_authtok_get.so.1
ppp     auth required         pam_dhkeys.so.1
ppp     auth required         pam_dial_auth.so.1
ppp     auth binding          pam_unix_auth.so.1 server_policy
ppp     auth required         pam_ldap.so.1
#
# Default definitions for Authentication management
# Used when service name is not explicitly mentioned for authentication
#
other   auth requisite        pam_authtok_get.so.1
other   auth required         pam_dhkeys.so.1
other   auth required         pam_unix_cred.so.1
other   auth binding          pam_unix_auth.so.1 server_policy
other   auth required         pam_ldap.so.1
#
# passwd command (explicit because of a different authentication module)
#
passwd  auth binding          pam_passwd_auth.so.1 server_policy
passwd  auth required         pam_ldap.so.1
#
# cron service (explicit because of non-usage of pam_roles.so.1)
#
cron    account required      pam_unix_account.so.1
#
# Default definition for Account management
# Used when service name is not explicitly mentioned for account management
#
other   account requisite     pam_roles.so.1
other   account binding       pam_unix_account.so.1 server_policy
other   account required      pam_ldap.so.1
#
# Default definition for Session management
# Used when service name is not explicitly mentioned for session management
#
other   session required      pam_unix_session.so.1
#
# Default definition for  Password management
# Used when service name is not explicitly mentioned for password management
#
other   password required     pam_dhkeys.so.1
other   password requisite    pam_authtok_get.so.1
other   password requisite    pam_authtok_check.so.1
other   password required     pam_authtok_store.so.1 server_policy
#
# Support for Kerberos V5 authentication and example configurations can
# be found in the pam_krb5(5) man page under the "EXAMPLES" section.
#
```

IETF Schemas for LDAP

Schemas are definitions that describe what types of information can be stored as entries in a server's directory.

For a directory server to support Solaris LDAP naming clients, schemas defined in this chapter must be configured in the server unless schema is mapped using the schema mapping feature of the clients.

There are three required LDAP schemas defined by IETF: the RFC 2307 Network Information Service schema, the LDAP Mailgroups Internet draft, and the LDAP Internet Print Protocol (IPP) draft schema. To support the Naming Information Service, the definition of these schemas must be added to the directory server. The various RFCs can also be accessed on the IETF Web site `http://www.ietf.org`.

Note – Internet drafts are draft documents valid for a maximum of six months and might be updated, or rendered obsolete, by other documents at any time.

RFC 2307 Network Information Service Schema

The LDAP servers must be configured to support the revised RFC 2307.

The `nisSchema` OID is `1.3.6.1.1`. The RFC 2307 attributes are the following.

```
( nisSchema.1.0 NAME 'uidNumber'
DESC 'An integer uniquely identifying a user in an
        administrative domain'
EQUALITY integerMatch SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.1 NAME 'gidNumber'
DESC 'An integer uniquely identifying a group in an
        administrative domain'
EQUALITY integerMatch SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.2 NAME 'gecos'
DESC 'The GECOS field; the common name'
EQUALITY caseIgnoreIA5Match
SUBSTRINGS caseIgnoreIA5SubstringsMatch
SYNTAX 'IA5String' SINGLE-VALUE )

( nisSchema.1.3 NAME 'homeDirectory'
DESC 'The absolute path to the home directory'
EQUALITY caseExactIA5Match
SYNTAX 'IA5String' SINGLE-VALUE )

( nisSchema.1.4 NAME 'loginShell'
```

```
DESC 'The path to the login shell'
EQUALITY caseExactIA5Match
SYNTAX 'IA5String' SINGLE-VALUE )

( nisSchema.1.5 NAME 'shadowLastChange'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.6 NAME 'shadowMin'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.7 NAME 'shadowMax'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.8 NAME 'shadowWarning'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.9 NAME 'shadowInactive'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.10 NAME 'shadowExpire'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.11 NAME 'shadowFlag'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.12 NAME 'memberUid'
EQUALITY caseExactIA5Match
SUBSTRINGS caseExactIA5SubstringsMatch
SYNTAX 'IA5String' )

( nisSchema.1.13 NAME 'memberNisNetgroup'
EQUALITY caseExactIA5Match
SUBSTRINGS caseExactIA5SubstringsMatch
SYNTAX 'IA5String' )

( nisSchema.1.14 NAME 'nisNetgroupTriple'
DESC 'Netgroup triple'
SYNTAX 'nisNetgroupTripleSyntax' )

( nisSchema.1.15 NAME 'ipServicePort'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.16 NAME 'ipServiceProtocol'
SUP name )

( nisSchema.1.17 NAME 'ipProtocolNumber'
EQUALITY integerMatch
```

```
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.18 NAME 'oncRpcNumber'
EQUALITY integerMatch
SYNTAX 'INTEGER' SINGLE-VALUE )

( nisSchema.1.19 NAME 'ipHostNumber'
DESC 'IP address as a dotted decimal, eg. 192.168.1.1
        omitting leading zeros'
SUP name )

( nisSchema.1.20 NAME 'ipNetworkNumber'
DESC 'IP network as a dotted decimal, eg. 192.168,
        omitting leading zeros'
SUP name SINGLE-VALUE )

( nisSchema.1.21 NAME 'ipNetmaskNumber'
DESC 'IP netmask as a dotted decimal, eg. 255.255.255.0,
         omitting leading zeros'
EQUALITY caseIgnoreIA5Match
SYNTAX 'IA5String{128}' SINGLE-VALUE )

( nisSchema.1.22 NAME 'macAddress'
DESC 'MAC address in maximal, colon separated hex
      notation, eg. 00:00:92:90:ee:e2'
EQUALITY caseIgnoreIA5Match
SYNTAX 'IA5String{128}' )

( nisSchema.1.23 NAME 'bootParameter'
DESC 'rpc.bootparamd parameter'
SYNTAX 'bootParameterSyntax' )

( nisSchema.1.24 NAME 'bootFile'
DESC 'Boot image name'
EQUALITY caseExactIA5Match
SYNTAX 'IA5String' )

( nisSchema.1.26 NAME 'nisMapName'
SUP name )

( nisSchema.1.27 NAME 'nisMapEntry'
EQUALITY caseExactIA5Match
SUBSTRINGS caseExactIA5SubstringsMatch
SYNTAX 'IA5String{1024}' SINGLE-VALUE )

( nisSchema.1.28 NAME 'nisPublicKey'
DESC 'NIS public key'
SYNTAX 'nisPublicKeySyntax' )

( nisSchema.1.29 NAME 'nisSecretKey'
DESC 'NIS secret key'
SYNTAX 'nisSecretKeySyntax' )

( nisSchema.1.30 NAME 'nisDomain'
DESC 'NIS domain'
```

```
SYNTAX 'IA5String' )

( nisSchema.1.31 NAME 'automountMapName'
DESC 'automount Map Name'
EQUALITY caseExactIA5Match
SUBSTR caseExactIA5SubstringsMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )

( nisSchema.1.32 NAME 'automountKey'
DESC 'Automount Key value'
EQUALITY caseExactIA5Match
SUBSTR caseExactIA5SubstringsMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )

( nisSchema.1.33 NAME 'automountInformation'
DESC 'Automount information'
EQUALITY caseExactIA5Match
SUBSTR caseExactIA5SubstringsMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
```

The `nisSchema` OID is `1.3.6.1.1`. The RFC 2307 `objectClasses` are the following.

```
( nisSchema.2.0 NAME 'posixAccount' SUP top AUXILIARY
  DESC 'Abstraction of an account with POSIX attributes'
  MUST ( cn $ uid $ uidNumber $ gidNumber $ homeDirectory )
  MAY ( userPassword $ loginShell $ gecos $ description ) )

( nisSchema.2.1 NAME 'shadowAccount' SUP top AUXILIARY
  DESC 'Additional attributes for shadow passwords'
  MUST uid
  MAY ( userPassword $ shadowLastChange $ shadowMin
        shadowMax $ shadowWarning $ shadowInactive $
        shadowExpire $ shadowFlag $ description ) )

( nisSchema.2.2 NAME 'posixGroup' SUP top STRUCTURAL
  DESC 'Abstraction of a group of accounts'
  MUST ( cn $ gidNumber )
  MAY ( userPassword $ memberUid $ description ) )

( nisSchema.2.3 NAME 'ipService' SUP top STRUCTURAL
  DESC 'Abstraction an Internet Protocol service.
        Maps an IP port and protocol (such as tcp or udp)
        to one or more names; the distinguished value of
        the cn attribute denotes the service's canonical
        name'
  MUST ( cn $ ipServicePort $ ipServiceProtocol )
  MAY ( description ) )

( nisSchema.2.4 NAME 'ipProtocol' SUP top STRUCTURAL
  DESC 'Abstraction of an IP protocol. Maps a protocol number
        to one or more names. The distinguished value of the cn
        attribute denotes the protocol's canonical name'
  MUST ( cn $ ipProtocolNumber )
  MAY  description )
```

```
( nisSchema.2.5 NAME 'oncRpc' SUP top STRUCTURAL
  DESC 'Abstraction of an Open Network Computing (ONC)
        [RFC1057] Remote Procedure Call (RPC) binding.
        This class maps an ONC RPC number to a name.
        The distinguished value of the cn attribute denotes
        the RPC service's canonical name'
  MUST ( cn $ oncRpcNumber $ description )
  MAY  description )

( nisSchema.2.6 NAME 'ipHost' SUP top AUXILIARY
  DESC 'Abstraction of a host, an IP device. The distinguished
        value of the cn attribute denotes the host's canonical
        name. Device SHOULD be used as a structural class'
  MUST ( cn $ ipHostNumber )
  MAY ( l $ description $ manager $ userPassword ) )

( nisSchema.2.7 NAME 'ipNetwork' SUP top STRUCTURAL
  DESC 'Abstraction of a network. The distinguished value of
        the cn attribute denotes the network's canonical name'
  MUST ipNetworkNumber
  MAY ( cn $ ipNetmaskNumber $ l $ description $ manager ) )

( nisSchema.2.8 NAME 'nisNetgroup' SUP top STRUCTURAL
  DESC 'Abstraction of a netgroup. May refer to other netgroups'
  MUST cn
  MAY ( nisNetgroupTriple $ memberNisNetgroup $ description ) )

( nisSchema.2.9 NAME 'nisMap' SUP top STRUCTURAL
  DESC 'A generic abstraction of a NIS map'
  MUST nisMapName
  MAY description )

( nisSchema.2.10 NAME 'nisObject' SUP top STRUCTURAL
  DESC 'An entry in a NIS map'
  MUST ( cn $ nisMapEntry $ nisMapName )
  MAY description )

( nisSchema.2.11 NAME 'ieee802Device' SUP top AUXILIARY
  DESC 'A device with a MAC address; device SHOULD be
        used as a structural class'
  MAY macAddress )

( nisSchema.2.12 NAME 'bootableDevice' SUP top AUXILIARY
  DESC 'A device with boot parameters; device SHOULD be
  used as a structural class'
  MAY ( bootFile $ bootParameter ) )

( nisSchema.2.14 NAME 'nisKeyObject' SUP top AUXILIARY
  DESC 'An object with a public and secret key'
  MUST ( cn $ nisPublicKey $ nisSecretKey )
  MAY ( uidNumber $ description ) )

( nisSchema.2.15 NAME 'nisDomainObject' SUP top AUXILIARY
  DESC 'Associates a NIS domain with a naming context'
```

```
  MUST nisDomain )

( nisSchema.2.16 NAME 'automountMap' SUP top STRUCTURAL
  MUST ( automountMapName )
  MAY description )

( nisSchema.2.17 NAME 'automount' SUP top STRUCTURAL
  DESC 'Automount information'
  MUST ( automountKey $ automountInformation )
  MAY description )
```

Mail Alias Schema

Mail alias information uses the schema defined by the LDAP Mailgroups Internet draft, formerly known as the draft-steinback-ldap-mailgroups draft. Until a new schema becomes available, Solaris LDAP clients will continue to use this schema for mail alias information.

The original LDAP Mailgroups schema contains a large number of attributes and object classes. Only two attributes and a single object class are used by Solaris clients. These are listed below.

The mail alias Attributes are the following.

```
( 0.9.2342.19200300.100.1.3
  NAME 'mail'
  DESC 'RFC822 email address for this person'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String(256)'
  SINGLE-VALUE )

( 2.16.840.1.113730.3.1.30
  NAME 'mgrpRFC822MailMember'
  DESC 'RFC822 mail address of email only member of group'
  EQUALITY CaseIgnoreIA5Match
  SYNTAX 'IA5String(256)' )
```

The mail alias `objectClass` is the following.

```
( 2.16.840.1.113730.3.2.4
  NAME 'mailGroup'
  SUP top
  STRUCTURAL
  MUST mail
  MAY ( cn $ mailAlternateAddress $ mailHost $ mailRequireAuth $
   mgrpAddHeader $ mgrpAllowedBroadcaster $ mgrpAllowedDomain $
   mgrpApprovePassword $ mgrpBroadcasterModeration $ mgrpDeliverTo $
   mgrpErrorsTo $ mgrpModerator $ mgrpMsgMaxSize $
   mgrpMsgRejectAction $ mgrpMsgRejectText $ mgrpNoMatchAddrs $
   mgrpRemoveHeader $ mgrpRFC822MailMember ))
```

Directory User Agent Profile (DUAProfile) Schema

The DUAConfSchemaOID is 1.3.6.1.4.1.11.1.3.1.

```
DESC 'Default LDAP server host address used by a DUA'
            EQUALITY caseIgnoreMatch
            SYNTAX 1.3.6.1.4.1.1466.115.121.1.15
            SINGLE-VALUE )

           ( DUAConfSchemaOID.1.1 NAME 'defaultSearchBase'
             DESC 'Default LDAP base DN used by a DUA'
             EQUALITY distinguishedNameMatch
             SYNTAX 1.3.6.1.4.1.1466.115.121.1.12
             SINGLE-VALUE )

           ( DUAConfSchemaOID.1.2 NAME 'preferredServerList'
             DESC 'Preferred LDAP server host addresses to be used by a
             DUA'
             EQUALITY caseIgnoreMatch
             SYNTAX 1.3.6.1.4.1.1466.115.121.1.15
             SINGLE-VALUE )

           ( DUAConfSchemaOID.1.3 NAME 'searchTimeLimit'
             DESC 'Maximum time in seconds a DUA should allow for a
             search to complete'
             EQUALITY integerMatch
             SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
             SINGLE-VALUE )

           ( DUAConfSchemaOID.1.4 NAME 'bindTimeLimit'
             DESC 'Maximum time in seconds a DUA should allow for the
             bind operation to complete'
             EQUALITY integerMatch
             SYNTAX 1.3.6.1.4.1.1466.115.121.1.27
             SINGLE-VALUE )

           ( DUAConfSchemaOID.1.5 NAME 'followReferrals'
             DESC 'Tells DUA if it should follow referrals
             returned by a DSA search result'
             EQUALITY caseIgnoreIA5Match
             SYNTAX 1.3.6.1.4.1.1466.115.121.1.7
             SINGLE-VALUE )

           ( DUAConfSchemaOID.1.6 NAME 'authenticationMethod'
             DESC 'A keystring which identifies the type of
             authentication method used to contact the DSA'
             EQUALITY caseIgnoreMatch
             SYNTAX 1.3.6.1.4.1.1466.115.121.1.15
             SINGLE-VALUE )
```

```
( DUAConfSchemaOID.1.7 NAME 'profileTTL'
  DESC 'Time to live, in seconds, before a client DUA
  should re-read this configuration profile'
      'serviceSearchDescriptor'
  DESC 'LDAP search descriptor list used by a DUA'
  EQUALITY caseExactMatch
  SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )

( DUAConfSchemaOID.1.9 NAME 'attributeMap'
  DESC 'Attribute mappings used by a DUA'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )

( DUAConfSchemaOID.1.10 NAME 'credentialLevel'
  DESC 'Identifies type of credentials a DUA should
  use when binding to the LDAP server'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 1.3.6.1.4.1.1466.115.121.1.26
  SINGLE-VALUE )

( DUAConfSchemaOID.1.11 NAME 'objectclassMap'
  DESC 'Objectclass mappings used by a DUA'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )

( DUAConfSchemaOID.1.12 NAME 'defaultSearchScope' SINGLE-VALUE )

( DUAConfSchemaOID.1.13 NAME 'serviceCredentialLevel'
  DESC 'Identifies type of credentials a DUA
  should use when binding to the LDAP server for a
  specific service'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )

( DUAConfSchemaOID.1.15 NAME 'serviceAuthenticationMethod'
  DESC 'Authentication Method used by a service of the DUA'
  EQUALITY caseIgnoreMatch
  SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )

   ( DUAConfSchemaOID.2.4 NAME 'DUAConfigProfile'
       SUP top STRUCTURAL
     DESC 'Abstraction of a base configuration for a DUA'
     MUST ( cn )
     MAY ( defaultServerList $ preferredServerList $
    defaultSearchBase $ defaultSearchScope $
    searchTimeLimit $ bindTimeLimit $
    credentialLevel $ authenticationMethod $
    followReferrals $ serviceSearchDescriptor $
    serviceCredentialLevel $ serviceAuthenticationMethod $
    objectclassMap $ attributeMap $
    profileTTL ) )
```

Solaris Schemas

The schemas required for the Solaris platform are the following.

- Solaris Projects schema
- Role-based access control and execution profile schemas
- Printer schemas

Solaris Projects Schema

`/etc/project` is a local source of attributes associated with projects. For more information, see `project`(4).

The Project Attributes are the following.

```
( 1.3.6.1.4.1.42.2.27.5.1.1 NAME 'SolarisProjectID'
  DESC 'Unique ID for a Solaris Project entry'
  EQUALITY integerMatch
  SYNTAX INTEGER SINGLE )

( 1.3.6.1.4.1.42.2.27.5.1.2 NAME 'SolarisProjectName'
  DESC 'Name of a Solaris Project entry'
  EQUALITY caseExactIA5Match
  SYNTAX IA5String SINGLE )

( 1.3.6.1.4.1.42.2.27.5.1.3 NAME 'SolarisProjectAttr'
  DESC 'Attributes of a Solaris Project entry'
  EQUALITY caseExactIA5Match
  SYNTAX IA5String )

( 1.3.6.1.4.1.42.2.27.5.1.30 NAME 'memberGid'
  DESC 'Posix Group Name'
  EQUALITY caseExactIA5Match
  SYNTAX 'IA5String' )
```

The Project `objectClass` is the following.

```
( 1.3.6.1.4.1.42.2.27.5.2.1 NAME 'SolarisProject'
  SUP top STRUCTURAL
  MUST ( SolarisProjectID $ SolarisProjectName )
  MAY ( memberUid $ memberGid $ description $ SolarisProjectAttr ) )
```

Role-Based Access Control and Execution Profile Schema

`/etc/user_attr` is a local source of extended attributes associated with users and roles. For more information, see `user_attr`(4).

The role-based access control Attributes are the following.

```
( 1.3.6.1.4.1.42.2.27.5.1.4 NAME 'SolarisAttrKeyValue'
  DESC 'Semi-colon separated key=value pairs of attributes'
  EQUALITY caseIgnoreIA5Match
  SUBSTRINGS caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.7 NAME 'SolarisAttrShortDesc'
  DESC 'Short description about an entry, used by GUIs'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.8 NAME 'SolarisAttrLongDesc'
  DESC 'Detail description about an entry'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.9 NAME 'SolarisKernelSecurityPolicy'
  DESC 'Solaris  kernel security policy'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.10 NAME 'SolarisProfileType'
  DESC 'Type of object defined in profile'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.11 NAME 'SolarisProfileId'
  DESC 'Identifier of object defined in profile'
  EQUALITY caseExactIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.12 NAME 'SolarisUserQualifier'
  DESC 'Per-user login attributes'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.13 NAME 'SolarisReserved1'
  DESC 'Reserved for future use'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.14 NAME 'SolarisReserved2'
  DESC 'Reserved for future use'
  EQUALITY caseIgnoreIA5Match
  SYNTAX 'IA5String' SINGLE-VALUE )
```

The role based access control `objectClassses` are the following.

```
( 1.3.6.1.4.1.42.2.27.5.2.3 NAME 'SolarisUserAttr' SUP top AUXILIARY
  DESC 'User attributes'
  MAY ( SolarisUserQualifier $ SolarisAttrReserved1 $ \
        SolarisAttrReserved2 $ SolarisAttrKeyValue ) )
```

```
( 1.3.6.1.4.1.42.2.27.5.2.4 NAME 'SolarisAuthAttr' SUP top STRUCTURAL
  DESC 'Authorizations data'
  MUST cn
  MAY ( SolarisAttrReserved1 $ SolarisAttrReserved2 $ \
        SolarisAttrShortDesc $ SolarisAttrLongDesc $ \
        SolarisAttrKeyValue ) )

( 1.3.6.1.4.1.42.2.27.5.2.5 NAME 'SolarisProfAttr' SUP top STRUCTURAL
  DESC 'Profiles data'
  MUST cn
  MAY ( SolarisAttrReserved1 $ SolarisAttrReserved2 $ \
        SolarisAttrLongDesc $ SolarisAttrKeyValue ) )

( 1.3.6.1.4.1.42.2.27.5.2.6 NAME 'SolarisExecAttr' SUP top AUXILIARY
  DESC 'Profiles execution attributes'
  MAY ( SolarisKernelSecurityPolicy $ SolarisProfileType $ \
        SolarisAttrReserved1 $ SolarisAttrReserved2 $ \
        SolarisProfileId $ SolarisAttrKeyValue ) )
```

Internet Print Protocol Information for LDAP

The following sections provide information about the attributes and `ObjectClasses` for the internet print protocol and the Sun printer.

Internet Print Protocol (IPP) Attributes

```
( 1.3.18.0.2.4.1140
NAME 'printer-uri'
DESC 'A URI supported by this printer.
This URI SHOULD be used as a relative distinguished name (RDN).
If printer-xri-supported is implemented, then this URI value
MUST be listed in a member value of printer-xri-supported.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE )

( 1.3.18.0.2.4.1107
NAME 'printer-xri-supported'
DESC 'The unordered list of XRI (extended resource identifiers) supported
by this printer.
Each member of the list consists of a URI (uniform resource identifier)
followed by optional authentication and security metaparameters.'
EQUALITY caseIgnoreMatch
```

```
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )

( 1.3.18.0.2.4.1135
NAME 'printer-name'
DESC 'The site-specific administrative name of this printer, more end-user
friendly than a URI.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127}  SINGLE-VALUE )

( 1.3.18.0.2.4.1119
NAME 'printer-natural-language-configured'
DESC 'The configured language in which error and status messages will be
generated (by default) by this printer.
Also, a possible language for printer string attributes set by operator,
system administrator, or manufacturer.
Also, the (declared) language of the "printer-name", "printer-location",
"printer-info", and "printer-make-and-model" attributes of this printer.
For example: "en-us" (US English) or "fr-fr" (French in France) Legal values of
language tags conform to [RFC3066] "Tags for the Identification of Languages".'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127}  SINGLE-VALUE )

( 1.3.18.0.2.4.1136
NAME 'printer-location'
DESC 'Identifies the location of the printer. This could include
things like: "in Room 123A", "second floor of building XYZ".'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} SINGLE-VALUE )

( 1.3.18.0.2.4.1139
NAME 'printer-info'
DESC 'Identifies the descriptive information about this printer.
This could include things like: "This printer can be used for
printing color transparencies for HR presentations", or
"Out of courtesy for others, please print only small (1-5 page)
jobs at this printer", or even "This printer is going away on July 1, 1997,
please find a new printer".'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127}
SINGLE-VALUE )

( 1.3.18.0.2.4.1134
NAME 'printer-more-info'
DESC 'A URI used to obtain more information about this specific printer.
For example, this could be an HTTP type URI referencing an HTML page
accessible to a Web Browser.
The information obtained from this URI is intended for end user consumption.'
```

```
EQUALITY caseIgnoreMatch ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE )

( 1.3.18.0.2.4.1138
NAME 'printer-make-and-model'
DESC 'Identifies the make and model of the device.
The device manufacturer MAY initially populate this attribute.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.15{127}  SINGLE-VALUE )

( 1.3.18.0.2.4.1133
NAME 'printer-ipp-versions-supported'
DESC 'Identifies the IPP protocol version(s) that this printer supports,
including major and minor versions,
i.e., the version numbers for which this Printer implementation meets
the conformance requirements.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1132
NAME 'printer-multiple-document-jobs-supported'
DESC 'Indicates whether or not the printer supports more than one
document per job, i.e., more than one Send-Document or Send-Data
operation with document data.'
EQUALITY booleanMatch
SYNTAX 1.3.6.1.4.1.1466.115.121.1.7 SINGLE-VALUE )

( 1.3.18.0.2.4.1109
NAME 'printer-charset-configured'
DESC 'The configured charset in which error and status messages will be
generated (by default) by this printer.
Also, a possible charset for printer string attributes set by operator,
system administrator, or manufacturer.
For example: "utf-8" (ISO 10646/Unicode) or "iso-8859-1" (Latin1).
Legal values are defined by the IANA Registry of Coded Character Sets and
the "(preferred MIME name)" SHALL be used as the tag.
For coherence with IPP Model, charset tags in this attribute SHALL be
lowercase normalized.
This attribute SHOULD be static (time of registration) and SHOULD NOT be
dynamically refreshed attributetypes: (subsequently).'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{63} SINGLE-VALUE )

( 1.3.18.0.2.4.1131
NAME 'printer-charset-supported'
DESC 'Identifies the set of charsets supported for attribute type values of
type Directory String for this directory entry.
For example: "utf-8" (ISO 10646/Unicode) or "iso-8859-1" (Latin1).
Legal values are defined by the IANA Registry of Coded Character Sets and
the preferred MIME name.'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{63} )
```

```
( 1.3.18.0.2.4.1137
NAME 'printer-generated-natural-language-supported'
DESC 'Identifies the natural language(s) supported for this directory entry.
For example: "en-us" (US English) or "fr-fr" (French in France).
Legal values conform to [RFC3066], Tags for the Identification of Languages.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{63} )

( 1.3.18.0.2.4.1130
NAME 'printer-document-format-supported'
DESC 'The possible document formats in which data may be interpreted
and printed by this printer.
Legal values are MIME types come from the IANA Registry of Internet Media Types.'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1129
NAME 'printer-color-supported'
DESC 'Indicates whether this printer is capable of any type of color printing
at all, including highlight color.'
EQUALITY booleanMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.7  SINGLE-VALUE )

( 1.3.18.0.2.4.1128
NAME 'printer-compression-supported'
DESC 'Compression algorithms supported by this printer.
For example: "deflate, gzip".  Legal values include; "none", "deflate"
attributetypes: (public domain ZIP), "gzip" (GNU ZIP), "compress" (UNIX).'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{255} )

( 1.3.18.0.2.4.1127
NAME 'printer-pages-per-minute'
DESC 'The nominal number of pages per minute which may be output by this
printer (e.g., a simplex or black-and-white printer).
This attribute is informative, NOT a service guarantee.
Typically, it is the value used in marketing literature to describe this printer.'
EQUALITY integerMatch
ORDERING integerOrderingMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.27  SINGLE-VALUE )

( 1.3.18.0.2.4.1126 NAME 'printer-pages-per-minute-color'
DESC 'The nominal number of color pages per minute which may be output by this
printer (e.g., a simplex or color printer).
This attribute is informative, NOT a service guarantee.
Typically, it is the value used in marketing literature to describe this printer.'
EQUALITY integerMatch
ORDERING integerOrderingMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.27  SINGLE-VALUE )

( 1.3.18.0.2.4.1125 NAME 'printer-finishings-supported'
DESC 'The possible finishing operations supported by this printer.
Legal values include; "none", "staple", "punch", "cover", "bind", "saddle-stitch",
"edge-stitch", "staple-top-left", "staple-bottom-left", "staple-top-right",
"staple-bottom-right", "edge-stitch-left", "edge-stitch-top", "edge-stitch-right",
```

```
"edge-stitch-bottom", "staple-dual-left", "staple-dual-top", "staple-dual-right",
"staple-dual-bottom".'
EQUALITY caseIgnoreMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{255} )

( 1.3.18.0.2.4.1124 NAME 'printer-number-up-supported'
DESC 'The possible numbers of print-stream pages to impose upon a single side of
an instance of a selected medium. Legal values include; 1, 2, and 4.
Implementations may support other values.'
EQUALITY integerMatch
ORDERING integerOrderingMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.27 )

( 1.3.18.0.2.4.1123 NAME 'printer-sides-supported'
DESC 'The number of impression sides (one or two) and the two-sided impression
rotations supported by this printer.
Legal values include; "one-sided", "two-sided-long-edge", "two-sided-short-edge".'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1122 NAME 'printer-media-supported'
DESC 'The standard names/types/sizes (and optional color suffixes) of the media
supported by this printer.
For example: "iso-a4",  "envelope", or "na-letter-white".
Legal values  conform to ISO 10175, Document Printing Application (DPA), and any
IANA registered extensions.'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{255} )

( 1.3.18.0.2.4.1117 NAME 'printer-media-local-supported'
DESC 'Site-specific names of media supported by this printer, in the language in
"printer-natural-language-configured".
For example: "purchasing-form" (site-specific name) as opposed to
(in "printer-media-supported"): "na-letter" (standard keyword from ISO 10175).'
EQUALITY caseIgnoreMatch SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{255} )

( 1.3.18.0.2.4.1121 NAME 'printer-resolution-supported'
DESC 'List of resolutions supported for printing documents by this printer.
Each resolution value is a string with 3 fields:
1) Cross feed direction resolution (positive integer), 2) Feed direction
resolution (positive integer), 3) Resolution unit.
Legal values are "dpi" (dots per inch) and "dpcm" (dots per centimeter).
Each resolution field is delimited by ">".  For example:  "300> 300> dpi>".'
EQUALITY caseIgnoreMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{255} )

( 1.3.18.0.2.4.1120 NAME 'printer-print-quality-supported'
DESC 'List of print qualities supported for printing documents on this printer.
For example: "draft, normal".  Legal values include; "unknown", "draft", "normal",
"high".'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1110 NAME 'printer-job-priority-supported'
DESC 'Indicates the number of job priority levels supported.
```

```
An IPP conformant printer which supports job priority must always support a
full range of priorities from "1" to "100"
(to ensure consistent behavior), therefore this attribute describes the
"granularity".
 Legal values of this attribute are from "1" to "100".'
EQUALITY integerMatch
ORDERING integerOrderingMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.27  SINGLE-VALUE )

( 1.3.18.0.2.4.1118
NAME 'printer-copies-supported'
DESC 'The maximum number of copies of a document that may be printed as a single job.
A value of "0" indicates no maximum limit.
A value of "-1" indicates unknown.'
EQUALITY integerMatch
ORDERING integerOrderingMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.27  SINGLE-VALUE )

( 1.3.18.0.2.4.1111
NAME 'printer-job-k-octets-supported'
DESC 'The maximum size in kilobytes (1,024 octets actually) incoming print job that
this printer will accept.
A value of "0" indicates no maximum limit.  A value of "-1" indicates unknown.'
EQUALITY integerMatch
ORDERING integerOrderingMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.27  SINGLE-VALUE )

( 1.3.18.0.2.4.1113
NAME 'printer-service-person'
DESC 'The name of the current human service person responsible for servicing this
printer.
It is suggested that this string include information that would enable other humans
to reach the service person, such as a phone number.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127}
SINGLE-VALUE )

( 1.3.18.0.2.4.1114
NAME 'printer-delivery-orientation-supported'
DESC 'The possible delivery orientations of pages as they are printed and ejected
from this printer.
Legal values include; "unknown", "face-up", and "face-down".'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1115
NAME 'printer-stacking-order-supported'
DESC 'The possible stacking order of pages as they are printed and ejected from
this printer.
Legal values include; "unknown", "first-to-last", "last-to-first".'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1116
NAME 'printer-output-features-supported'
DESC 'The possible output features supported by this printer.
```

```
Legal values include; "unknown", "bursting", "decollating", "page-collating",
"offset-stacking".'
EQUALITY caseIgnoreMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.18.0.2.4.1108
NAME 'printer-aliases'
DESC 'Site-specific administrative names of this printer in addition the printer
name specified for printer-name.'
EQUALITY caseIgnoreMatch
ORDERING caseIgnoreOrderingMatch
SUBSTR caseIgnoreSubstringsMatch
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15{127} )

( 1.3.6.1.4.1.42.2.27.5.1.63
NAME 'sun-printer-bsdaddr'
DESC 'Sets the server, print queue destination name and whether the client generates
protocol extensions.
"Solaris" specifies a Solaris print server extension. The value is represented b the
following value: server "," destination ", Solaris".'
SYNTAX '1.3.6.1.4.1.1466.115.121.1.15' SINGLE-VALUE )

( 1.3.6.1.4.1.42.2.27.5.1.64
NAME 'sun-printer-kvp'
DESC 'This attribute contains a set of key value pairs which may have meaning to the
print subsystem or may be user defined.
Each value is represented by the following: key "=" value.'
SYNTAX '1.3.6.1.4.1.1466.115.121.1.15' )
```

Internet Print Protocol (IPP) `ObjectClasses`

```
objectclasses: ( 1.3.18.0.2.6.2549
NAME 'slpService'
DESC 'DUMMY definition'
SUP 'top' MUST (objectclass) MAY ())

objectclasses: ( 1.3.18.0.2.6.254
NAME 'slpServicePrinter'
DESC 'Service Location Protocol (SLP) information.'
AUXILIARY SUP 'slpService')

objectclasses: ( 1.3.18.0.2.6.258
NAME 'printerAbstract'
DESC 'Printer related information.'
ABSTRACT SUP 'top' MAY ( printer-name
$ printer-natural-language-configured
$ printer-location
$ printer-info
$ printer-more-info
$ printer-make-and-model
$ printer-multiple-document-jobs-supported
$ printer-charset-configured
$ printer-charset-supported
```

```
$ printer-generated-natural-language-supported
$ printer-document-format-supported
$ printer-color-supported
$ printer-compression-supported
$ printer-pages-per-minute
$ printer-pages-per-minute-color
$ printer-finishings-supported
$ printer-number-up-supported
$ printer-sides-supported
$ printer-media-supported
$ printer-media-local-supported
$ printer-resolution-supported
$ printer-print-quality-supported
$ printer-job-priority-supported
$ printer-copies-supported
$ printer-job-k-octets-supported
$ printer-current-operator
$ printer-service-person
$ printer-delivery-orientation-supported
$ printer-stacking-order-supported $ printer! -output-features-supported ))

objectclasses: ( 1.3.18.0.2.6.255
NAME 'printerService'
DESC 'Printer information.'
STRUCTURAL SUP 'printerAbstract' MAY ( printer-uri
$ printer-xri-supported ))

objectclasses: ( 1.3.18.0.2.6.257
NAME 'printerServiceAuxClass'
DESC 'Printer information.'
AUXILIARY SUP 'printerAbstract' MAY ( printer-uri $ printer-xri-supported ))

objectclasses: ( 1.3.18.0.2.6.256
NAME 'printerIPP'
DESC 'Internet Printing Protocol (IPP) information.'
AUXILIARY SUP 'top' MAY   ( printer-ipp-versions-supported $
printer-multiple-document-jobs-supported ))

objectclasses: ( 1.3.18.0.2.6.253
NAME 'printerLPR'
DESC 'LPR information.'
AUXILIARY SUP 'top' MUST ( printer-name ) MAY ( printer-aliases))

objectclasses: ( 1.3.6.1.4.1.42.2.27.5.2.14
NAME 'sunPrinter'
DESC 'Sun printer information'
SUP 'top' AUXILIARY MUST (objectclass $ printer-name)  MAY
(sun-printer-bsdaddr $ sun-printer-kvp))
```

Sun Printer Attributes

```
ATTRIBUTE ( 1.3.6.1.4.1.42.2.27.5.1.63
NAME sun-printer-bsdaddr
DESC 'Sets the server, print queue destination name and whether the
```

```
     client generates protocol extensions. "Solaris" specifies a
     Solaris print server extension.  The value is represented by
     the following value: server "," destination ", Solaris".'
EQUALITY caseIgnoreIA5Match
SYNTAX 1.3.6.1.4.1.1466.115.121.1.15
SINGLE-VALUE
)


ATTRIBUTE ( 1.3.6.1.4.1.42.2.27.5.1.64
NAME sun-printer-kvp
DESC 'This attribute contains a set of key value pairs which may have
      meaning to the print subsystem or may be user defined.  Each
      value is represented by the following: key "=" value.'
EQUALITY caseIgnoreIA5Match
SYNTAX  1.3.6.1.4.1.1466.115.121.1.15  )
```

Sun Printer `ObjectClasses`

```
OBJECTCLASS ( 1.3.6.1.4.1.42.2.27.5.2.14
NAME sunPrinter
DESC 'Sun printer information'
SUP  top
AUXILIARY
MUST ( printer-name )
MAY  ( sun-printer-bsdaddr $ sun-printer-kvp ))
```

Generic Directory Server Requirements for LDAP

To support LDAP clients based on Solaris 9 or later Solaris versions, the server, regardless of what brand, must support the LDAP v3 protocol and compound naming and auxiliary object classes. In addition, at least one of the following controls must be supported.

- Simple paged-mode (RFC 2696)
- Virtual List View controls

  The server must support at least one of the following authentication methods.

```
anonymous
simple
sasl/cram-MD5
sasl/digest-MD5
```

If using `pam_unix`, the server must support storing passwords in UNIX crypt format.

If using TLS, the server must support SSL or TLS.

Default Filters Used by LDAP Naming Services

If you do not manually specify a parameter for a given service using an SSD, the default filter is used. To list the default filters for a given service, use `ldaplist` with the `-v` option.

In the following example, `filter=(&(objectclass=iphost)(cn=abcde)` defines the default filters.

```
database=hosts
filter=(&(objectclass=iphost)(cn=abcde)
user data=(&(%s) (cn=abcde))
```

`ldaplist` generates the following list of default filters, where `%s` signifies a string and `%d`, a number.

```
hosts
(&(objectclass=iphost)(cn=%s))
--------------
passwd
(&(objectclass=posixaccount)(uid=%s))
--------------
services
(&(objectclass=ipservice)(cn=%s))
--------------
group
(&(objectclass=posixgroup)(cn=%s))
--------------
netgroup
(&(objectclass=nisnetgroup)(cn=%s))
--------------
networks
(&(objectclass=ipnetwork)(ipnetworknumber=%s))
--------------
netmasks
(&(objectclass=ipnetwork)(ipnetworknumber=%s))
--------------
rpc
(&(objectclass=oncrpc)(cn=%s))
--------------
protocols
(&(objectclass=ipprotocol)(cn=%s))
--------------
```

```
bootparams
(&(objectclass=bootableDevice)(cn=%s))
--------------
ethers
(&(objectclass=ieee802Device)(cn=%s))
--------------
publickey
(&(objectclass=niskeyobject)(cn=%s))
or
(&(objectclass=niskeyobject)(uidnumber=%d))
--------------
aliases
(&(objectclass=mailGroup)(cn=%s))
--------------
```

TABLE 14–4 LDAP Filters Used in `getXbyY` Calls

Filter	Definition
bootparamByName	(&(objectClass=bootableDevice)(cn=%s))
etherByHost	(&(objectClass=ieee802Device)(cn=%s))
etherByEther	(&(objectClass=ieee802Device)(macAddress=%s))
groupByName	(&(objectClass=posixGroup)(cn=%s))
groupByGID	(&(objectClass=posixGroup)(gidNumber=%ld))
groupByMember	(&(objectClass=posixGroup)(memberUid=%s))
hostsByName	(&(objectClass=ipHost)(cn=%s))
hostsByAddr	(&(objectClass=ipHost)(ipHostNumber=%s))
keyByUID	(&(objectClass=nisKeyObject)(uidNumber=%s))
keyByHost	(&(objectClass=nisKeyObject)(cn=%s))
netByName	(&(objectClass=ipNetwork)(cn=%s))
netByAddr	(&(objectClass=ipNetwork)(ipNetworkNumber=%s))
nisgroupMember	(membernisnetgroup=%s)
maskByNet	(&(objectClass=ipNetwork)(ipNetworkNumber=%s))
printerByName	(& (objectClass=sunPrinter)(|(printer-name=%s) (printer-aliases=%s)))
projectByName	(&(objectClass=SolarisProject) (SolarisProjectName=%s))
projectByID	(&(objectClass=SolarisProject) (SolarisProjectID=%ld))
protoByName	(&(objectClass=ipProtocol)(cn=%s))

TABLE 14–4 LDAP Filters Used in `getXbyY` Calls *(Continued)*

Filter	Definition
`protoByNumber`	`(&(objectClass=ipProtocol)(ipProtocolNumber=%d))`
`passwordByName`	`(&(objectClass=posixAccount)(uid=%s))`
`passwordByNumber`	`(&(objectClass=posixAccount)(uidNumber=%ld))`
`rpcByName`	`(&(objectClass=oncRpc)(cn=%s))`
`rpcByNumber`	`(&(objectClass=oncRpc)(oncRpcNumber=%d))`
`serverByName`	`(&(objectClass=ipService)(cn=%s))`
`serverByPort`	`(&(objectClass=ipService)(ipServicePort=%ld))`
`serverByNameAndProto`	`(&(objectClass=ipService)(cn=%s)(ipServiceProtocol=%s))`
`specialByNameserver`	`(ipServiceProtocol=%s))`
`ByPortAndProto`	`(&(objectClass=shadowAccount)(uid=%s))`
`netgroupByTriple`	`(&(objectClass=nisNetGroup)(nisnetgrouptriple=(%s,%s,%s)))`
`netgroupByMember`	`(&(objectClass=nisNetGroup)(|(membernisnetgroup=%s)`
`authName`	`(&(objectClass=SolarisAuthAttr)(cn=%s))`
`auditUserByName`	`(&(objectClass=SolarisAuditUser)(uid=%s))`
`execByName`	`(&(objectClass=SolarisExecAttr)(cn=%s)(SolarisKernelSecurityPolicy=%s)(SolarisProfileType=%s))`
`execByPolicy`	`(&(objectClass=SolarisExecAttr)(SolarisProfileId=%s)(SolarisKernelSecurityPolicy=%s)(SolarisProfileType=%s))`
`profileByName`	`(&(objectClass=SolarisProfAttr)(cn=%s))`
`userByName`	`(&(objectClass=SolarisUserAttr)(uid=%s))`

The following table lists the `getent` attribute filters.

TABLE 14–5 `getent` Attribute Filters

Filter	Definition
`aliases`	`(objectClass=rfc822MailGroup)`

TABLE 14–5 `getent` Attribute Filters *(Continued)*

Filter	Definition
`auth_attr`	`(objectClass=SolarisAuthAttr)`
`audit_user`	`(objectClass=SolarisAuditUser)`
`exec_attr`	`(objectClass=SolarisExecAttr)`
`group`	`(objectClass=posixGroup)`
`hosts`	`(objectClass=ipHost)`
`networks`	`(objectClass=ipNetwork)`
`prof_attr`	`(objectClass=SolarisProfAttr)`
`protocols`	`(objectClass=ipProtocol)`
`passwd`	`(objectClass=posixAccount)`
`printers`	`(objectClass=sunPrinter)`
`rpc`	`(objectClass=oncRpc)`
`services`	`(objectClass=ipService)`
`shadow`	`(objectclass=shadowAccount)`
`project`	`(objectClass=SolarisProject)`
`usr_attr`	`(objectClass=SolarisUserAttr)`

CHAPTER 15

Transitioning From NIS to LDAP (Overview/Tasks)

This chapter describes how to enable support of NIS clients that use naming information stored in the LDAP directory. By following the procedures in this chapter, you can transition from using an NIS naming service to using LDAP naming services.

To determine the benefits of transitioning to LDAP, see "LDAP Naming Services Compared to Other Naming Services" on page 126.

The following information is included in this chapter.

NIS-to-LDAP Service Overview

The NIS–to–LDAP transition service (*N2L service*) replaces existing NIS daemons on the NIS master server with NIS–to–LDAP transition daemons. The N2L service also creates an NIS–to–LDAP mapping file on that server. The mapping file specifies the mapping between NIS map entries and equivalent Directory Information Tree (DIT) entries in LDAP. An NIS master server that has gone through this transition is referred to as an *N2L server*. The slave servers do not have an `NISLDAPmapping` file, so they continue to function in the usual manner. The slave servers periodically update their data from the N2L server as if it were a regular NIS master.

The behavior of the N2L service is controlled by the `ypserv` and `NISLDAPmapping` configuration files. A script, `inityp2l`, assists with the initial setup of these configuration files. Once the N2L server has been established, you can maintain N2L by directly editing the configuration files.

The N2L service supports the following:

- Import of NIS maps into the LDAP Directory Information Tree (DIT)
- Client access to DIT information with the speed and extensibility of NIS

In any naming system, only one source of information can be the authoritative source. In traditional NIS, NIS sources are the authoritative information. When using the N2L service, the source of authoritative data is the LDAP directory. The directory is managed by using directory management tools, as described in Chapter 9.

NIS sources are retained for emergency backup or backout only. After using the N2L service, you can gradually phase out NIS clients. Eventually, all NIS clients can be replaced by Solaris LDAP naming services clients.

Additional overview information is provided in the following subsections:

NIS-to-LDAP Tools and the Service Management Facility

The NIS and LDAP services are managed by the Service Management Facility. Administrative actions on these services, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. You can query the status of services by using the `svcs` command. For more information about using SMF with LDAP and NIS, see "LDAP and the Service Management Facility" on page 178 and "NIS and the Service Management Facility" on page 80. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

NIS-to-LDAP Audience Assumptions

You need to be familiar with NIS and LDAP concepts, terminology, and IDs to perform the procedures in this chapter. For more information about the NIS and LDAP naming services, see the following sections of this book.

- Chapter 4, for an overview of NIS
- Chapter 8, for an overview of LDAP

When Not to Use the NIS-to-LDAP Service

Do not use the N2L service in these situations:

- In an environment where there is no plan to share data between NIS and LDAP naming services clients

  In such an environment, an N2L server would serve as an excessively complex NIS master server.

- In an environment where NIS maps are managed by tools that modify the NIS source files (other than `yppasswd`)

  Regeneration of NIS sources from DIT maps is an imprecise task that requires manual checking of the resulting maps. Once the N2L service is used, regeneration of NIS sources is provided only for backout or reverting to NIS.

- In an environment with no NIS clients

  In such an environment, use Solaris LDAP naming services clients and their corresponding tools.

Effects of the NIS-to-LDAP Service on Users

Simply installing the files that are related to the N2L service does not change the NIS server's default behavior. At installation, the administrator will see some changes to NIS man pages and the addition of N2L helper scripts, `inityp2l` and `ypmap2src`, on the servers. But as long as `inityp2l` is not run or the N2L configuration files are not created manually on the NIS server, the NIS components continue to start in traditional NIS mode and function as usual.

After `inityp2l` is run, users see some changes in server and client behavior. Following is a list of NIS and LDAP user types and a description of what each type of user should notice after the N2L service is deployed.

User Type	Effect of N2L Service
NIS master server administrators	The NIS master server is converted to an N2L server. The `NISLDAPmapping` and `ypserv` configuration files are installed on the N2L server. After the N2L server is established, you can use LDAP commands to administer your naming information.

User Type	Effect of N2L Service
NIS slave server administrators	After the N2L transition, an NIS slave server continues to run NIS in the usual manner. The N2L server pushes updated NIS maps to the slave server when `yppush` is called by `ypmake`. See the `ypmake`(1M) man page.
NIS clients	NIS read operations are no different than traditional NIS. When a Solaris LDAP naming services client changes information in the DIT, the information is copied into the NIS maps. The copy operation is complete after a configurable timeout expires. Such behavior is similar to the behavior of a normal NIS client when the client is connected to an NIS slave server.
	If an N2L server cannot bind to the LDAP server for a read, the N2L server returns the information from its own cached copy. Alternatively, the N2L server can return an internal server error. You can configure the N2L server to respond either way. See the `ypserv`(1M) man page for more details.
All users	When an NIS client makes a password change request, the change is immediately visible on the N2L master server and to native LDAP clients.
	If you attempt to change a password on the NIS client, and the LDAP server is unavailable, then the change is refused and the N2L server returns an internal server error. This behavior prevents incorrect information from being written into the cache.

NIS-to-LDAP Transition Terminology

The following terms are related to the implementation of the N2L service.

TABLE 15–1 Terminology Related to the N2L Transition

Term	Description
N2L configuration files	The `/var/yp/NISLDAPmapping` and `/var/yp/ypserv` files that the `ypserv` daemon uses to start the master server in N2L mode. See the `NISLDAPmapping`(4) and `ypserv`(4) man pages for details.
map	In the context of the N2L service, the term “map” is used in two ways: ■ To refer to a database file in which NIS stores a specific type of information ■ To describe the process of mapping NIS information to or from the LDAP DIT
mapping	The process of converting NIS entries to or from LDAP DIT entries.
mapping file	The `NISLDAPmapping` file that establishes how to map entries between NIS and LDAP files.

TABLE 15–1 Terminology Related to the N2L Transition *(Continued)*

Term	Description
standard maps	Commonly used NIS maps that are supported by the N2L service without requiring manual modification to the mapping file. A list of supported standard maps is provided in "Supported Standard Mappings" on page 232.
nonstandard maps	Standard NIS maps that are customized to use mappings between NIS and the LDAP DIT other than the mappings identified in RFC 2307 or its successor.
custom map	Any map that is not a standard map and therefore requires manual modifications to the mapping file when transitioning from NIS to LDAP.
LDAP client	Any traditional LDAP client that reads and writes to any LDAP server. A traditional LDAP client is a system that reads and writes to any LDAP server. A Solaris LDAP naming services client handles a customized subset of naming information.
LDAP naming services client	A Solaris LDAP client that handles a customized subset of naming information.
N2L server	An NIS master server that has been reconfigured as an N2L server by using the N2L service. Reconfiguration includes replacing NIS daemons and adding new configuration files.

NIS-to-LDAP Commands, Files, and Maps

There are two utilities, two configuration files, and a mapping that are associated with the N2L transition.

TABLE 15–2 Descriptions of N2L Commands, Files, and Maps

Command/File/Map	Description
`/usr/lib/netsvc/yp/inityp2l`	A utility that assists with the creation of the `NISLDAPmapping` and `ypserv` configuration files. This utility is not a general-purpose tool for the management of these files. An advanced user can maintain the N2L configuration files or create custom mappings by using a text editor to examine and customize the `inityp2l` output. See the `inityp2l`(1M) man page.
`/usr/lib/netsvc/yp/ypmap2src`	A utility that converts standard NIS maps to approximations of the equivalent NIS source files. The primary use for `ypmap2src` is to convert from an N2L transition server to traditional NIS. See the `ypmap2src`(1M) man page.
`/var/yp/NISLDAPmapping`	A configuration file that specifies the mapping between NIS map entries and equivalent Directory Information Tree (DIT) entries in LDAP. See the `NISLDAPmapping`(4) man page.
`/var/yp/ypserv`	A file that specifies configuration information for the NIS–to–LDAP transition daemons. See the `ypserv`(4) man page.

TABLE 15–2 Descriptions of N2L Commands, Files, and Maps *(Continued)*

Command/File/Map	Description
`ageing.byname`	A mapping used by `yppasswdd` to read and write password aging information to the DIT when the NIS-to-LDAP transition is implemented.

Supported Standard Mappings

By default, the N2L service supports mappings between the following list of maps and RFC 2307, or its successors', LDAP entries. These standard maps do not require manual modification to the mapping file. Any maps on your system that are not in the following list are considered custom maps and require manual modification.

The N2L service also supports automatic mapping of the `auto.*` maps. However, since most `auto.*` file names and contents are specific to each network configuration, those files are not specified in this list. The exceptions to this are the `auto.home` and `auto.master` maps, which are supported as standard maps.

```
audit_user
auth_attr
auto.home
auto.master
bootparams
ethers.byaddr ethers.byname
exec_attr
group.bygid group.byname group.adjunct.byname
hosts.byaddr hosts.byname
ipnodes.byaddr ipnodes.byname
mail.byaddr mail.aliases
netgroup netgroup.byprojid netgroup.byuser netgroup.byhost
netid.byname
netmasks.byaddr
networks.byaddr networks.byname
passwd.byname passwd.byuid passwd.adjunct.byname
printers.conf.byname
prof_attr
project.byname project.byprojectid
protocols.byname protocols.bynumber
publickey.byname
rpc.bynumber
services.byname services.byservicename
timezone.byname
user_attr
```

During the NIS-to-LDAP transition, the `yppasswdd` daemon uses the N2L-specific map, `ageing.byname`, to read and write password aging information to the DIT. If you are not using password aging, then the `ageing.byname` mapping is ignored.

Transitioning From NIS to LDAP (Task Map)

The following table identifies the procedures needed to install and manage the N2L service with standard and with custom NIS–to–LDAP mappings.

Task	Description	For Instructions
Complete all prerequisites.	Be sure that you have properly configured your NIS server and Sun Java System Directory Server (LDAP server).	"Prerequisites for the NIS-to-LDAP Transition" on page 234
Set up the N2L service.	Run `inityp2l` on the NIS master server to set up one of these mappings:	
	Standard mappings	"How to Set Up the N2L Service With Standard Mappings" on page 235
	Custom or nonstandard mappings	"How to Set Up the N2L Service With Custom or Nonstandard Mappings" on page 237
Customize a map.	View examples of how to create custom maps for the N2L transition.	"Examples of Custom Maps" on page 239
Configure Sun Java System Directory Server with N2L.	Configure and tune Sun Java System Directory Server as your LDAP server for the N2L transition.	"NIS-to-LDAP Best Practices With Sun Java System Directory Server" on page 241
Troubleshoot the system.	Identify and resolve common N2L issues.	"NIS-to-LDAP Troubleshooting" on page 244
Revert to NIS.	Revert to NIS using the appropriate map:	
	Maps based on old NIS source files	"How to Revert to Maps Based on Old Source Files" on page 249
	Maps based on the current DIT	"How to Revert to Maps Based on Current DIT Contents" on page 249

Prerequisites for the NIS-to-LDAP Transition

Before implementing the N2L service, you must check or complete the following items.

- Make sure that the system is set up as a working traditional NIS server before running the `inityp2l` script to enable N2L mode.
- Configure the LDAP directory server on your system.

  Sun Java System Directory Server (formerly Sun ONE Directory Server) and compatible versions of directory servers offered by Sun Microsystems, Inc., are supported with the NIS-to-LDAP migration tools. If you use Sun Java System Directory Server, configure the server by using the `idsconfig` command *before* you set up the N2L service. For more information about `idsconfig`, see Chapter 11 and the `idsconfig`(1M) man page.

  Other (third party) LDAP servers might work with the N2L service, but they are not supported by Sun. If you are using an LDAP server other than the Sun Java System Directory Server or compatible Sun servers, you must manually configure the server to support RFC 2307, or its successors', schemas *before* you set up the N2L service.
- Make sure that the `nsswitch.conf` file lists `files` before `nis` for the lookup order, at least for the `hosts` and `ipnodes` entries.
- Ensure that the addresses of the N2L master server and the LDAP server are present in the `hosts` or `ipnodes` files on the N2L master server. Whether the server addresses must be listed in `hosts`, `ipnodes`, or both files depends on how your system is configured to resolve local host names.

  An alternative solution is to list the LDAP server address, not its host name, in `ypserv`. This means that the LDAP server address is listed in another place, so changing the address of either the LDAP server or the N2L master server requires additional file modifications.

Setting Up the NIS-to-LDAP Service

You can set up the N2L service either by using standard mappings or by using custom mappings, as described in the next two procedures.

As part of the NIS-to -LDAP conversion, you need to run the `inityp2l` command. This command runs an interactive script for which you must provide configuration information. The following list shows the type of information you need to provide. See the `ypserv`(1M) man page for explanations of these attributes.

- The name of the configuration file being created (default = `/etc/default/ypserv`)
- The DN that stores configuration information in LDAP (default = `ypserv`)
- Preferred server list for mapping data to/from LDAP
- Authentication method for mapping data to/from LDAP
- Transport Layer Security (TLS) method for mapping data to/from LDAP
- Proxy user bind DN to read/write data from/to LDAP
- Proxy user password to read/write data from/to LDAP
- Timeout value (in seconds) for LDAP bind operation
- Timeout value (in seconds) for LDAP search operation
- Timeout value (in seconds) for LDAP modify operation
- Timeout value (in seconds) for LDAP add operation
- Timeout value (in seconds) for LDAP delete operation
- Time limit (in seconds) for search operation on LDAP server
- Size limit (in bytes) for search operation on LDAP server
- Whether N2L should follow LDAP referrals
- LDAP retrieval error action, number of retrieval attempts, and timeout (in seconds) between each attempt
- Store error action, number of attempts, and timeout (in seconds) between each attempt
- Mapping file name
- Whether to generate mapping information for `auto_direct` map

  The script places relevant information regarding custom maps at appropriate places in the mapping file.
- The naming context
- Whether to enable password changes
- Whether to change the default TTL values for any map

Note – `sasl/cram-md5` authentication is *not* supported by most LDAP servers, including Sun Java System Directory Server.

▼ How to Set Up the N2L Service With Standard Mappings

Use this procedure if you are transitioning the maps listed in "Supported Standard Mappings" on page 232. If you are using custom or nonstandard maps, see "How to Set Up the N2L Service With Custom or Nonstandard Mappings" on page 237.

When the LDAP server has been set up, run the `inityp2l` script and supply configuration information when prompted. `inityp2l` sets up the configuration and mapping files for standard and `auto.*` maps.

1. **Complete the prerequisite steps that are listed in "Prerequisites for the NIS-to-LDAP Transition" on page 234.**

2. **On the NIS master server, become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

3. **Convert the NIS master server into an N2L server.**

   ```
   # inityp2l
   ```

   Run the `inityp2l` script on the NIS master server and follow the prompts. See "Setting Up the NIS-to-LDAP Service" on page 234 for a list of the information you need to provide.

   See the `inityp2l`(1M) man page for more details.

4. **Determine if the LDAP Directory Information Tree (DIT) is fully initialized.**

   The DIT is fully initialized if it already contains the information necessary to populate all the maps that are listed in the `NISLDAPmapping` file.

   - If no, continue with Step 5 and skip Step 6.
   - If yes, skip Step 5 and go to Step 6.

5. **Initialize the DIT for the transition from the NIS source files.**

   Perform these steps only if the DIT has *not* been fully initialized.

   a. **Make sure that the old NIS maps are up-to-date.**

      ```
      # cd /var/yp
      # make
      ```

      For more information, see the `ypmake`(1M) man page.

   b. **Stop the NIS daemons.**

      ```
      # svcadm disable network/nis/server:default
      ```

   c. **Copy the old maps to the DIT, then initialize N2L support for the maps.**

      ```
      # ypserv -Ir
      ```

      Wait for `ypserv` to exit.

Tip – The original NIS `dbm` files are not overwritten. You can recover these files, if needed.

---

d. Start the NIS daemons to ensure that they use the new maps.

```
# svcadm enable network/nis/server:default
```

This completes the set up of the N2L service with standard maps. You do not need to complete Step 6.

6. Initialize the NIS maps.

Perform these steps only if the DIT is fully initialized and you skipped Step 5.

a. Stop the NIS daemons.

```
# svcadm disable network/nis/server:default
```

b. Initialize the NIS maps from information in the DIT.

```
# ypserv -r
```

Wait for `ypserv` to exit.

Tip – The original NIS `dbm` files are not overwritten. You can recover these files, if needed.

---

c. Start the NIS daemons to ensure that they use the new maps.

```
# svcadm enable network/nis/server:default
```

▼ How to Set Up the N2L Service With Custom or Nonstandard Mappings

Use this procedure if the following circumstances apply:

- You have maps that are not listed in "Supported Standard Mappings" on page 232.
- You have standard NIS maps that you want to map to non-RFC 2307 LDAP mappings.

1. Complete the prerequisite steps that are listed in "Prerequisites for the NIS-to-LDAP Transition" on page 234.

2. On the NIS master server, become superuser or assume an equivalent role.

Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

3. Configure the NIS master server into the N2L server.

```
# inityp2l
```

Run the `inityp2l` script on the NIS master server and follow the prompts. See "Setting Up the NIS-to-LDAP Service" on page 234 for a list of the information you need to provide.

See the `inityp2l`(1M) man page for more details.

4. **Modify the `/var/yp/NISLDAPmapping` file.**

   See "Examples of Custom Maps" on page 239 for examples of how to modify the mapping file.

5. **Determine if the LDAP Directory Information Tree (DIT) is fully initialized.**

   The DIT is fully initialized if it already contains the information necessary to populate all the maps that are listed in the `NISLDAPmapping` file.

   - If no, complete Step 6, Step 8, and Step 9.
   - If yes, skip Step 6 and complete Step 7, Step 8, and Step 9.

6. **Initialize the DIT for the transition from the NIS source files.**

   a. **Make sure that the old NIS maps are up-to-date.**

   ```
   # cd /var/yp
   # make
   ```

   For more information, see the `ypmake`(1M) man page.

   b. **Stop the NIS daemons.**

   ```
   # svcadm disable network/nis/server:default
   ```

   c. **Copy the old maps to the DIT, then initialize N2L support for the maps.**

   ```
   # ypserv -Ir
   ```

   Wait for `ypserv` to exit.

   Tip – The original NIS `dbm` files are not overwritten. You can recover these files, if needed.

   ---

   d. **Start the NIS daemons to ensure that they use the new maps.**

   ```
   # svcadm enable network/nis/server:default
   ```

   e. **Skip Step 7 and continue with Step 8.**

7. **Initialize the NIS maps.**

   Perform this step only if the DIT is fully initialized.

   a. **Stop the NIS daemons.**

   ```
   # svcadm disable network/nis/server:default
   ```

   b. **Initialize the NIS maps from information in the DIT.**

   ```
   # ypserv -r
   ```

   Wait for `ypserv` to exit.

Tip – The original NIS `dbm` files are not overwritten. You can recover these files, if needed.

c. **Start the NIS daemons to ensure that they use the new maps.**

```
# svcadm enable network/nis/server:default
```

8. **Verify that the LDAP entries are correct.**

   If the entries are not correct, then the entries can not be found by LDAP naming services clients.

```
# ldapsearch -h server -s sub -b "ou=servdates, dc=..." \
"objectclass=servDates"
```

9. **Verify the contents of the `LDAP_` maps.**

   The following sample output shows how to use `makedm` to verify the contents of the `hosts.byaddr` map.

```
# makedbm -u LDAP_servdate.bynumber
plato: 1/3/2001
johnson: 2/4/2003,1/3/2001
yeats: 4/4/2002
poe: 3/3/2002,3/4/2000
```

   If the contents are as expected, the transition from NIS to LDAP was successful.

   Note that the original NIS `dbm` files are not overwritten, so you can always recover those files. See "Reverting to NIS" on page 248 for more information.

Examples of Custom Maps

The following two examples show how you might customize maps. Use your preferred text editor to modify the `/var/yp/NISLDAPmapping` file as needed. For more information about file attributes and syntax, see the `NISLDAPmapping`(4) man page and the LDAP naming services information in Chapter 9.

Example 1–Moving Host Entries

This example shows how to move host entries from the default location to another (nonstandard) location in the DIT.

Change the `nisLDAPobjectDN` attribute in the `NISLDAPmapping` file to the new base LDAP distinguished name (DN). For this example, the internal structure of the LDAP objects is unchanged, so `objectClass` entries are unchanged.

Change:

```
nisLDAPobjectDN hosts: \
                        ou=hosts,?one?, \
                        objectClass=device, \
                        objectClass=ipHost
```

To:

```
nisLDAPobjectDN hosts: \
                        ou=newHosts,?one?, \
                        objectClass=device, \
                        objectClass=ipHost
```

This change causes entries to be mapped under

```
dn: ou=newHosts, dom=domain1, dc=sun, dc=com
```

instead of under

```
dn: ou=hosts, dom=domain1, dc=sun, dc=com.
```

Example 2–Implementing a Custom Map

This example shows how to implement a custom map.

A hypothetical map, *servdate.bynumber*, contains information about the servicing dates for systems. This map is indexed by the machine's serial number which, in this example, is 123. Each entry consists of the machine owner's name, a colon, and a comma-separated list of service dates, such as John Smith:1/3/2001,4/5/2003.

The old map structure is to be mapped onto LDAP entries of the following form:

```
dn: number=123,ou=servdates,dc=... \
                number: 123 \
                userName: John Smith \
                date: 1/3/2001 \
                date: 4/5/2003 \
                 .
                 .
                 .
                objectClass: servDates
```

By examining the `NISLDAPmapping` file, you can see that the mapping closest to the required pattern is `group`. The custom mappings can be modeled on the `group` mapping. Since there is only one map, no `nisLDAPdatabaseIdMapping` attribute is required. The attributes to be added to `NISLDAPmapping` are the following:

```
nisLDAPentryTtl servdate.bynumber:1800:5400:3600

nisLDAPnameFields servdate.bynumber: \
                        ("%s:%s", uname, dates)

nisLDAPobjectDN servdate.bynumber: \
```

```
                          ou=servdates, ?one? \
                          objectClass=servDates:

nisLDAPattributeFromField servdate.bynumber: \
                          dn=("number=%s,", rf_key), \
                          number=rf_key, \
                          userName=uname, \
                          (date)=(dates, ",")

nisLDAPfieldFromAttribute servdate.bynumber: \
                          rf_key=number, \
                          uname=userName, \
                          dates=("%s,", (date), ",")
```

NIS-to-LDAP Best Practices With Sun Java System Directory Server

The N2L service supports Sun Java System Directory Server (formerly Sun ONE Directory Server) and compatible versions of directory servers offered by Sun Microsystems, Inc. Other (third party) LDAP servers might work with the N2L service, but they are not supported by Sun. If you are using an LDAP server other than the Sun Java System Directory Server or compatible Sun servers, you must manually configure the server to support RFC 2307, or its successors', schemas.

If you are using the Sun Java System Directory Server, you can enhance the directory server to improve performance. To make these enhancements, you must have LDAP administrator privileges on the Sun Java System Directory Server. In addition, the directory server might need to be rebooted, a task that must be coordinated with the server's LDAP clients. The Sun Java System Directory Server (and Sun ONE and iPlanet Directory Server) documentation is available on the docs.sun.com web site.

Creating Virtual List View Indexes With Sun Java System Directory Server

For large maps, LDAP virtual list view (VLV) indexes must be used to ensure LDAP searches return complete results. For information about setting up VLV indexes on the Sun Java System Directory Server, see the Sun Java System Directory Server documentation on the docs.sun.com web site.

VLV search results use a fixed page size of 50000. If VLVs are used with Sun Java System Directory Server, both the LDAP server and N2L server must be able to handle transfers of this size. If all of your maps are known to be smaller than this limit, you do not need to use VLV indexes. However, if your maps are larger than the size limit, or you are unsure of the size of all maps, use VLV indexes to avoid incomplete returns.

If you are using VLV indexes, set up the appropriate size limits as follows.

- On the Sun Java System Directory Server: `nsslapd-sizelimit` attribute must be set greater than or equal to 50000 or `-1`. See the `idsconfig`(1M) man page.
- On the N2L server: `nisLDAPsearchSizelimit` attribute must be set greater than or equal to 50000 or zero. For more information, see the `NISLDAPmapping`(4) man page.

Once VLV indexes have been created, activate them by running `directoryserver` with the `vlvindex` option on the Sun Java System Directory Server. See the `directoryserver`(1M) man page for more information.

VLVs for Standard Maps

Use the Sun Java System Directory Server `idsconfig` command to set up VLVs if the following conditions apply:

- You are using the Sun Java System Directory Server.
- You are mapping standard maps to RFC 2307 LDAP entries.

VLVs are domain specific, so each time `idsconfig` is run, VLVs are created for one NIS domain. Therefore, during the NIS–to–LDAP transition, you must run `idsconfig` once for *each* `nisLDAPdomainContext` attribute included in the `NISLDAPmapping` file.

VLVs for Custom and Nonstandard Maps

You must manually create new Sun Java System Directory Server VLVs for maps, or copy and modify existing VLV indexes, if the following conditions apply:

- You are using the Sun Java System Directory Server.
- You have large custom maps or have standard maps that are mapped to nonstandard DIT locations.

To view existing VLV indexes, type the following:

```
# ldapsearch -h hostname -s sub -b "cn=ldbm database,cn=plugins,cn=config" \
"objectClass=vlvSearch"
```

Avoiding Server Timeouts With Sun Java System Directory Server

When the N2L server refreshes a map, the result might be a large LDAP directory access. If the Sun Java System Directory Server is not correctly configured, the refresh operation might time out before completion. To avoid directory server timeouts, modify the following Sun Java System Directory Server attributes manually or by running the `idsconfig` command.

For example, to increase the minimum amount of time in seconds that the server should spend performing the search request, modify these attributes:

```
dn: cn=config
nsslapd-timelimit: -1
```

For testing purposes, you can use an attribute value of `-1`, which indicates no limit. When you have determined the optimum limit value, change the attribute value. Do *not* maintain any attribute settings at `-1` on a production server. With no limits, the server might be vulnerable to Denial of Service attacks.

For more information about configuring Sun Java System Directory Server with LDAP, see "Setting Up Sun Java System Directory Server With LDAP Clients (Tasks)" in *System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP)* of this book.

Avoiding Buffer Overruns With Sun Java System Directory Server

To avoid buffer overruns, modify the Sun Java System Directory Server attributes manually or by running the `idsconfig` command.

1. For example, to increase the maximum number of entries that are returned for a client search query, modify these attributes:

   ```
   dn: cn=config
   nsslapd-sizelimit: -1
   ```

2. To increase the maximum number of entries that are verified for a client search query, modify these attributes:

   ```
   dn: cn=config, cn=ldbm database, cn=plugins, cn=config
   nsslapd-lookthroughlimit: -1
   ```

For testing purposes, you can use an attribute value of `-1`, which indicates no limit. When you have determined the optimum limit value, change the attribute value. Do *not* maintain any attribute settings at `-1` on a production server. With no limits, the server might be vulnerable to Denial of Service attacks.

If VLVs are being used, the `sizelimit` attribute values should be set as defined in "Creating Virtual List View Indexes With Sun Java System Directory Server" on page 241. If VLVs are not being used, the size limit should be set large enough to accommodate the largest container.

For more information about configuring Sun Java System Directory Server with LDAP, see Chapter 11.

NIS-to-LDAP Restrictions

When the N2L server has been set up, the NIS source files are no longer used. Therefore, do not run `ypmake` on an N2L server. If `ypmake` is accidentally run, such as for an existing `cron` job, the N2L service is unaffected. However, a warning is logged suggesting that `yppush` should be called explicitly.

NIS-to-LDAP Troubleshooting

This section covers two areas of troubleshooting:

Common LDAP Error Messages

Sometimes the N2L server logs errors that relate to internal LDAP problems, resulting in LDAP-related error messages. Although the errors are nonfatal, they indicate problems to investigate. For example, the N2L server might continue to operate, but provide out-of-date or incomplete results.

The following list includes some of the common LDAP error messages that you might encounter when implementing the N2L service. Error descriptions, and possible causes and solutions for the errors, are included.

`Administrative limit exceeded`

Error Number: 11

Cause: An LDAP search was made that was larger than allowed by the directory server's `nsslapd-sizelimit` attribute. Only partial information will be returned.

Solution: Increase the value of the `nsslapd-sizelimit` attribute, or implement a VLV index for the failing search.

`Invalid DN Syntax`

Error Number: 34

Cause: An attempt has been made to write an LDAP entry with a DN that contains illegal characters. The N2L server attempts to escape illegal characters, such as the + symbol, that are generated in DNs.

Solution: Check the LDAP server error log to find out which illegal DNs were written, then modify the `NISLDAPmapping` file that generated the illegal DNs.

`Object class violation`

Error Number: 65

Cause: An attempt has been made to write an LDAP entry that is invalid. Generally, this error is due to missing `MUST` attributes that can be caused by either of the following circumstances.

- Bugs in the `NISLDAPmapping` file that create entries with missing attributes
- Attempts to add an `AUXILIARY` attribute to an object that does not exist

  For example, if a user name has not yet been created from the `passwd.byxxx` map, an attempt to add auxiliary information to that user will fail.

Solution: For bugs in the `NISLDAPmapping` file, check what was written in the server error log to determine the nature of the problem.

`Can't contact LDAP server`

Error Number: 81

Cause: The `ypserv` file might be incorrectly configured to point to the wrong LDAP directory server. Alternatively, the directory server might not be running.

Solution:

- Reconfigure the `ypserv` file to point to the correct LDAP directory server.
- To confirm that the LDAP server is running, become superuser, or assume an equivalent role, on the directory server and type:

  ```
  # pgrep -l slapd
  ```

`Timeout`

Error Number: 85

Cause: An LDAP operation timed out, typically while updating a map from the DIT. The map might now contain out-of-date information.

Solution: Increase the `nisLDAPxxxTimeout` attributes in the `ypserv` configuration file.

NIS-to-LDAP Issues

The following problems could occur while running the N2L server. Possible causes and solutions are provided.

Debugging the `NISLDAPmapping` File

The mapping file, `NISLDAPmapping`, is complex. Many potential errors might cause the mapping to behave in unexpected ways. Use the following techniques to resolve such problems.

Console Message Displays When `ypserv -ir` (or `-Ir`) Runs

Problem: A simple message is displayed on the console and the server exits (a detailed description is written to `syslog`).

Cause: The syntax of the mapping file might be incorrect.

Solution: Check and correct the syntax in the `NISLDAPmapping` file.

NIS Daemon Exits at Startup

Problem: When `ypserv` or other NIS daemons run, an LDAP-related error message is logged and the daemon exits.

Cause: The cause might be one of the following:

- The LDAP server cannot be contacted.
- An entry found in an NIS map or in the DIT is incompatible with the mapping specified.
- An attempt to read or write to the LDAP server returns an error.

Solution: Examine the error log on the LDAP server. See the LDAP errors that are listed in "Common LDAP Error Messages" on page 244.

Unexpected Results From NIS Operations

Problem: NIS operations do not return the expected results, but no errors are logged.

Cause: Incorrect entries might exist in the LDAP or NIS maps, which results in mappings not completing as intended.

Solution: Check and correct entries in the LDAP DIT and in the N2L versions of the NIS maps.

1. Check that the correct entries exist in the LDAP DIT, and correct the entries as needed.

   If you are using the Sun Java System Directory Server, start the management console by running `directoryserver startconsole`.

2. Check that the N2L versions of the NIS maps in the `/var/yp` directory contain the expected entries by comparing the newly generated map to the original map. Correct entries as needed.

   ```
   # cd /var/yp/domainname
   # makedbm -u test.byname
   # makedbm -u LDAP_test.byname
   ```

   Be aware of the following when checking the output for the maps:

   - The order of entries might not be the same in both files.

     Use the `sort` command before comparing output.

   - The use of white space might not be the same in both files.

     Use the `diff -b` command when comparing output.

Processing Order of NIS Maps

Problem: Object class violations occur.

Cause: When the `ypserv -i` command is run, each NIS map is read and its contents are written into the DIT. Several maps might contribute attributes to the same DIT object. Generally, one map creates most of the object, including all the object's `MUST` attributes. Other maps contribute additional `MAY` attributes.

Maps are processed in the same order that `nisLDAPobjectDN` attributes appear in the `NISLDAPmapping` file. If maps containing `MAY` attributes get processed before maps containing `MUST` attributes, then object class violations occur. See Error 65 in "Common LDAP Error Messages" on page 244 for more information about this error.

Solution: Reorder the `nisLDAPobjectDN` attributes so that maps are processed in the correct order.

As a temporary fix, rerun the `ypserv -i` command several times. Each time the command is executed, more of the LDAP entry is built up.

Note – Mapping in such a way that all of an object's `MUST` attributes cannot be created from at least one map is *not* supported.

N2L Server Timeout Issue

Problem: The server times out.

Cause: When the N2L server refreshes a map, the result might be a large LDAP directory access. If the Sun Java System Directory Server is not correctly configured, this operation might time out before completion.

Solution: To avoid directory server timeouts, modify the Sun Java System Directory Server attributes manually or by running the `idsconfig` command. See "Common LDAP Error Messages" on page 244 and "NIS-to-LDAP Best Practices With Sun Java System Directory Server" on page 241 for details.

N2L Lock File Issue

Problem: The `ypserv` command starts but does not respond to NIS requests.

Cause: The N2L server lock files are not correctly synchronizing access to the NIS maps. This should never happen.

Solution: Type the following commands on the N2L server.

```
# svcadm disable network/nis/server:default
# rm /var/run/yp_maplock /var/run/yp_mapupdate
# svcadm enable network/nis/server:default
```

N2L Deadlock Issue

Problem: The N2L server deadlocks.

Cause: If the addresses of the N2L master server and the LDAP server are not listed properly in the `hosts`, `ipnodes`, or `ypserv` files, a deadlock might result. See "Prerequisites for the NIS-to-LDAP Transition" on page 234 for details about proper address configuration for N2L.

For an example of a deadlock scenario, consider the following sequence of events:

1. An NIS client tries to look up an IP address.
2. The N2L server finds that the `hosts` entry is out-of-date.
3. The N2L server tries to update the `hosts` entry from LDAP.
4. The N2L server gets the name of its LDAP server from `ypserv`, then does a search by using `libldap`.
5. `libldap` tries to convert the LDAP server's name to an IP address by making a call to the name service switch.
6. The name service switch might make an NIS call to the N2L server, which deadlocks.

Solution: List the addresses of the N2L master server and the LDAP server in the `hosts` or `ipnodes` files on the N2L master server. Whether the server addresses must be listed in `hosts`, `ipnodes`, or both files depends on how these files are configured to resolve local host names. Also, check that the `hosts` and `ipnodes` entries in the `nsswitch.conf` file list `files` before `nis` in the lookup order.

An alternative solution to this deadlock problem is to list the LDAP server address, not its host name, in the `ypserv` file. This means that the LDAP server address would be listed in another place. Therefore, changing the address of either the LDAP server or the N2L server would require slightly more effort.

Reverting to NIS

A site that has transitioned from NIS to LDAP using the N2L service is expected to gradually replace all NIS clients with Solaris LDAP naming services clients. Support for NIS clients eventually becomes redundant. However, if required, the N2L service provides two ways to return to traditional NIS, as explained in the next two procedures.

Tip – Traditional NIS ignores the N2L versions of the NIS maps if those maps are present. After reverting to NIS, if you leave the N2L versions of the maps on the server, the N2L maps do not cause problems. Therefore, it might be useful to keep the N2L maps in case you later decide to re-enable N2L. However, the maps do take up disk space.

▼ How to Revert to Maps Based on Old Source Files

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Stop the `NIS` daemons.**

   ```
   # svcadm disable network/nis/server:default
   ```

3. **Disable N2L.**

   This command backs up and moves the N2L mapping file.

   ```
   # mv /var/yp/NISLDAPmapping backup_filename
   ```

4. **Set the `NOPUSH` environment variable so the new maps are not pushed by `ypmake`.**

   ```
   # NOPUSH=1
   ```

5. **Make a new set of NIS maps that are based on the old sources.**

   ```
   # cd /var/yp
   # make
   ```

6. **(Optional) Remove N2L versions of the NIS maps.**

   ```
   # rm /var/yp/domainname/LDAP_*
   ```

7. **Start the `NIS` daemons.**

   ```
   # svcadm enable network/nis/server:default
   ```

▼ How to Revert to Maps Based on Current DIT Contents

Back up the old NIS source files before performing this procedure.

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Stop the `NIS` daemons.**

   ```
   # svcadm disable network/nis/server:default
   ```

3. **Update the maps from the DIT.**

   ```
   # ypserv -r
   ```

Wait for `ypserv` to exit.

4. **Disable N2L.**

   This command backs up and moves the N2L mapping file.

   ```
   # mv /var/yp/NISLDAPmapping backup_filename
   ```

5. **Regenerate the NIS source files.**

   ```
   # ypmap2src
   ```

6. **Manually check that regenerated NIS source files have the correct content and structure.**

7. **Move the regenerated NIS source files to the appropriate directories.**

8. **(Optional) Remove the N2L versions of the mapping files.**

   ```
   # rm /var/yp/domainname/LDAP_*
   ```

9. **Start the `NIS` daemons.**

   ```
   # svcadm enable network/nis/server:default
   ```

CHAPTER 16

Transitioning From NIS+ to LDAP

This chapter describes how to make the transition from using the NIS+ naming service to LDAP naming services.

NIS+ to LDAP Overview

The NIS+ server daemon, `rpc.nisd`, stores NIS+ data in proprietary-format files in the `/var/nis/data` directory. While it is entirely possible to keep NIS+ data synchronized with LDAP, such synchronization has previously required an external agent. However, the NIS+ daemon now enables you to use an LDAP server as a data repository for NIS+ data. Since this makes it possible for NIS+ and LDAP clients to share the same naming service information, it is easier to transition from using NIS+ as the main naming service, to using LDAP for the same role.

By default, the `rpc.nisd` daemon continues to work as before, relying only on the`/var/nis/data` NIS+ database. If desired, the system administrator can choose to use an LDAP server as the authoritative data repository for any subset of the NIS+ database. In this case, the `/var/nis/data` files serve as a cache for the `rpc.nisd` daemon, reducing LDAP lookup traffic, and enabling the `rpc.nisd` to continue working if the LDAP server is temporarily unavailable. In addition to continuous synchronization between NIS+ and LDAP, you can also perform uploads of NIS+ data to LDAP, or downloads of LDAP data to NIS+.

Mapping of data to and from LDAP is controlled by a flexible configuration file syntax. (All standard NIS+ tables (except for `client_info.org_dir` and `timezone.org_dir`) are covered by a template mapping file, `/var/nis/NIS+LDAPmapping.template`), which should require little or no change for most NIS+ installations. (See "`client_info` and `timezone` Tables (NIS+ to LDAP)" on page 280 for information on `client_info.org_dir` and `timezone.org_dir`.) In addition to locations for NIS+ data in the LDAP Directory

Information Tree (DIT), the mapping file also allows establishing time-to-live (TTL) for NIS+ data sourced from LDAP. While there often is a one-to-one mapping between NIS+ column values and LDAP attribute values, the mapping file can be used to maintain more complicated relationships as well.

The `/etc/default/rpc.nisd` file is used to select LDAP server and authentication, and controls some general `rpc.nisd` behavior. See `rpc.nisd`(4). The details of the mapping are specified via the `/var/nis/NIS+LDAPmapping` file. For more information, see `NIS+LDAPmapping`(4). The name of the mapping file can be changed by editing the `/lib/svc/method/nisplus` file. See "NIS+ to LDAP Tools and the Service Management Facility" on page 253 for more information.

The following terms are used in this chapter.

- Container

  A container is the location in the LDAP DIT where all related entries are stored. For example, user account information is often stored in the `ou=People` container, while host address information can be stored in the `ou=Hosts` container.

- Netname

  A netname is an entity in secure RPC (user or machine) that can be authenticated.

- Mapping

  Mapping is the relationship between an NIS+ object and an LDAP entry. For example, data from the `name` column in the `passwd.org_dir` NIS+ table (such as the user name of an account) corresponds to the LDAP `uid` attribute of the `posixAccount` object class in the `ou=People` container. The configuration can establish a mapping between the `name` column and the `uid` attribute. You can also say that the `name` column is mapped to the `uid` attribute (or vice versa).

- Principal

  A principal is an entity in NIS+ (user or machine) that can be authenticated. Usually, there is a one-to–one correspondence between netnames and principal names.

`rpc.nisd` Configuration Files

Two configuration files control `rpc.nisd` operation.

- `/etc/default/rpc.nisd`

  This file contains information regarding the LDAP server and authentication, the NIS+ base domain, the LDAP default search base, exception processing, and general `rpc.nisd` configuration, which applies whether or not LDAP mapping is in effect.

- `/var/nis/NIS+LDAPmapping`

  This file contains information on mapping of NIS+ data to and from LDAP. The template file (`/var/nis/NIS+LDAPmapping.template`) covers all standard NIS+ objects, except `client_info.org_dir` and `timezone.org_dir`. See

"client_info and timezone Tables (NIS+ to LDAP)" on page 280 and NIS+LDAPmapping(4).

Configuration is done by assigning values to pre-defined attributes. In addition to the configuration files, the configuration attributes can also be read from LDAP (see "Storing Configuration Information in LDAP" on page 288) or can be specified on the rpc.nisd command line by way of the -x option. If the same attribute is specified in more than one place, the priority order is (from higher to lower) as follows.

1. rpc.nisd -x option
2. Configuration file
3. LDAP

NIS+ to LDAP Tools and the Service Management Facility

Most of the command line administrative tasks associated with the NIS+ to LDAP transition are managed by the Service Management Facility. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the svcadm(1M) and svcs(1) man pages for more details.

- Administrative actions on the NIS+ to LDAP transition service, such as enabling, disabling, or restarting, can be performed using the svcadm command.

Tip – Temporarily disabling a service by using the -t option provides some protection for the service configuration. If the service is disabled with the -t option, the original settings would be restored for the service after a reboot. If the service is disabled without -t, the service will remain disabled after reboot.

- The NIS+ Fault Managed Resource Identifier (FMRI) is svc:/network/rpc/nisplus:<*instance*>. The FMRI for the LDAP client service is svc:/network/ldap/client:<*instance*>.
- You can query the status of NIS+ by using the svcs command.
  - Example of svcs command and output.

```
# svcs \*nisplus\*
STATE          STIME    FMRI
online         Sep_01   svc:/network/rpc/nisplus:default
```

- Example of svcs -l command and output. To get the output shown below, you must use the instance name in the FMRI.

```
# svcs -l network/rpc/nisplus:default
fmri         svc:/network/rpc/nisplus:default
enabled      false
state        disabled
```

```
next_state   none
restarter    svc:/system/svc/restarter:default
dependency   require_all/none svc:/network/rpc/keyserv (online)
```

- You can check a daemon's presence by using the `ps` command.

```
# ps -e | grep rpc.nisd
  root 23320     1   0   Aug 27 ?        16:30 ./ns-slapd -D \
  /usr/iplanet/ds5/slapd-lastrev -i /usr/iplanet/ds5/slapd-lastrev/
  root 25367 25353   0 15:35:19 pts/1     0:00 grep slapd
```

Note – Do not use the `-f` option with `ps` because this option attempts to translate user IDs to names, which causes more naming service lookups that might not succeed.

When Not to Use SMF With NIS+ to LDAP

In general, the `/usr/sbin/rpc.nisd` daemon is administered using the `svcadm` command. However, when `rpc.nisd` is invoked with `-x nisplusLDAPinitialUpdateOnly=yes`, `rpc.nisd` performs the specified initial update action, then exits. That is, `rpc.nisd` does not daemonize. The Service Management Facility should not be used in conjunction with `-x nisplusLDAPinitialUpdateOnly=yes`. SMF can be used any other time you want to start, stop, or restart the `rpc.nisd` daemon.

The following example shows `rpc.nisd` used with `-x nisplusLDAPinitialUpdateOnly=yes`.

```
# /usr/sbin/rpc.nisd -m mappingfile \
-x nisplusLDAPinitialUpdateAction=from_ldap \
-x nisplusLDAPinitialUpdateOnly=yes
```

Modifying the `/lib/svc/method/nisplus` File

If you want to include specific options when you invoke the `rpc.nisd` daemon with the Service Management Facility, you can use the `svcprop` command or modify the `/lib/svc/method/nisplus` file. See the `svcprop`(1) man page for more information about using the `svcprop` command. The following procedure describes how to modify the `/lib/svc/method/nisplus` file.

▼ *How to Modify the `/lib/svc/method/nisplus` File*

1. **Become superuser or assume an equivalent role.**

   Roles contain authorizations and privileged commands. For more information about roles, see "Using Role-Based Access Control (Tasks)" in *System Administration Guide: Security Services*.

2. **Stop the NIS+ service.**

   ```
   # svcadm disable network/rpc/nisplus:default
   ```

3. **Open the `/lib/svc/method/nisplus` file.**

   Use the editor of your choice.

4. **Edit the file to add the desired options.**

   Change:

   ```
   if [ -d /var/nis/data -o -d /var/nis/$hostname ]; then
                       /usr/sbin/rpc.nisd || exit $
   ```

   To:

   ```
   if [ -d /var/nis/data -o -d /var/nis/$hostname ]; then
                        /usr/sbin/rpc.nisd -Y -B || exit $?
   ```

   In this example, the `-Y` and `-B` options are added to `rpc.nisd`, so the options are automatically implemented at startup.

5. **Save and quit the `/lib/svc/method/nisplus` file.**

6. **Start the NIS+ service.**

   ```
   # svcadm enable network/rpc/nisplus:default
   ```

Creating Attributes and Object Classes

Depending on how you configure the NIS+/LDAP mapping, you might need to create a number of new LDAP attributes and object classes. The examples show how to do this by specifying LDIF data that can be used as input to the `ldapadd` command. Create a file containing the LDIF data, and then invoke `ldapadd`(1).

```
# ldapadd -D bind-DN -f ldif -file
```

This method works with Sun Java System Directory Server, and might work with other LDAP servers as well.

Note – Except for the `defaultSearchBase`, `preferredServerList`, and `authenticationMethod` attributes, as well as the SYNTAX specifications, the object identifiers (OIDs) used in this chapter are intended for illustration only. As no official OIDs have been assigned, you are free to use any suitable OIDs.

Getting Started With the NIS+ to LDAP Transition

For an introduction to the configuration needed to start using an LDAP repository for NIS+ data, see `NIS+LDAPmapping`(4). The remainder of this section goes into more detail about the organization of the configuration files.

`/etc/default/rpc.nisd` File

All assignments in the `/etc/default/rpc.nisd` file are of the `attributeName=value` type.

General Configuration

The following attributes control general configuration of the `rpc.nisd`, and are active whether or not LDAP mapping is in effect. They should generally be left at their default values. See `rpc.nisd`(4) for more information.

- `nisplusNumberOfServiceThreads`
- `nisplusThreadCreationErrorAction`
- `nisplusThreadCreationErrorAttempts`
- `nisplusThreadCreationErrorTimeout`
- `nisplusDumpErrorAction`
- `nisplusDumpErrorAttempts`
- `nisplusDumpErrorTimeout`
- `nisplusResyncService`
- `nisplusUpdateBatching`
- `nisplusUpdateBatchingTimeout`

Configuration Data From LDAP

The following attributes control the reading of other configuration attributes from LDAP. These attributes cannot themselves reside in LDAP. They are read only from the command line or the configuration file. See `rpc.nisd`(4) for more information.

- `nisplusLDAPconfigDN`
- `nisplusLDAPconfigPreferredServerList`
- `nisplusLDAPconfigAuthenticationMethod`
- `nisplusLDAPconfigTLS`
- `nisplusLDAPconfigTLSCertificateDBPath`
- `nisplusLDAPconfigProxyUser`

- `nisplusLDAPconfigProxyPassword`

Server Selection

- `preferredServerList`

  Specify the LDAP server and port number.

```
# LDAP server can be found at port 389
# LDAP server can be found at port 389
on the local machine
# preferredServerList=127.0.0.1
# Could also be written
# preferredServerList=127.0.0.0.1:389
LDAP server on the machine at IP
# address "1.2.3.4", at port 65042
# preferredServerList=1.2.3.4:65042
```

Authentication and Security

- `authenticationMethod`
- `nisplusLDAPproxyUser`
- `nisplusLDAPproxyPassword`

The authentication method and, if appropriate for the method selected, the proxy user (bind distinguished name [DN]) and password (key or other shared secret) to be used between the `rpc.nisd` daemon and the LDAP server. See "Security and Authentication" on page 270 for more information.

- `nisplusLDAPTLS`
- `nisplusLDAPTLSCertificateDBPath`

Optionally use SSL, and specify the location of the certificate file. See "Using SSL" on page 272 for more information.

Default Location in LDAP and NIS+

- `defaultSearchBase`

  The point in the LDAP DIT where the containers for RFC 2307- style naming services data live. This is the default used when individual container DNs do not specify a full search base. See "`nisplusLDAPobjectDN` Attribute" on page 261 for more information.

- `nisplusLDAPbaseDomain`

  The default NIS+ domain name to use when NIS+ object specifications (see "`nisplusLDAPdatabaseIdMapping` Attribute" on page 259) are not fully qualified.

Timeout/Size Limits and Referral Action for LDAP Communication

- `nisplusLDAPbindTimeout`
- `nisplusLDAPmodifyTimeout`
- `nisplusLDAPaddTimeout`
- `nisplusLDAPdeleteTimeout`

The above parameters are timeouts for the `ldap` `bind`, `modify`, `add`, and `delete` operations, respectively. They should generally be left at their default values.

- `nisplusLDAPsearchTimeout`
- `nisplusLDAPsearchTimeLimit`

The above parameters set the timeout for the LDAP search operation, and request a server-side search time limit, respectively. Since the `nisplusLDAPsearchTimeLimit` will control how much time the LDAP server spends on the search request, make sure that `nisplusLDAPsearchTimeLimit` is not smaller than `nisplusLDAPsearchTimeout`. Depending on the performance of the NIS+ server, the LDAP server, and the connection between them, you might have to increase the search limits from the default values. Watch for timeout syslog messages from `rpc.nisd` as a clue to making these values larger.

- `nisplusLDAPsearchSizeLimit`

  The above parameter requests a limit on the amount of LDAP data returned for an LDAP search request. The default is to ask for no limitation. This is a server side limit. The LDAP server might impose restrictions on the maximum, and these restrictions might be tied to the proxy user (bind DN) used. Make sure that the LDAP server allows the `rpc.nisd` to transfer enough data to account for the largest container (depending on the site, often the container used for `passwd.org_dir`, `mail_aliases.org_dir`, or `netgroup.org_dir`). Consult your LDAP server documentation for more information.

- `nisplusLDAPfollowReferral`

  The above parameter defines the action to be taken when an LDAP operation results in a referral to another LDAP server. The default is to *not* follow referrals. Enable follow referrals if you want or need referrals to be honored. Keep in mind that while referrals are convenient, they can also slow down operations by making the `rpc.nisd` talk to multiple LDAP servers for each request. The `rpc.nisd` should generally be pointed directly to an LDAP server that can handle all LDAP requests that the `rpc.nisd` might make.

Error Actions

The following parameters define the actions to take when an error occurs during an LDAP operation. You should generally leave these at their defaults. See `rpc.nisd`(4) for more information.

- `nisplusLDAPinitialUpdateAction`

- nisplusLDAPinitialUpdateOnly
- nisplusLDAPretrieveErrorAction
- nisplusLDAPretrieveErrorAttempts
- nisplusLDAPretrieveErrorTimeout
- nisplusLDAPstoreErrorAction
- nisplusLDAPstoreErrorAttempts
- nisplusLDAPstoreErrorTimeout
- nisplusLDAPrefreshErrorAction
- nisplusLDAPrefreshErrorAttempts
- nisplusLDAPrefreshErrorTimeout

General LDAP Operation Control

- nisplusLDAPmatchFetchAction

  The above parameter determines whether or not LDAP data should be pre-fetched for NIS+ match operations. In most cases, leave this value at the default. See rpc.nisd(4) for more information.

/var/nis/NIS+LDAPmapping File

The presence of the default NIS+LDAPmapping file serves as a master switch for NIS+/LDAP mapping.

If you use a non-default mapping file, you will have to edit the /lib/svc/method/nisplus script to specify the mapping file name on the rpc.nisd line by using the -m *mappingfile* option. See "NIS+ to LDAP Tools and the Service Management Facility" on page 253 for more information.

For each NIS+ object that should be mapped to or from LDAP, the NIS+LDAPmapping file specifies two to five attributes, depending on the object and whether or not the default values are sufficient.

nisplusLDAPdatabaseIdMapping Attribute

You must establish an alias to be used in the other mapping attributes. If the NIS+ object name is not fully qualified (does not end in a dot), the value of the nisplusLDAPbaseDomain is appended.

For example,

```
nisplusLDAPdatabaseIdMapping    rpc:rpc.org_dir
```

defines the database id rpc as an alias for the NIS+ rpc.org_dir table.

Note that NIS+ table objects might appear twice with two different database ids, once for the table object itself (if the object should be mapped to LDAP), and once for the table entries. For example,

```
nisplusLDAPdatabaseIdMapping    rpc_table:rpc.org_dir
nisplusLDAPdatabaseIdMapping    rpc:rpc.org_dir
```

defines the database ids `rpc_table` and `rpc` as aliases for the `rpc.org_dir` table. Later definitions will make it clear that `rpc_table` is used for the `rpc.org_dir` table object, and `rpc` for the entries in that table.

`nisplusLDAPentryTtl` Attribute

Since the `rpc.nisd` daemon's local database (in memory and on disk) functions as a cache for LDAP data, the `nisplusLDAPentryTtl` attribute allows you to set the time-to-live (TTL) values of entries in that cache. There are three TTLs for each database ID. The first two control the initial TTL when the `rpc.nisd` first loads the corresponding NIS+ object data from disk, and the third TTL is assigned to an object when it is read or refreshed from LDAP.

For example the following results in the `rpc.org_dir` table object getting an initial TTL randomly selected in the range 21600 to 43200 seconds.

```
nisplusLDAPentryTtl    rpc_table:21600:43200:43200
```

When that initial TTL expires and the table object is refreshed from LDAP, the TTL will be set to 43200 seconds.

Similarly the following will assign an initial TTL between 1800 and 3600 seconds to the entries in the `rpc.org_dir` table when it is first loaded.

```
nisplusLDAPentryTtl    rpc:1800:3600:3600
```

Each entry gets its own randomly selected TTL in the range specified. When a table entry expires and is refreshed, the TTL is set to 3600 seconds.

When selecting TTL values, consider the trade-off between performance and consistency. If the TTLs used for LDAP data cached by the `rpc.nisd` are very long, performance is the same as if `rpc.nisd` was not mapping data from LDAP at all. However, if the LDAP data is changed (by some entity other than `rpc.nisd`), it can also take a very long time before that change is visible in NIS+.

Conversely, selecting a very short (or even zero) TTL means that changes to LDAP data are quickly visible in NIS+, but can also impose a significant performance penalty. Typically, an NIS+ operation that also reads data from or writes data to LDAP will take at least two to three times longer (plus the LDAP lookup overhead) than the same operation without LDAP communication. Although performance can vary greatly depending on the hardware resources, scanning a large (tens of thousands or hundreds of thousands of entries) LDAP container to identify NIS+ entries that should be refreshed can take a long time. The `rpc.nisd`daemon performs this scan in the background, continuing to serve possibly stale data while it is running, but the background scan still consumes CPU and memory on the NIS+ server.

Carefully consider how critical it is to have NIS+ data in close synchronization with LDAP, and select the longest TTL that is acceptable for each NIS+ object. The default (when no `nisplusLDAPentryTtl` is specified) is 1 hour. The template mapping file `/var/nis/NIS+LDAPmapping.template` changes this to 12 hours for objects other than table entries. However, there is no auto-recognition of non-entry objects, so if you add mapping for a non-entry object, the TTL will default to 1 hour.

Note – There are no TTLs for nonexistent objects. Hence, no matter which TTLs are in effect for LDAP-mapped entries in an NIS+ table, a request for an entry that does not exist in NIS+ will query LDAP for that entry.

`nisplusLDAPobjectDN` Attribute

For each mapped NIS+ object, `nisplusLDAPobjectDN` establishes the location in the LDAP DIT where the object data resides. It also allows specification of the action to take when an LDAP entry is deleted. Each `nisplusLDAPobjectDN` value has three parts. The first specifies where LDAP data is read from, the second to where it is written, and the third what should happen when LDAP data is deleted. Refer to the following example.

```
nisplusLDAPobjectDN    rpc_table:\
                                    cn=rpc,ou=nisPlus,?base?\
                                                objectClass=nisplusObjectContainer:\
                                    cn=rpc,ou=nisPlus,?base?\
                                                objectClass=nisplusObjectContainer,\
                                                    objectClass=top
```

The above example shows that the `rpc.org_dir` table object should be read from the DN `cn=rpc,ou=nisPlus`, (since the value ends in a comma, the value of the `defaultSearchBase` attribute is appended), with scope `base`, and that entries with a value of `nisplusObjectContainer` for the `ObjectClass` attribute are selected.

The table object is written to the same place. The delete specification is missing, which implies the default action, which is as follows. If the NIS+ table object is deleted, the entire LDAP entry should also be deleted.

If data should be read from, but not written to LDAP, omit the write portion (and the colon separating it from the read part).

```
nisplusLDAPobjectDN    rpc_table:\
                                    cn=rpc,ou=nisPlus,?base?\
                                    objectClass=nisplusObjectContainer
```

Note that the `nisplusObjectContainer` object class is not part of RFC 2307. In order to use it, you must configure your LDAP server as detailed in "Mapping NIS+ Objects Other Than Table Entries" on page 273.

For the `rpc.org_dir` table entries, you could use the following example.

```
nisplusLDAPobjectDN rpc:ou=Rpc,?one?objectClass=oncRpc:\
                                        ou=Rpc,?one?objectClass=onRpc,objectClass=top
```

The above shows that the table entries are read from and written to the base `ou=Rpc`. Again, the trailing comma appends the `defaultSearchBase` value. Select entries that have an `objectClass` attribute value of `oncRpc`. When creating an entry in the `ou=Rpc` container in LDAP, you also must specify `top` as an `objectClass` value.

As an example showing a non-default delete specification, consider the following.

```
nisplusLDAPobjectDN    user_attr:\
                                    ou=People,?one?objectClass=SolarisUserAttr,\
                                        solarisAttrKeyValue=*:\
                                    ou=People,?one?objectClass=SolarisUserAttr:\
                                        dbid=user_attr_del
```

The `user_attr.org_dir` data resides in the `ou=People` LDAP container, which it shares with account information from other sources, such as the `passwd.org_dir` NIS+ table.

Select entries in that container that have the `solarisAttrKeyValue` attribute, since only those contain `user_attr.org_dir` data. The `dbid=user_attr_del` portion of the `nisplusLDAPobjectDN` shows that when an entry in the `user_attr.org_dir` NIS+ table entry is deleted, deletion of the corresponding LDAP entry (if any) should follow the rules in the rule set identified by the `user_attr_del` database ID. See "nisplusLDAPcolumnFromAttribute Attribute" on page 262 for more information.

nisplusLDAPattributeFromColumn Attribute

`nisplusLDAPattributeFromColumn` specifies the rules used to map NIS+ data to LDAP. Mapping rules for the other direction is controlled by `nisplusLDAPcolumnFromAttribute`.

nisplusLDAPcolumnFromAttribute Attribute

`nisplusLDAPcolumnFromAttribute` specifies the rules used to map LDAP data to NIS+.

The full entry mapping syntax can be found on `NIS+LDAPmapping`(4). However, a few examples should make things clearer.

The NIS+ `rpc.org_dir` table contains four columns called `cname`, `name`, `numbe`, and `comment`. Therefore, the entries for the NIS+ RPC program number (100300) with the canonical name `nisd` and the aliases `rpc.nisd` and `nisplusd` could be represented by the following NIS+ entries in `rpc.org_dir`.

```
nisd nisd 100300    NIS+ server
nisd rpc.nisd 100300    NIS+ server
nisd nisplusd 100300    NIS+ server
```

Assuming the `defaultSearchBase` value is `dc=some,dc=domain`, the corresponding LDAP entry, as listed by `ldapsearch`(1), would be the following.

```
dn: cn=nisd,ou=Ppc,dc=some,dc=domain
cn: nisd
cn: rpc.nsid
cn: nisplusd
oncRpcNumber: 100300
description: NIS+ server
objectClass: oncRpc
```

This makes for a simple one-to-one mapping between NIS+ and LDAP data, and the corresponding mapping attribute value going from NIS+ to LDAP is the following.

```
nisplusLDAPattributeFromColumn \
rpc:        dn=("cn=%s,", name), \
                cn=cname, \
                cn=name, \
                oncRpcNumber=number, \
                description=comment
```

This constructs the DN for the entry to be `cn=%s`, with the value of the `cname` column substituted for `%s`.

```
cn=nisd,
```

Since the value ends in a comma, the read base value from the `nisplusObjectDN` is appended, and you have the following.

```
cn=nisd,ou=Rpc,dc=some,dc=domain
```

The `oncRpcNumber` and `description` attribute values are just simple assignments of the corresponding NIS+ column values. The `rpc.nisd` will collect the multiple NIS+ entries into one LDAP entry, with multiple `cn` values to represent the different `name` column values.

Similarly, the mapping from LDAP to NIS+ would be as follows.

```
nisplusLDAPcolumnFromAttribute \
                    rpc:        cname=cn, \
                                    (name)=(cn), \
                                number=oncRpcNumber, \
                                comment=description
```

The above assigns the `oncRpcNumber` and `description` values to the corresponding NIS+ columns. The multi-valued `cn` (denoted by `(cn)` is mapped to multiple `name` column values (denoted by `(name)`). Since the `name` column cannot be multi-valued, the `rpc.nisd` creates one NIS+ entry for each `cn` value.

Finally, the `nisplusLDAPattributeFromColumn` value is an example of rule sets used for deletion.

```
nisplusLDAPattributeFromColumn \
user_attr_del:    dn=("uid=%s,", name), \
                      SolarisUserQualifier=, \
```

```
SolarisAttrReserved1=, \
 SolarisAttrReserved2=, \
SolarisAttrKeyValue=
```

Again, the `user_attr.org_dir` data shares the `ou=People` container with other account information (from the `passwd.org_dir` and other tables). If an entry in the `user_attr.org_dir` table is deleted, you probably do not want to delete the entire `ou=People` entry. Instead, the delete entry above says that when a `user_attr.org_dir` entry is deleted, the `SolarisUserQualifier`, `SolarisAttrReserved1`, `SolarisAttrReserved2`, and `SolarisAttrKeyValue` attributes (if any) are deleted from the `ou=People` entry specified by the following rule.

```
dn=("uid=%s,", name)
```

The rest of the LDAP entry is left unchanged.

NIS+ to LDAP Migration Scenarios

Likely scenarios for a migration from NIS+ to LDAP include the following.

- *Convert all NIS+ clients to LDAP in one operation.* You can use the `rpc.nisd` daemon to upload any NIS+ data that does not yet exist in LDAP. See "How to Convert All NIS+ Data to LDAP in One Operation" on page 265.
- *Do a gradual migration from NIS+ to LDAP.* Start by converting NIS+ data to LDAP (see "How to Convert All NIS+ Data to LDAP in One Operation" on page 265). You could have both NIS+ and LDAP clients sharing the same naming service data, and let the `rpc.nisd` automatically keep NIS+ and LDAP data synchronized. Initially, perhaps, NIS+ would be authoritative, and the LDAP server(s) would maintain a duplicate of the NIS+ data for the benefit of LDAP clients. At a convenient time, LDAP can become the authoritative naming service, and NIS+ service gradually phased out, until there are no more NIS+ clients.
- LDAP is already used as a naming service, so you need to merge the NIS+ and LDAP data. There are three possible ways to perform this merge.
  - *Add the NIS+ data to LDAP.* Entries that exist in NIS+, but not in LDAP, are added to LDAP. Entries that appear both in NIS+ and LDAP, but with different data, end up with the NIS+ data. See "How to Convert All NIS+ Data to LDAP in One Operation" on page 265.
  - *Overwrite the NIS+ data with the LDAP data.* If there are entries that exist in NIS+ but not in LDAP, they will disappear from NIS+. Entries that exist both in NIS+ and LDAP end up with the LDAP data. See "How to Convert All LDAP Data to NIS+ in One Operation" on page 265.
  - *Merge NIS+ and LDAP data, resolving conflicts on an individual basis.* See "Merging NIS+ and LDAP Data" on page 265.

▼ How to Convert All NIS+ Data to LDAP in One Operation

- **Use the `rpc.nisd` to upload any NIS+ data that does not yet exist in LDAP.**

  Assuming all NIS+/LDAP data mappings have been established in the default location (`/var/nis/NIS+LDAPmapping`), use the following command.

```
# /usr/sbin/rpc.nisd -D \
-x nisplusLDAPinitialUpdateAction=to_ldap \
-x nisplusLDAPinitialUpdateOnly=yes
```

  The above would make the `rpc.nisd` upload data to LDAP, and then exit. The NIS+ data would be unaffected by this operation.

  See the `nisplusLDAPinitialUpdateAction` attribute on `rpc.nisd`(4).

▼ How to Convert All LDAP Data to NIS+ in One Operation

- **Use the `rpc.nisd` to download all LDAP data to NIS+, overwriting existing NIS+ data.**

  Assuming all NIS+/LDAP data mappings have been established in the default location (`/var/nis/NIS+LDAPmapping`), use the following command.

```
# /usr/sbin/rpc.nisd -D \
-x nisplusLDAPinitialUpdateAction=from_ldap \
-x nisplusLDAPinitialUpdateOnly=yes
```

  The above would make the `rpc.nisd` daemon download data from LDAP, and then exit. The LDAP data would be unaffected by this operation.

  See the `nisplusLDAPinitialUpdateAction` attribute on `rpc.nisd`(4).

Merging NIS+ and LDAP Data

"NIS+ to LDAP Migration Scenarios" on page 264 showed how to synchronize NIS+ and LDAP data when data conflicts between the two should be resolved by letting either the NIS+ or the LDAP data be authoritative. Merging data requires a more complicated procedure.

The example procedure in this section assumes the following.

- You are putting a backup of the NIS+ data in the `/nisbackup` directory.
- Valid mapping configuration already exists in `/etc/default/rpc.nisd` and `/var/nis/tmpmap` (for tables that should be merged).
- Flat file representations of the NIS+ data before the merge are stored in `/before`, and after-merge representations in `/after`.
- `niscat` is used to dump flat file representations of custom NIS+ tables not supported by `nisaddent`(1M). You might have your own commands or scripts for dumping and loading such custom tables from and to NIS+. If so, those commands/scripts should be used in preference to `niscat` since the latter has no

convenient counterpart to load data back into NIS+.

If you are forced to dump data using `niscat`(1), you can use `nistbladm`(1) to load entries back into NIS+ one by one.

- Your command path includes `/usr/lib/nis` (which is where `nisaddent`(1M) resides).

▼ How to Merge NIS+ and LDAP Data

Caution – If the LDAP data should change between the download in Step 4 and the upload in Step 10, the upload might overwrite those changes. For this reason, you should try to prevent modifications to the LDAP data during this procedure. Consult your LDAP server documentation for more information.

1. **Back up all NIS+ data using the `nisbackup` command.**

   ```
   # nisbackup -a /nisbackup
   ```

2. **Identify the NIS+ tables that have data which must be merged with LDAP. Dump the contents of these tables to flat files. For example, dump the contents of `group.org_dir` by using `nisaddent` as follows.**

   ```
   # nisaddent -d group | sort > /before/group
   ```

   Piping the `nisaddent` output to `sort` will make for convenient comparison later on.

3. **Stop the NIS+ service.**

   ```
   # svcadm disable network/rpc/nisplus:default
   ```

4. **Download LDAP data to NIS+.**

   ```
   # /usr/sbin/rpc.nisd -D -m tmpmap \
   -x nisplusLDAPinitialUpdateAction=from_ldap \
   -x nisplusLDAPinitialUpdateOnly=yes
   ```

5. **Start the NIS+ service.**

   ```
   # svcadm enable network/rpc/nisplus:default
   ```

   The `rpc.nisd` daemon will now be serving the data downloaded from LDAP. If the conflicts to be resolved are such that NIS+ clients should not be exposed to them, make sure to perform this and the following steps when there are few (preferably no) active NIS+ clients.

6. **Dump the NIS+ data for the affected tables.**

   The following example uses the `group.org_dir` table.

   ```
   # nisaddent -d group | sort > /after/group
   ```

7. **Create merged versions of the tables.**

   Use the file merge procedure of your choice to produce the merged tables. If no other tools are available, you can use `diff`(1) to collect differences between the `/before` and `/after` files, and merge manually with a text editor.

   The following example assumes that the merged results are available in `/after`.

8. **Load the merged data into NIS+. The following example uses the `group` table.**

   ```
   # nisaddent -m -f /after/group group
   ```

9. **Remove LDAP entries that should not exist after the merge.**

   A. If there are LDAP entries that do not exist in the (now merged) NIS+ data, and that should not exist in LDAP after the upload, you must remove those LDAP entries.

   Your LDAP server might provide a convenient method for removing multiple entries, such as a way to delete all entries in a container. If this is not the case, you can use `ldapsearch`(1) to generate a list of entries for each container. For example, to generate a list of all entries in the `ou=Rpc` container, use `ldapsearch`(1) as follows.

   ```
   # ldapsearch -h server-address -D bind-DN -w password \
   -b ou=Rpc,search-base 'objectClass=*' dn | \
   grep -i ou=Rpc | grep -v -i \^ou=Rpc > \
   /tmp/delete-dn
   ```

   See "Performance and Indexing" on page 272 for an explanation of the meta-arguments (*server-address*, *bind-DN*, for example).

   B. You can now edit the result file (`/tmp/delete-dn`) to specify only those entries that should be removed. Alternatively, in order to remove all entries in the container, use the file as is, and rely on the NIS+ upload to restore the LDAP data. Either way, you should backup the LDAP data before performing the `ldapdelete` operation below.

   C. Use `ldapdelete` to remove LDAP entries, redirecting `stdout` (which usually is one blank line for each entry removed) to `/dev/null`.

   ```
   # ldapdelete -h server-address -D bind-DN -w password \
   /tmp/delete-dn /dev/null
   ```

   D. Repeat the above procedure for each container that has at least one entry which must be removed.

10. **Upload the merged NIS+ data to LDAP.**

    a. **Stop the NIS+ service.**

       ```
       # svcadm disable network/rpc/nisplus:default
       ```

    b. **Perform the upload.**

       ```
       # /usr/sbin/rpc.nisd -D -m tmpmap \
       -x nisplusLDAPinitialUpdateAction=to_ldap \
       -x nisplusLDAPinitialUpdateOnly=yes
       ```

11. (Optional) Modify the `/lib/svc/method/nisplus` file as needed.

- If the `rpc.nisd` daemon uses the LDAP repository, specify an appropriate mapping file with the `-m` *mappingfile* option, if the default `/var/yp/NIS+LDAPmapping` file is not used.
- If the `rpc.nisd` daemon provides NIS (YP) emulation, specify the `-Y` option by using `svcprop` or by modifying the `/lib/svc/method/nisplus` file .

See "NIS+ to LDAP Tools and the Service Management Facility" on page 253 for more information.

12. Start the NIS+ service.

```
# svcadm enable network/rpc/nisplus:default
```

Masters and Replicas (NIS+ to LDAP)

Only NIS+ masters are allowed to write data to LDAP. NIS+ replicas can obtain updates either from the NIS+ master (which might or might not have obtained it from LDAP), or they can read data directly from an LDAP server. A combination of the two is also possible. Therefore, there are two principal ways to arrange for NIS+ replication.

- *Leave NIS+ replicas unchanged, and let them obtain their data updates from the NIS+ master.*

  This arrangement has the advantage of configurational simplicity (only the NIS+ master need have a connection to an LDAP server), and also maintains the old replication relationship (master knows about new data first, replicas later). It is probably the most convenient solution while NIS+ remains authoritative for naming service data. However, it also lengthens the path between LDAP and NIS+ replica servers.
- *Let NIS+ replicas obtain their data directly from LDAP instead of from the NIS+ master.*

  In this case, replicas could have updated data before or after the NIS+ master, depending on lookup traffic and TTLs for data derived from LDAP. This arrangement is more complicated, but can be convenient when LDAP is the authoritative naming services repository, and few or no updates are made directly to NIS+ data.

Replication Timestamps

When an NIS+ replica is obtaining data for at least one object in a particular NIS+ directory from LDAP, the update timestamps printed by `nisping`(1M) do not necessarily indicate the degree of data consistency between the NIS+ master and the

replica. For example, assume that the NIS+ directory `dir1` contains the tables `table1` and `table2`. When the replica is obtaining data for both `table1` and `table2` from the NIS+ master, you might see an output like the following.

```
# nisping dir1
Master server is "master.some.domain."
Last update occurred at Mon Aug  5 22:11:09 2002

Replica server is "replica.some.domain."
    Last Update seen was Mon Aug  5 22:11:09 2002
```

The above indicates that the master and replica have exactly the same data. However, if the replica is getting data for either or both of `table1` and `table2` from LDAP, the output only shows that the replica has received an NIS_PING from the master, and updated its resynchronization time stamp for housekeeping purposes. The data in the table or tables mapped from LDAP might differ from that on the NIS+ master if either of the following are true.

- The LDAP data differs from that on the NIS+ master.
- The replica has data in its cache (its local version of the NIS+ database) that has not expired, but that is not up to date with LDAP.

If you cannot accept this type of data inconsistency, let all NIS+ replicas obtain their data from the NIS+ master only. Once you have configured the NIS+ master to get data from LDAP, you do not need to make modifications to the replicas.

The Directory Server (NIS+ to LDAP)

The LDAP mapping portion of the `rpc.nisd` daemon uses LDAP protocol version 3 to talk to the LDAP server. The default mapping configuration (`/var/nis/NIS+LDAPmapping.template`) expects that the LDAP server supports an extended version of RFC 2307. RFCs can be retrieved from `http://www.ietf.org/rfc.html`. While the mapping between NIS+ and LDAP data can be modified using `NIS+LDAPmapping`(4), there is a basic assumption that the LDAP data is organized along the principles laid out in RFC 2307.

For example, in order to share account information between direct LDAP clients and NIS+ clients, the LDAP server must support storing account (user) passwords in the UNIX `crypt` format. If the LDAP server cannot be configured to do so, you can still store NIS+ data, including accounts, in LDAP. However, you will not be able to fully share account information between NIS+ users and LDAP `bindDN`s.

Configuring the Sun Java System Directory Server

Refer to the Sun Java System Directory Server Collection for detailed instructions on the installation, setup and administration of Sun Java System Directory Server.

You can use `idsconfig`(1M) to configure Sun Java System Directory Server for LDAP clients using LDAP as a naming service. The setup provided by `idsconfig`(1M) is also appropriate when using NIS+ with an LDAP data repository.

Note – If you are using an LDAP server other than Sun Java System Directory Server, you must manually configure the server to support the RFC 2307 schemas.

Assigning Server Address and Port Number

The `/etc/default/rpc.nisd` file is set up to use a local LDAP server at port `389`. If this is not correct in your configuration, establish a new value for the `preferredServerList` attribute. For example, to use an LDAP server at IP address `192.0.0.1` and port `65535`, you specify the following.

```
preferredServerList=192.0.0.1:65535
```

Security and Authentication

Authentication between NIS+ clients and the NIS+ server is not affected when the NIS+ server is obtaining data from LDAP. However, in order to maintain the integrity of the NIS+ data when it is stored in LDAP, consider configuring authentication between the `rpc.nisd` daemon and the LDAP server. Several different types of authentication are available, depending on the capabilities of the LDAP server.

The LDAP authentication supported by the `rpc.nisd` daemon includes the following.

- `none`

  The `none` authentication method is the default. While using `none` requires no setup, it also provides no security. It is only suitable for use in environments that have no security requirements at all.

  To use the `none` authentication, make sure that the `authenticationMethod` attribute has the following value.

  ```
  authenticationMethod=none
  ```

The authentication methods that actually provide at least some security typically require that you associate a shared secret (a password or key) with a DN in LDAP. The DN you select for use by the `rpc.nisd` daemon can be unique, or can also be used for other purposes. It should have appropriate capabilities to support the expected LDAP

traffic. For example, if the `rpc.nisd` daemon should be able to write data to LDAP, the selected DN must have the right to add/update/delete LDAP data in the containers used for the NIS+ data. Also, the LDAP server might, by default, impose limitations on resource usage (such as search time limits or search result size limitations). If this is the case, the selected DN must have sufficient capabilities to support enumeration of the NIS+ data containers.

- `simple`

  The `simple` authentication method provides authentication by unencrypted exchange of a password string. Since the password is sent in the clear between the LDAP client (the `rpc.nisd` daemon) and LDAP server, the `simple` method is suitable only when information exchange between the NIS+ and LDAP servers is protected by some other method.

  For instance, transport layer encryption of LDAP traffic, or the special case where the NIS+ and LDAP server is one and the same system, and the NIS+/LDAP traffic stays in the kernel, protected from the eyes of unauthorized users.

  Modify the configuration of the `rpc.nisd` daemon with the DN and password to use for the `simple` authentication. For example, if the DN is `cn=nisplusAdmin,ou=People,dc=some,dc=domain`, and the password `aword`, establish the following.

```
authenticationMethod=simple
nisplusLDAPproxyUser=cn=nisplusAdmin,ou=People,dc=some,dc=domain
nisplusLDAPproxyPassword=aword
```

  Be sure to protect the place where the password is stored from unauthorized access. Remember that if the password is specified on the `rpc.nisd` command line, it might be visible to any user on the system via commands such as `ps`(1).

- `sasl/digest-md5`

  The `sasl/digest-md5` authentication method provides authentication using the `digest/md5` algorithm.

  Consult your LDAP server documentation for information on how to set up an authorization identity for use with `digest-md5`, and modify the `/etc/default/rpc.nisd` file to specify this identity and its associated password.

```
authenticationMethod=sasl/digest-md5
nisplusLDAPproxyUser=cn=nisplusAdmin,ou=People,dc=some,dc=domain
nisplusLDAPproxyPassword=aword
```

  Be sure to protect the file where the password is stored from unauthorized access.

- `sasl/cram-md5`

  Authentication using the `cram/md5` algorithm. Probably only supported by the obsolete SunDS LDAP server.

  Consult your LDAP server documentation for information on how to set up a bind DN for use with `cram-md5`, and modify the `/etc/default/rpc.nisd` file to specify this DN and its associated password.

```
authenticationMethod=sasl/cram-md5
nisplusLDAPproxyUser=cn=nisplusAdmin,ou=People,dc=some,dc=domain
nisplusLDAPproxyPassword=aword
```

Be sure to protect the file where the password is stored from unauthorized access.

Using SSL

The `rpc.nisd` daemon also supports transport layer encryption of LDAP traffic using SSL. Consult your LDAP server documentation to generate an SSL certificate for LDAP server authentication. Store the certificate in a file on the NIS+ server (`/var/nis/cert7.db`, for example) and modify `/etc/default/rpc.nisd` as follows.

```
nisplusLDAPTLS=ssl
nisplusLDAPTLSCertificateDBPath=/var/nis/cert7.db
```

Be sure to protect the certificate file from unauthorized access. Note that the above provides session encryption and authentication of the LDAP server to the `rpc.nisd`. It does not provide authentication of the `rpc.nisd` to the LDAP server, since the certificate does not contain anything that identifies the LDAP client (`rpc.nisd`). However, you can combine SSL with another authentication method (`simple`, `sasl/digest-md5`) in order to achieve mutual authentication.

Performance and Indexing

When the `rpc.nisd` daemon is asked to enumerate an NIS+ table (using `niscat`(1) for example) that is mapped from LDAP, it will enumerate the corresponding LDAP container if at least one entry in the table has an expired TTL. Although this container enumeration is done in the background, so that LDAP performance is of limited importance, it can nevertheless be beneficial to establish LDAP indices to speed up container enumeration for large containers.

To obtain an estimate of the amount of time required for enumeration of a particular container, you can use a command like the following.

% **/bin/time ldapsearch -h** *server-address* **-D** *bind-DN* **-w** *password* ****

-b *container***,** *search-base 'cn=*'* **/dev/null**

where

- *server-address*

  IP address portion of `preferredServerList` value from `/etc/default/rpc.nisd`

- *bind-DN*

  `nisplusLDAPproxyUser` value from `/etc/default/rpc.nisd`

- *password*

  `nisplusLDAPproxyPassword` value from `/etc/default/rpc.nisd`
- *container*

  One of the RFC 2307 container names (`ou=Services`, `ou=Rpc`, and so on)
- *search-base*

  `defaultSearchBase` value from `/etc/default/rpc.nisd`

The "real" value printed by `/bin/time` is the elapsed (wall-clock) time. If this value exceeds a significant fraction (25 percent or more) of the TTL for the corresponding table entries (see "Authentication and Security" on page 257), it might be beneficial to index the LDAP container.

The `rpc.nisd` supports the `simple page` and VLV indexing methods. Refer to your LDAP server documentation to find out which indexing methods it supports, and how to create such indices.

Mapping NIS+ Objects Other Than Table Entries

You can store NIS+ objects other than table entries in LDAP. However, doing so has no particular value unless you also have NIS+ replicas that obtain those NIS+ objects from LDAP. The recommended choices are the following.

- *There are no replicas, or the replicas obtain their data from the NIS+ master only.*

  Edit the mapping configuration file (see `NIS+LDAPmapping`(4)) to remove the following attribute values for all non-table-entry objects.

```
nisplusLDAPdatabaseIdMapping
nisplusLDAPentryTtl
nisplusLDAPobjectDN
```

  For example, if you started out from the `/var/nis/NIS+LDAPmapping.template` file, the sections you need to remove (or disable by commenting) are as follows.

```
# Standard NIS+ directories
nisplusLDAPdatabaseIdMapping    basedir:
.
.
.

nisplusLDAPdatabaseIdMapping    user_attr_table:user_attr.org_dir

nisplusLDAPdatabaseIdMapping     audit_user_table:audit_user.org_dir
```

```
# Standard NIS+ directories
nisplusLDAPentryTtl             basedir:21600:43200:43200
.
.
.

nisplusLDAPentryTtl    user_attr_table:21600:43200:43200
nisplusLDAPentryTtl    audit_user_table:21600:43200:43200

# Standard NIS+ directories
nisplusLDAPobjectDN    basedir:cn=basedir,ou=nisPlus,?base?\

                    objectClass=nisplusObjectContainer:\
                                cn=basedir,ou=nisPlus,?base?\
                                    objectClass=nisplusObjectContainer,\
                                    objectClass=top
.
.
.

nisplusLDAPobjectDN    audit_user_table:cn=audit_user,ou=nisPlus,?base?\
                                objectClass=nisplusObjectContainer:\
                                cn=audit_user,ou=nisPlus,?base?\
                                    objectClass=nisplusObjectContainer,\
                                    objectClass=top
```

- *NIS+ replicas obtain their data from LDAP server.*

  Create the `nisplusObject` attribute and `nisplusObjectContainer` object class as shown in the following example (LDIF data is suitable for `ldapadd`(1). Attribute and object class OIDs are for illustration only.)

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes: ( 1.3.6.1.4.1.42.2.27.5.42.42.1.0 NAME 'nisplusObject'
                                DESC 'An opaque representation of an NIS+ object'
                                SYNTAX 1.3.6.1.4.1.1466.115.121.1.5 SINGLE-VALUE )

dn: cn=schema
changetype: modify
add: objectclasses

objectclasses: (1.3.6.1.4.1.42.2.27.5.42.42.2.0 NAME'nisplusObjectContainer'

SUP top STRUCTURAL DESC 'Abstraction of an NIS+ object'
MUST ( cn $ nisplusObject ) )
```

  You also need to create a container for the NIS+ objects. The following LDIF syntax shows how to create the `ou=nisPlus,dc=some,dc=domain` container, and can be used as input to `ldapadd`(1).

```
dn: ou=nisPlus,dc=some,dc=domain
ou: nisPlus
objectClass: top
objectClass: organizationalUnit
```

NIS+ Entry Owner, Group, Access, and TTL

When NIS+ table entries are created from LDAP data, the default behavior is to initialize the entry object owner, group, access rights, and TTL using the corresponding values from the table object in which the entry object lives. This is normally sufficient, but there might be cases where these NIS+ entry attributes must be established individually. An example of this would be a site that did not use the `rpc.nispasswdd`(1M) daemon. In order to allow individual users to change their NIS+ passwords (and re-encrypt their Diffie-Hellman keys stored in the `cred.org_dir` table), `passwd.org_dir` and `cred.org_dir` entries for the user should be owned by the user, and have modify rights for the entry owner.

If you need to store table entry owner, group, access, or TTL in LDAP for one or more NIS+ tables, you need to do the following.

▼ How to Store Additional Entry Attributes in LDAP

1. **Consult your LDAP server documentation, and create the following new attributes and object class. (LDIF data is suitable for `ldapadd`. Attribute and object class OIDs are for illustration only.)**

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.4.0 NAME 'nisplusEntryOwner' \
                                DESC 'Opaque representation of NIS+ entry owner' \
                                SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.4.1 NAME 'nisplusEntryGroup' \
                                DESC 'Opaque representation of NIS+ entry group' \
                                SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.4.2 NAME 'nisplusEntryAccess' \
                                DESC 'Opaque representation of NIS+ entry access' \
                                SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.4.3 NAME 'nisplusEntryTtl' \
                                DESC 'Opaque representation of NIS+ entry TTL' \
                                SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )

dn: cn=schema
changetype: modify
add: objectclasses

objectclasses:(1.3.6.1.4.1.42.2.27.5.42.42.5.0 NAME 'nisplusEntryData'\
SUP top STRUCTURAL DESC 'NIS+ entry object non-column data'\

MUST ( cn ) MAY ( nisplusEntryOwner $ nisplusEntryGroup $\
nisplusEntryAccess $ nisplusEntryTtl ) )
```

2. **Modify the `nisplusLDAPobjectDN` attribute value for the relevant table(s) so that the write portion includes the newly created `nisplusEntryData` object class.**

   For example, for the `passwd.org_dir` table, assuming that you are using a mapping file based on `/var/nis/NIS+LDAPmapping.template`, edit as follows.

```
nisplusLDAPobjectDN    passwd:ou=People,?one?objectClass=shadowAccount,\
                                        objectClass=posixAccount:\
                                ou=People,?one?objectClass=shadowAccount,\
                                        objectClass=posixAccount,\
                                        objectClass=account,objectClass=top
```

   Edit the attribute value as follows.

```
nisplusLDAPobjectDN    passwd:ou=People,?one?objectClass=shadowAccount,\
                                        objectClass=posixAccount:\
                                ou=People,?one?objectClass=shadowAccount,\
                                        objectClass=posixAccount,\
                                        objectClass=nisplusEntryData,\
                                        objectClass=account,objectClass=top
```

3. **Edit the `nisplusLDAPattributeFromColumn` and `nisplusLDAPcolumnFromAttribute` attribute values to specify any desired subset of owner, group, access, or TTL.**

   In Step 2, you created the LDAP attributes used to store these values. For NIS+, there are predefined pseudo-column names called `zo_owner`, `zo_group`, `zo_access`, and `zo_ttl`, respectively. For example, in order to store owner, group, and access for `passwd.org_dir` entries in LDAP, modify the `nisplusLDAPattributeFromColumn` value from the following.

```
nisplusLDAPattributeFromColumn \
        passwd:         dn=("uid=%s,", name), \
                cn=name, \
                uid=name, \
                userPassword=("{crypt$}%s", passwd), \
                uidNumber=uid, \
                gidNumber=gid, \
                gecos=gcos, \
                homeDirectory=home, \
                loginShell=shell, \
                (shadowLastChange,shadowMin,shadowMax, \
                 shadowWarning, shadowInactive,shadowExpire)=\
                    (shadow, ":")
```

   Edit to read as follows.

```
nisplusLDAPattributeFromColumn \
        passwd:         dn=("uid=%s,", name), \
                cn=name, \
                uid=name, \
                userPassword=("{crypt$}%s", passwd), \
                uidNumber=uid, \
                gidNumber=gid, \
                gecos=gcos, \
```

```
                homeDirectory=home, \
                loginShell=shell, \
                (shadowLastChange,shadowMin,shadowMax, \
                 shadowWarning, shadowInactive,shadowExpire)=\
                    (shadow, ":"), \
                nisplusEntryOwner=zo_owner, \
                nisplusEntryGroup=zo_group, \
                nisplusEntryAccess=zo_access
```

Similarly, to set NIS+ entry owner, group, and access from LDAP data for the `passwd.org_dir` table, modify the following.

```
nisplusLDAPcolumnFromAttribute \
        passwd:         name=uid, \
                ("{crypt$}%s", passwd)=userPassword, \
                uid=uidNumber, \
                gid=gidNumber, \
                gcos=gecos, \
                home=homeDirectory, \
                shell=loginShell, \
                shadow=("%s:%s:%s:%s:%s:%s", \
                    shadowLastChange, \
                    shadowMin, \
                    shadowMax, \
                    shadowWarning, \
                    shadowInactive, \
                    shadowExpire)
```

Edit to read as follows.

```
nisplusLDAPcolumnFromAttribute \
        passwd:         name=uid, \
                ("crypt$%s", passwd)=authPassword, \
                uid=uidNumber, \
                gid=gidNumber, \
                gcos=gecos, \
                home=homeDirectory, \
                shell=loginShell, \
                shadow=("%s:%s:%s:%s:%s:%s", \
                    shadowLastChange, \
                    shadowMin, \
                    shadowMax, \
                    shadowWarning, \
                    shadowInactive, \
                    shadowExpire), \
                zo_owner=nisplusEntryOwner, \
                zo_group=nisplusEntryGroup, \
                zo_access=nisplusEntryAccess
```

4. **[Upload owner, group, access, and/or TTL entry data to LDAP.]**

   See "How to Convert All NIS+ Data to LDAP in One Operation" on page 265 for more information.

5. **Restart the NIS+ service in order to make the mapping change take effect.**

   ```
   # svcadm restart network/rpc/nisplus:default
   ```

Principal Names and Netnames (NIS+ to LDAP)

NIS+ authentication relies on principal names (a user or host name, qualified by the domain name) and netnames (the secure RPC equivalent of principal names) to uniquely identify an entity (principal) that can be authenticated. While RFC 2307 provides for storing the Diffie-Hellman keys used for NIS+ authentication, there is no specified place for the principal names or netnames.

The `/var/nis/NIS+LDAPmapping.template` file works around this problem by deriving the domain portion of principal and netnames from the owner name (itself a principal name) of the `cred.org_dir` table. Hence, if the NIS+ domain is `x.y.z.`, and the owner of the `cred.org_dir` table is `aaa.x.y.z.`, all principal names for NIS+ entries created from LDAP data will be of the following form.

user or system`.x.y.z.`

Netnames are of the following form.

`unix.`*uid*`@x.y.z.`

`unix.`*nodename*`@x.y.z.`

While this method of constructing principal and netnames probably is sufficient for most NIS+ installations, there are also some cases in which it fails, as shown in the following.

- The owner name of the `cred.org_dir` table belongs to a different domain than the one shared by the principal and netnames in the `cred.org_dir` table. This could be the case for a `cred.org_dir` table in a subdomain, if the owner is a principal from the parent domain. You can fix this problem in one of the following ways.
  - *Change the owner of the* `cred.org_dir` *table to match the domain of the entries in the table.*
  - *Change the mapping rules for the* `cred.org_dir` *database IDs to use the owner of some other NIS+ object (which could be created especially for that purpose, if no suitable object already exists).*

    For example, if the `cred.org_dir` table in the domain `sub.dom.ain.` is owned by `master.dom.ain.`, but principal and netnames in `cred.org_dir.sub.dom.ain.` should belong to `sub.dom.ain`, you could create a link object as follows.

    ```
    # nisln cred.org_dir.sub.dom.ain. \
    credname.sub.dom.ain.
    ```

Set the owner of the link object to an appropriate principal in the `sub.dom.ain.` as follows.

```
# nischown trusted.sub.dom.ain. credname.sub.dom.ain.
```

Edit the mapping file. Change

```
(nis+:zo_owner[]cred.org_dir, "*.%s")), \
```

to

```
(nis+:zo_owner[]credname.sub.dom.ain., "*.%s")), \
```

Note that the use of a link object called `credname` is an example. Any valid object type (except an entry object) and object name will do. The important point is to set the owner of the object to have the correct domain name.

- If you do not want to give ownership even of a special purpose object to a principal from the domain used for the principal and netnames, create `nisplusPrincipalName` and `nisplusNetname` attributes as detailed below.

- *The* `cred.org_dir` *table contains principal and netnames belonging to more than one domain.*

  Consult the documentation for your LDAP server, and create the `nisplusPrincipalName` and `nisplusNetname` attributes, as well as the `nisplusAuthName` object class. (The following is LDIF data for `ldapadd`. Attribute and object class OIDs are for illustration only.)

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.7.0 NAME 'nisplusPrincipalName' \
          DESC 'NIS+ principal name' \
          SINGLE-VALUE \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )

attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.9.0 NAME 'nisplusNetname' \
          DESC 'Secure RPC netname' \
          SINGLE-VALUE \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 )

dn: cn=schema
changetype: modify
add: objectclasses
objectclasses:    ( 1.3.6.1.4.1.42.2.27.5.42.42.10.0 NAME 'nisplusAuthName' \
          SUP top AUXILLIARY DESC 'NIS+ authentication identifiers' \
          MAY ( nisplusPrincipalName $ nisplusNetname ) )
```

You now need to enable the `cred.org_dir` mapping to use the newly created `nisplusNetname` and `nisplusPrincipalName` attributes. The template mapping file, `/var/nis/NIS+LDAPmapping.template`, contains commented-out lines for this purpose. See the `nisplusObjectDN` and `nisplusLDAPattributeFromColumn/ nisplusLDAPcolumnFromAttribute` attribute values for the `credlocal`, `creduser`, and `crednode` database IDs.

Once you have edited your mapping file to this effect, restart the NIS+ service. Do not forget to edit the `/lib/svc/method/nisplus` file to include the `-m` and `-Y` options, or use the `svcprop` command, as appropriate. See "NIS+ to LDAP Tools and the Service Management Facility" on page 253 for more information.

```
# svcadm restart network/rpc/nisplus:default
```

`client_info` and `timezone` Tables (NIS+ to LDAP)

Because RFC 2307 does not provide schemas for the information kept in the NIS+ `client_info.org_dir` and `timezone.org_dir` tables, mapping of these tables is not enabled by default in the template mapping file (`/var/nis/NIS+LDAPmapping.template`). If you want to keep the `client_info` and`timezone` information in LDAP, consult your LDAP server documentation, and create the new attributes and object classes discussed in the following sections.

`client_info` Attributes and Object Class

Create attributes and object class as below, and then create the container for the client_info data. The suggested container name is `ou=ClientInfo`. LDIF data is for `ldapadd`(1). The attribute and object class OIDs used in the following are examples only.

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.12.0 \
          NAME 'nisplusClientInfoAttr' \
          DESC 'NIS+ client_info table client column' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.12.1 \
          NAME 'nisplusClientInfoInfo' \
          DESC 'NIS+ client_info table info column' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.12.2 \
          NAME 'nisplusClientInfoFlags' \
          DESC 'NIS+ client_info table flags column' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )

dn: cn=schema
changetype: modify
add: objectclasses
objectclasses:    ( 1.3.6.1.4.1.42.2.27.5.42.42.13.0 \
```

```
NAME 'nisplusClientInfoData' \
DESC 'NIS+ client_info table data' \
SUP top STRUCTURAL MUST ( cn ) \
MAY ( nisplusClientInfoAttr $ nisplusClientInfoInfo $ nisplusClientInfoFlags ) )
```

To create the container, put the following LDIF data in a file. Substitute your actual search base for *searchBase*.

```
dn: ou=ClientInfo, searchBase

objectClass: organizationalUnit

ou: ClientInfo

objectClass: top
```

Use the above file as input to the `ldapadd` command in order to create the `ou=ClientInfo` container. For example, if your LDAP administrator DN is `cn=directory manager`, and the file with the LDIF data is called `cifile`, do the following.

```
# ldapadd -D cn="directory manager" -f cifile
```

Depending on the authentication required, the `ldapadd` command might prompt for a password.

The `/var/nis/NIS+LDAPmapping.template` file contains commented-out definitions for the `client_info.org_dir` table. Copy these to the actual mapping file, enable by removing the comment character '#', and restart the `rpc.nisd` daemon.

```
# svcadm restart network/rpc/nisplus:default
```

If necessary, synchronize NIS+ and LDAP data as described in "NIS+ to LDAP Migration Scenarios" on page 264.

`timezone` Attributes and Object Class

Create attributes and object class as below, and then create the container for the timezone data. The suggested container name is `ou=Timezone`. (The LDIF data is suitable for `ldapadd`(1). Attribute and object class OIDs are examples only.)

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.15.0 NAME 'nisplusTimeZone' \
          DESC 'tzone column from NIS+ timezone table' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )

dn: cn=schema
changetype: modify
```

```
add: objectclasses
objectclasses:    ( 1.3.6.1.4.1.42.2.27.5.42.42.16.0 NAME 'nisplusTimeZoneData' \
          DESC 'NIS+ timezone table data' \
          SUP top STRUCTURAL MUST ( cn ) \
          MAY ( nisplusTimeZone $ description ) )
```

To create the `ou=Timezone` container, put the following LDIF data in a file. Substitute your actual search base for *searchBase*.

```
dn: ou=Timezone,searchBase ou: Timezone objectClass: top

objectClass: organizationalUnit
```

Use the above file as input to `ldapadd`(1) in order to create the `ou=Timezone` container. For example, if your LDAP administrator DN is `cn=directory manager`, and the file with the LDIF data is called `tzfile`.

```
# ldapadd -D cn="directory manager" -f tzfile
```

Depending on the authentication required, the `ldapadd` command might prompt for a password.

The `/var/nis/NIS+LDAPmapping.template` file contains commented-out definitions for the `timezone.org_dir` table. Copy these to the actual mapping file, enable by removing the comment character '#', and restart the `rpc.nisd` daemon.

```
# svcadm restart network/rpc/nisplus:default
```

If necessary, synchronize NIS+ and LDAP data as described in "NIS+ to LDAP Migration Scenarios" on page 264.

Adding New Object Mappings (NIS+ to LDAP)

The template mapping file, `/var/nis/NIS+LDAPmapping.template`, contains mapping information for all standard NIS+ objects. In order to support mapping of site or application specific objects, you will need to add new mapping entries. This is a simple task for non-entry (that is, directory, group, link, or table) objects, but can become complex for entry objects, if the LDAP organization of the corresponding entry data differs greatly from that used by NIS+. The following example shows the simple case.

▼ How to Map Non-Entry Objects

1. **Find the fully qualified name of the object to be mapped.**

If this name resides under the domain name specified by the `nisplusLDAPbaseDomain` attribute, you can omit the portion that equals the `nisplusLDAPbaseDomain` value.

For example, if `nisplusLDAPbaseDomain` has the value `some.domain.`, and the object to be mapped is a table called `nodeinfo.some.domain.`, the object name can be shortened to `nodeinfo`.

2. **Invent a database id to identify the object.**

   The database id must be unique for the mapping configuration used, but is not otherwise interpreted. It does not show up in the LDAP data. In order to reduce confusion with entry object mappings, create a database id identifying the table object proper (not the table entries) using an explanatory string like `_table` at the end.

   For this example, use the database id `nodeinfo_table`, and establish the connection between the database id and the object in the standard mapping file location (`/var/nis/NIS+LDAPmapping`) by adding the following.

```
nisplusLDAPdatabaseIdMapping    nodeinfo_table:nodeinfo.some.domain.
```

   Assuming that `nisplusLDAPbaseDomain` is `some.domain.`, the following would also work.

```
nisplusLDAPdatabaseIdMapping    nodeinfo_table:nodeinfo
```

3. **Decide on a TTL for the object.**

   This is the time during which the `rpc.nisd` daemon regards its local copy of the object as valid. When the TTL expires, the next reference to the object will initiate an LDAP lookup to refresh the object.

   There are two different TTL values. The first is set when the `rpc.nisd` daemon first loads the object from disk (after a reboot or restart), and the second pertains to all refreshes from LDAP. The first TTL is selected randomly from a configured range. For example, if `nodeinfo_table` should be valid for a period of between one and three hours following initial load, and for twelve hours thereafter, specify the following.

```
nisplusLDAPentryTtl        nodeinfo_table:3600:10800:43200
```

4. **Decide where the object data should be stored in LDAP.**

   The template mapping file suggests putting non-entry object data in the `ou=nisPlus` container.

   If you use this scheme, and have not yet created the appropriate attribute, object class, and container, see "Mapping NIS+ Objects Other Than Table Entries" on page 273.

   For example, assume you want to store the `nodeinfo` object in the `ou=nisPlus,dc=some,dc=domain` container, and that the LDAP entry should have the `cn` `nodeinfo`. Create the following `nisplusLDAPobjectDN`.

```
nisplusLDAPobjectDN    nodeinfo_table:\
                cn=nodeinfo,ou=nisPlus,dc=some,dc=domain?base?\
                objectClass=nisplusObjectContainer:\
```

```
cn=nodeinfo,ou=nisPlus,dc=some,dc=domain?base?\
    objectClass=nisplusObjectContainer,\
    objectClass=top
```

Since NIS+ replicas do not write data to LDAP, you can use the `nisplusLDAPobjectDN` above for both master and replicas.

5. **(Skip this step if the NIS+ object to be mapped has not yet been created in NIS+.) Store the object data in LDAP. You could use the `rpc.nisd` daemon for this purpose, but it is easier to use the `nisldapmaptest`(1M) utility, as you can leave the `rpc.nisd` daemon running.**

   ```
   # nisldapmaptest -m /var/nis/NIS+LDAPmapping -o -t nodeinfo -r
   ```

   The `-o` option specifies the table object itself, not the table entries.

6. **Verify that the object data is stored in LDAP. (This example assumes the LDAP server is running on the local machine at port `389`.)**

   ```
   # ldapsearch -b ou=nisPlus,dc=some,dc=domain cn=nodeinfo
   ```

   The output would appear similar to the following.

```
dn: cn=nodeinfo,ou=nisPlus,dc=some,dc=domain
objectclass: nisplusObjectContainer
objectclass: top
cn: nodeinfo
nisplusobject=<base 64 encoded data>
```

7. **Restart the NIS+ service.**

   The service will start by using the new mapping information. Do not forget to edit the `/lib/svc/method/nisplus` file to add the `-m` and `-Y` options, or use the `svcprop` command, as appropriate. See "NIS+ to LDAP Tools and the Service Management Facility" on page 253 for more information.

   ```
   # svcadm restart network/rpc/nisplus:default
   ```

Adding Entry Objects

`NIS+LDAPmapping`(4) specifies the syntax and semantics of table entry mapping in detail, and also provides examples that show how to use each syntactic element. However, the simplest and least error-prone approach is usually to identify an already existing mapping that is similar to what you want to do, and then copy and modify that existing mapping.

For example, assume that you have an NIS+ table called `nodeinfo`, which is used to store inventory and owner information for nodes. Assume that the NIS+ table was created by the following command.

```
# nistbladm -c -D access=og=rmcd,nw=r -s : nodeinfo_tbl \
cname=S inventory=S owner= nodeinfo.‘domainname‘.
```

The cname column is expected to contain the canonical name of the node. In other words, the same value as that of the cname column in the hosts.org_dir table for the node.

Also assume that the corresponding information is kept in the ou=Hosts container in LDAP, and that the nodeInfo object class (which is an invention for this example, and is not defined in any RFC) has cn as a MUST attribute, and that nodeInventory and nodeOwner are MAY attributes.

In order to upload existing nodeinfo data to LDAP, it will be convenient to create the new mapping attributes in a separate file. You could, for example, use /var/nis/tmpmapping.

1. Create a database id that identifies the NIS+ table to be mapped.

   ```
   nisplusLDAPdatabaseIdMapping    nodeinfo:nodeinfo
   ```

2. Set the TTL for entries in the nodeinfo table. Since the information is expected to change only rarely, use a twelve hour TTL. When the rpc.nisd daemon first loads the nodeinfo table from disk, the TTLs for entries in the table are randomly selected to be between six and twelve hours.

   ```
   nisplusLDAPentryTtl        nodeinfo:21600:43200:43200
   ```

3. Identify an existing mapping that has similar properties to the one you want to create. In this example, mapping the attribute values is trivial (straight assignment). Instead, the complication is that you store the LDAP data in an existing container, so that you have to be careful during removal of the nodeinfo data. You do not want to remove the entire ou=Hosts entry, just the nodeInventory and nodeOwner attributes. You will need a special deletion rule set for this purpose.

   To summarize, you are looking for a mapping that shares a container, and has a delete rule set. One possible candidate is the netmasks mapping, which shares the ou=Networks container, and does have a delete rule set.

4. The template netmasks mapping has the default mapping (from /var/nis/NIS+LDAPmapping.template) as follows.

```
nisplusLDAPobjectDN    netmasks:ou=Networks,?one?objectClass=ipNetwork,\
                                                ipNetMaskNumber=*:\
                                          ou=Networks,?one?objectClass=ipNetwork:
                                                dbid=netmasks_del
```

   Transferred to the new mapping for nodeinfo, the database id should be nodeinfo, the container ou=Hosts, and the object class nodeInfo. Thus, the first line of the nodeinfo mapping becomes the following.

```
nisplusLDAPobjectDN    nodeinfo:ou=Hosts,?one?objectClass=nodeInfo,\
```

   The second line in the netmasks mapping is the part of the search filter that selects only those ou=Networks entries that contain the ipNetMaskNumber attribute. In this example, select the ou=Hosts entries that have the following nodeInventory attribute.

```
nodeInventory=*:\
```

The third and fourth lines are the write portion of the `nisplusLDAPobjectDN`, and they specify where in LDAP `nodeinfo` data is written, as well as the rule set that is used when `nodeinfo` data is deleted. In this case, create a delete rule set identified by the database id `nodeinfo_del`. Because you are always writing to an existing entry in `ou=Hosts`, you only need to specify the object class for the `nodeinfo` data proper as follows.

```
ou=Hosts,?one?objectClass=nodeInfo:\
                              dbid=nodeinfo_del
```

Putting it all together, our `nisplusLDAPobjectDN` is the following.

```
nisplusLDAPobjectDN    nodeinfo:ou=Hosts,?one?objectClass=nodeInfo,\
                                              nodeInventory=*:\
                                         ou=Hosts,?one?objectClass=nodeInfo:\
                                             dbid=nodeinfo_del
```

5. Create the rule set that maps `nodeinfo` data from NIS+ to LDAP. The template (from `netmasks`) is the following.

```
nisplusLDAPattributeFromColumn \
        netmasks:    dn=("ipNetworkNumber=%s,", addr), \
                        ipNetworkNumber=addr, \
                        ipNetmaskNumber=mask, \
                        description=comment
```

The `ou=Hosts` container has an additional complication in this case, as RFC 2307 specifies the `dn` should contain the IP address. However, the IP address is not stored in the `nodeinfo` table, so you must obtain it in another manner. Fortunately, the `crednode` mapping in the template file shows how to obtain the IP address.

```
nisplusLDAPattributeFromColumn \
        crednode:    dn=("cn=%s+ipHostNumber=%s,", \
                                (cname, "%s.*"), \
            ldap:ipHostNumber:?one?("cn=%s", (cname, "%s.*"))), \
```

Thus, you can copy that portion of the `crednode` mapping. In this case, however, the `cname` column value is the actual host name (not the principal name), so you do not need to extract just a portion of the `cname`. Making the obvious substitutions of attribute and column names, the `nodeinfo` mapping becomes the following.

```
nisplusLDAPattributeFromColumn \
        nodeinfo:    dn=("cn=%s+ipHostNumber=%s,", cname, \
            ldap:ipHostNumber:?one?("cn=%s", cname)), \
                nodeInventory=inventory, \
                nodeOwner=owner
```

6. When mapping data from LDAP to NIS+, the template `netmasks` entry is as follows.

```
nisplusLDAPcolumnFromAttribute \
        netmasks:    addr=ipNetworkNumber, \
                mask=ipNetmaskNumber, \
                comment=description
```

After substituting attribute and column names, this result is the following.

```
nisplusLDAPcolumnFromAttribute \
        nodeinfo:    cname=cn, \
                inventory=nodeInventory, \
                owner=nodeOwner
```

7. The delete rule set for `netmasks` is as follows.

```
nisplusLDAPattributeFromColumn \
        netmasks_del:    dn=("ipNetworkNumber=%s,", addr), \
                ipNetmaskNumber=
```

The above specifies that when a `netmasks` entry is deleted in NIS+, the `ipNetmaskNumber` attribute in the corresponding `ou=Networks` LDAP entry is deleted. In this case, delete the `nodeInventory` and `nodeOwner` attributes. Therefore, using the `dn` specification from item (5) above, results in the following.

```
nisplusLDAPattributeFromColumn \
        nodeinfo_del:    dn=("cn=%s+ipHostNumber=%s,", cname, \
            ldap:ipHostNumber:?one?("cn=%s", cname)), \
                nodeInventory=, \
                nodeOwner=
```

The mapping information is complete.

8. Stop, and later start, the NIS+ service, to begin using the mapping file.

```
# svcadm disable network/rpc/nisplus:default
```

9. If data is already in the NIS+ `nodeinfo` table, upload that data to LDAP. Put the new `nodeinfo` mapping information into a separate file, `/var/nis/tmpmapping`.

```
# /usr/sbin/rpc.nisd -D -m /var/nis/tmpmapping \
-x nisplusLDAPinitialUpdateAction=to_ldap \
-x nisplusLDAPinitialUpdateOnly=yes
```

10. Add the mapping information from the temporary file, `/var/nis/tmpmapping`, to the actual mapping file. Use an editor to do this, or append the data (assuming the actual mapping file is `/var/nis/NIS+LDAPmapping`) as follows.

```
# cp -p /var/nis/NIS+LDAPmapping \
/var/nis/NIS+LDAPmapping.backup

# cat /var/nis/tmpmapping >> /var/nis/NIS+LDAPmapping
```

Caution – Note the double arrow redirection, “>>”. A single arrow, “>”, would overwrite the target file.

11. Add the `-m` option to the `/lib/svc/method/nisplus` file. Also add the `-Y` or `-B` options as needed. See "NIS+ to LDAP Tools and the Service Management Facility" on page 253 for more information.
12. Start the NIS+ service.

```
# svcadm enable network/rpc/nisplus:default
```

Storing Configuration Information in LDAP

In addition to keeping NIS+/LDAP configuration information in the configuration files and on the command line, configuration attributes can also be stored in LDAP. This is useful if the configuration information is shared by many NIS+ servers, and is expected to change on a regular basis.

To enable storing of configuration attributes in LDAP, consult your LDAP server documentation and create the following new attributes and object class. The configuration information is expected to reside at the location specified by the `nisplusLDAPconfigDN` value (from the `rpc.nisd` command line, or from `/lib/svc/method/nisplus`), with a `cn` equal to the `nisplusLDAPbaseDomain` value (as it is known to the `rpc.nisd` daemon before reading any configuration information from LDAP).

LDIF data is suitable for `ldapadd`(1) (attribute and object class OIDs are examples only).

The `defaultSearchBase`, `preferredServerList`, and `authenticationMethod` attributes derive from a draft "DUA config" schema, which is intended to become an IETF standard. In any case, the following definitions are sufficient for the purposes of `NIS+LDAPmapping`(4).

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes:    ( 1.3.6.1.4.1.11.1.3.1.1.1 NAME 'defaultSearchBase' \
          DESC 'Default LDAP base DN used by a DUA' \
          EQUALITY distinguishedNameMatch \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.12 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.11.1.3.1.1.2 NAME 'preferredServerList' \
          DESC 'Preferred LDAP server host addresses to be used by a DUA' \
          EQUALITY caseIgnoreMatch \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.11.1.3.1.1.6 NAME 'authenticationMethod' \
          DESC 'Identifies the authentication method used to connect to the DSA'\
          EQUALITY caseIgnoreMatch \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.15 SINGLE-VALUE )
```

NIS+/LDAP configuration attributes are as follows.

```
dn: cn=schema
changetype: modify
add: attributetypes
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.0 \
          NAME 'nisplusLDAPTLS' \
          DESC 'Transport Layer Security' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.1 \
          NAME 'nisplusLDAPTLSCertificateDBPath' \
          DESC 'Certificate file' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.2 \
          NAME 'nisplusLDAPproxyUser' \
          DESC 'Proxy user for data store/retrieval' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.3 \
          NAME 'nisplusLDAPproxyPassword' \
          DESC 'Password/key/shared secret for proxy user' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.4 \
          NAME 'nisplusLDAPinitialUpdateAction' \
          DESC 'Type of initial update' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.5 \
          NAME 'nisplusLDAPinitialUpdateOnly' \
          DESC 'Exit after update ?' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.6 \
          NAME 'nisplusLDAPretrieveErrorAction' \
          DESC 'Action following an LDAP search error' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.7 \
          NAME 'nisplusLDAPretrieveErrorAttempts' \
          DESC 'Number of times to retry an LDAP search' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.8 \
          NAME 'nisplusLDAPretrieveErrorTimeout' \
          DESC 'Timeout between each search attempt' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.9 \
          NAME 'nisplusLDAPstoreErrorAction' \
          DESC 'Action following an LDAP store error' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.10 \
          NAME 'nisplusLDAPstoreErrorAttempts' \
          DESC 'Number of times to retry an LDAP store' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.11 \
          NAME 'nisplusLDAPstoreErrorTimeout' \
          DESC 'Timeout between each store attempt' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.12 \
          NAME 'nisplusLDAPrefreshErrorAction' \
```

```
          DESC 'Action when refresh of NIS+ data from LDAP fails' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.13 \
          NAME 'nisplusLDAPrefreshErrorAttempts' \
          DESC 'Number of times to retry an LDAP refresh' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.14 \
          NAME 'nisplusLDAPrefreshErrorTimeout' \
          DESC 'Timeout between each refresh attempt' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.15 \
          NAME 'nisplusNumberOfServiceThreads' \
          DESC 'Max number of RPC service threads' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.16 \
          NAME 'nisplusThreadCreationErrorAction' \
          DESC 'Action when a non-RPC-service thread creation fails' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.17 \
          NAME 'nisplusThreadCreationErrorAttempts' \
          DESC 'Number of times to retry thread creation' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.18 \
          NAME 'nisplusThreadCreationErrorTimeout' \
          DESC 'Timeout between each thread creation attempt' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.19 \
          NAME 'nisplusDumpErrorAction' \
          DESC 'Action when an NIS+ dump fails' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.20 \
          NAME 'nisplusDumpErrorAttempts' \
          DESC 'Number of times to retry a failed dump' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.21 \
          NAME 'nisplusDumpErrorTimeout' \
          DESC 'Timeout between each dump attempt' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.22 \
          NAME 'nisplusResyncService' \
          DESC 'Service provided during a resync' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.23 \
          NAME 'nisplusUpdateBatching' \
          DESC 'Method for batching updates on master' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.24 \
          NAME 'nisplusUpdateBatchingTimeout' \
          DESC 'Minimum time to wait before pinging replicas' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.25 \
          NAME 'nisplusLDAPmatchFetchAction' \
          DESC 'Should pre-fetch be done ?' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.26 \
```

```
          NAME 'nisplusLDAPbaseDomain' \
          DESC 'Default domain name used in NIS+/LDAP mapping' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 SINGLE-VALUE )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.27 \
          NAME 'nisplusLDAPdatabaseIdMapping' \
          DESC 'Defines a database id for an NIS+ object' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.28 \
          NAME 'nisplusLDAPentryTtl' \
          DESC 'TTL for cached objects derived from LDAP' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.29 \
          NAME 'nisplusLDAPobjectDN' \
          DESC 'Location in LDAP tree where NIS+ data is stored' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.30 \
          NAME 'nisplusLDAPcolumnFromAttribute' \
          DESC 'Rules for mapping LDAP attributes to NIS+ columns' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )
attributetypes:    ( 1.3.6.1.4.1.42.2.27.5.42.42.18.31 \
          NAME 'nisplusLDAPattributeFromColumn' \
          DESC 'Rules for mapping NIS+ columns to LDAP attributes' \
          SYNTAX 1.3.6.1.4.1.1466.115.121.1.26 )

dn: cn=schema
changetype: modify
add: objectclasses
objectclasses:    ( 1.3.6.1.4.1.42.2.27.5.42.42.19.0 NAME 'nisplusLDAPconfig' \
          DESC 'NIS+/LDAP mapping configuration' \
          SUP top STRUCTURAL MUST ( cn ) \
          MAY ( preferredServerList $ defaultSearchBase $
authenticationMethod $ nisplusLDAPTLS $ nisplusLDAPTLSCertificateDBPate
$ nisplusLDAPproxyUser $ nisplusLDAPproxyPassword $ nisplusLDAPinitialUpdateAction
$ nisplusLDAPinitialUpdateOnly $ nisplusLDAPretrieveErrorAction
$ nisplusLDAPretrieveErrorAttempts $ nisplusLDAPretrieveErrorTimeout
$ nisplusLDAPstoreErrorAction $ nisplusLDAPstoreErrorAttempts
$ nisplusLDAPstoreErrorTimeout $ nisplusLDAPrefreshErrorAction
$ nisplusLDAPrefreshErrorAttempts $ nisplusLDAPrefreshErrorTimeout
$ nisplusNumberOfServiceThreads $nisplusThreadCreationErrorAction
$ nisplusThreadCreationErrorAttempts $ nisplusThreadCreationErrorTimeout
$ nisplusDumpErrorAction $ nisplusDumpErrorAttempts
$ nisplusDumpErrorTimeout $ nisplusResyncService $ nisplusUpdateBatching
$ nisplusUpdateBatchingTimeout $ nisplusLDAPmatchFetchAction
$ nisplusLDAPbaseDomain $ nisplusLDAPdatabaseIdMapping $ nisplusLDAPentryTtl
$ nisplusLDAPobjectDN $ nisplusLDAPcolumnFromAttribute !
$ nisplusLDAPattributeFromColumn ) )
```

Create a file containing the following LDIF data (substitute your actual search base for *searchBase*, and the fully qualified domain name for *domain*.)

```
dn: cn=domain,searchBase

cn: domain

objectClass: top objectClass: nisplusLDAPconfig
```

Use the above file as input to `ldapadd`(1) to create the NIS+/LDAP configuration entry. Initially, the entry is empty. Use `ldapmodify`(1) to add configuration attributes. For example, to set the `nisplusNumberOfServiceThreads` attribute to “32”, create the following file (for input to `ldapmodify`(1)).

`dn: cn=`*`domain`***`,`** *`searchBase`***`nisplusNumberOfServiceThreads: 32`**

APPENDIX **A**

Solaris 10 Software Updates to DNS, NIS, and LDAP

The Solaris 10 version of the System Administration Guide: Naming and Directory Services (DNS, NIS, and LDAP) includes updates to DNS BIND and `pam_ldap`. It also incorporates some minor changes and additions to other content, as well as corrections to several documentation errors.

Service Management Facility Changes

The DNS, NIS, and LDAP services are now managed by the Service Management Facility. Administrative actions on these services, such as enabling, disabling, or restarting, can be performed by using the `svcadm` command. The service's status can be queried by using the `svcs` command. For an overview of SMF, refer to "Managing Services (Overview)" in *System Administration Guide: Basic Administration*. Also refer to the `svcadm`(1M) and `svcs`(1) man pages for more details.

Information specific to each service described in this book can be found in the following sections.

- "DNS and the Service Management Facility" on page 49
- "NIS and the Service Management Facility" on page 80
- "LDAP and the Service Management Facility" on page 178
- "NIS-to-LDAP Tools and the Service Management Facility" on page 228
- "NIS+ to LDAP Tools and the Service Management Facility" on page 253

For information about NIS+ and the Service Management Facility, see *System Administration Guide: Naming and Directory Services (NIS+)*.

DNS BIND

BIND 8.4.2 ships in the Solaris 10 release. This version of BIND provides a complete DNS client-server solution for IPv6 networks on Solaris software. There are no changes to the DNS BIND procedures in this guide.

BIND 9 is also supported in the Solaris 10 release and installs in the `/usr/sfw` directory. A migration document is available in the `/usr/sfw/doc/bind` directory. The information and procedures in Part II apply to BIND 9, except as indicated in the migration document.

`pam_ldap` Changes

The Solaris 10 OS release introduced several changes to `pam_ldap`, identified in the following list. See the `pam_ldap`(5) man page for more information.

- The previously supported `use_first_pass` and `try_first_pass` options are obsolete as of the Solaris 10 software release. These options are no longer needed, may safely be removed from `pam.conf`, and are silently ignored. They may be removed in a future release.
- Password prompting must be provided for by stacking `pam_authtok_get` before `pam_ldap` in the authentication and password module stacks, and by including `pam_passwd_auth` in the `passwd` service `auth` stack.
- The previously supported password update function is replaced in this release by the previously recommended use of `pam_authtok_store` with the `server_policy` option.
- The pam_ldap account management feature strengthens the overall security of the LDAP Naming Service. Specifically, the account management feature does the following.
  - Allows for tracking password aging and expiratio
  - Prevents users from choosing trivial or previously used passwords
  - Warns users if their passwords are about to expire
  - Locks out users after repeated login failures
  - Prevents users, other than the authorized system administrator, from deactivating initialized accounts

It is not possible to provide a clean automated update for the changes listed above. Therefore, an upgrade to a Solaris 10 or later release will not automatically update the existing `pam.conf` file to reflect the `pam_ldap` changes. If the existing `pam.conf` file contains a `pam_ldap` configuration, you will be notified after the upgrade via the `CLEANUP` file. You will need to examine the `pam.conf` file and modify it, as needed.

See `pam_passwd_auth`(5), `pam_authtok_get`(5), `pam_authtok_store`(5), and `pam.conf`(4) man pages for more information.

Documentation Errors

Several documentation errors have been corrected in this release.

Glossary

application-level naming service Application-level naming services are incorporated in applications offering services such as files, mail, and printing. Application-level naming services are bound below enterprise-level naming services. The enterprise-level naming services provide contexts in which contexts of application-level naming services can be bound.

attribute Each LDAP entry consists of a number of named *attributes* each of which has one or more values.

Also: The N2L service mapping and configuration files each consist of a number of named *attributes* each of which has one or more values.

authentication The means by which a server can verify a client's identity.

baseDN The DN where part of the DIT is rooted. When this is the baseDN for a NIS domains entries it is also referred to as a 'context'

cache manager The program that manages the local caches of NIS+ clients (`NIS_SHARED_DIRCACHE`), which are used to store location information about the NIS+ servers that support the directories most frequently used by those clients, including transport addresses, authentication information, and a time-to-live value.

child domain See *domain.*

client (1) The client is a principal (machine or user) requesting an naming service from an naming server.

(2) In the client-server model for file systems, the client is a machine that remotely accesses resources of a compute server, such as compute power and large memory capacity.

(3) In the client-server model, the client is an *application* that accesses services from a "server process." In this model, the client and the server can run on the same machine or on separate machines.

client-server model A common way to describe network services and the model user processes (programs) of those services. Examples include the name-server/name-resolver paradigm of the *Domain Name System (DNS)*. See also *client*.

context For the N2L service, a context is something under which a NIS domain is generally mapped. See also baseDN.

credentials The authentication information that the client software sends along with each request to a naming server. This information verifies the identity of a user or machine.

data encrypting key A key used to encipher and decipher data intended for programs that perform encryption. Contrast with *key encrypting key*.

data encryption standard (DES) A commonly used, highly sophisticated algorithm developed by the U.S. National Bureau of Standards for encrypting and decrypting data. See also SUN-DES-1.

databaseID For the N2L service, a databaseID is an alias for a group of maps containing NIS entries of the same format (having the same mappings to LDAP). The maps might have differing keys.

DBM DBM is the database originally used to store NIS maps.

decimal dotted notation The syntactic representation for a 32-bit integer that consists of four 8-bit numbers written in base 10 with periods (dots) separating them. Used to represent IP addresses in the Internet as in: 192.67.67.20.

DES See *data encryption standard (DES)*.

directory (1) An LDAP directory is a container for LDAP objects. In UNIX, a container for files and subdirectories.

directory cache A local file used to store data associated with directory objects.

directory information tree The DIT is the distributed directory structure for a given network. By default, Solaris LDAP clients access the information assuming that the DIT has a given structure. For each domain supported by the LDAP server, there is an assumed subtree with an assumed structure.

distinguished name A distinguished name is an entry in an X.500 directory information base (DIB) composed of selected attributes from each entry in the tree along a path leading from the root down to the named entry.

DIT See directory information tree.

DN A distinguished name in LDAP. A tree-like structured addressing scheme of the LDAP directory which gives a unique name to each LDAP entry.

DNS See *Domain Name System*.

DNS-forwarding An NIS server or an NIS+ server with NIS compatibility set forwards requests it cannot answer to DNS servers.

DNS zones Administrative boundaries within a network domain, often made up of one or more subdomains.

DNS zone files A set of files wherein the DNS software stores the names and IP addresses of all the workstations in a domain.

domain (1) In NIS+ a group of hierarchical objects managed by NIS+. There is one highest level domain (root domain) and zero or more subdomains. Domains and subdomains may be organized around geography, organizational or functional principles.

- *Parent domain*. Relative term for the domain immediately above the current domain in the hierarchy.
- *Child domain*. Relative term for the domain immediately below the current domain in the hierarchy.
- *Root domain*. Highest domain within the current NIS+ hierarchy.

(2) In the Internet, a part of a naming hierarchy usually corresponding to a Local Area Network (LAN) or Wide Area Network (WAN) or a portion of such a network. Syntactically, an Internet domain name consists of a sequence of names (labels) separated by periods (dots). For example, `sales.doc.com`.

(3) In International Organization for Standardization's open systems interconnection (OSI), "domain" is generally used as an administrative partition of a complex distributed system, as in MHS private management domain (PRMD), and directory management domain (DMD).

domain name The name assigned to a group of systems on a local network that share DNS administrative files. The domain name is required for the network information service database to work properly. See also *domain*.

Domain naming service (DNS) A service that provides the naming policy and mechanisms for mapping domain and machine names to addresses outside of the enterprise, such as those on the Internet. DNS is the network information service used by the Internet.

encryption The means by which the privacy of data is protected.

encryption key See *data encrypting key*.

enterprise-level network An "enterprise-level" network can be a single Local Area Network (LAN) communicating over cables, infra-red beams, or radio broadcast; or a cluster of two or more LANs linked together by cable or direct phone connections. Within an enterprise-level network, every machine is able to communicate with every other machine without reference to a global naming service such as DNS or X.500/LDAP.

entry	A single row of data in a database table, such as an LDAP element in a DIT.
field	A NIS map entry might consist of a number of components and separator characters. As part of the N2L service mapping process the entry is first broken down into a number of named *fields*.
GID	See *group ID*.
global naming service	A global naming service identifies (names) those enterprise-level networks around the world that are linked together via phone, satellite, or other communication systems. This world-wide collection of linked networks is known as the "Internet." In addition to naming networks, a global naming service also identifies individual machines and users within a given network.
group ID	A number that identifies the default *group* for a user.
indexed name	A naming format used to identify an entry in a table.
Internet address	A 32-bit address assigned to hosts using *TCP/IP*. See *decimal dotted notation*.
IP	Internet Protocol. The *network layer* protocol for the Internet protocol suite.
IP address	A unique number that identifies each host in a network.
key (encrypting)	A key used to encipher and decipher other keys, as part of a key management and distribution system. Contrast with *data encrypting key*.
key server	A Solaris operating environment process that stores private keys.
LDAP	Lightweight Directory Access Protocol is a standard, extensible directory access protocol used by LDAP naming service clients and servers to communicate with each other.
local-area network (LAN)	Multiple systems at a single geographical site connected together for the purpose of sharing and exchanging data and software.
mail exchange records	Files that contain a list of DNS domain names and their corresponding mail hosts.
mail hosts	A workstation that functions as an email router and receiver for a site.
mapping	The process of converting NIS entries to or from DIT entries. This process is controlled by a *mapping* file.
master server	The server that maintains the master copy of the network information service database for a particular domain. Namespace changes are always made to the naming service database kept by the domain's master server. Each domain has only *one* master server.
MIS	Management information systems (or services).

N2L server NIS-to-LDAP server. An NIS master server that has been reconfigured as an N2L server by using the N2L service. Reconfiguration includes replacing NIS daemons and adding new configuration files.

name resolution The process of translating workstation or user names to addresses.

name server Servers that run one or more network naming services.

naming service switch A configuration file (`/etc/nsswitch.conf`) that defines the sources from which an naming client can obtain its network information.

naming service A network service that handles machine, user, printer, domain, router, an other network names and addresses.

namespace (1) A namespace stores information that users, workstations, and applications must have to communicate across the network.

(2) The set of all names in a naming system.

NDBM NDBM is an improved version of DBM.

network mask A number used by software to separate the local subnet address from the rest of a given Internet protocol address.

network password See Secure RPC password.

NIS A distributed network information service containing key information about the systems and the users on the network. The NIS database is stored on the *master server* and all the *replica* or *slave servers*.

NIS maps A file used by NIS that holds information of a particular type, for example, the password entries of all users on a network or the names of all host machines on a network. Programs that are part of the NIS service query these maps. See also *NIS*.

NIS+ A distributed network information service containing hierarchical information about the systems and the users on the network. The NIS+ database is stored on the *master server* and all the *replica server*s.

NIS-compatibility mode A configuration of NIS+ that allows NIS clients to have access to the data stored in NIS+ tables. When in this mode, NIS+ servers can answer requests for information from both NIS and NIS+ clients.

parent domain See *domain*.

preferred server list A `client_info` table or a `client_info` file. Preferred server lists specify the preferred servers for a client or domain.

private key The private component of a pair of mathematically generated numbers, which, when combined with a private key, generates the DES key. The DES key in turn is used to encode and decode information. The private key of the sender is only available to the owner of the key. Every user or machine has its own public and private key pair.

public key The public component of a pair of mathematically generated numbers, which, when combined with a private key, generates the DES key. The DES key in turn is used to encode and decode information. The public key is available to all users and machines. Every user or machine has their own public and private key pair.

RDN Relative Distinguished Name. One part of a DN.

record See *entry*.

remote procedure call (RPC) An easy and popular paradigm for implementing the client-server model of distributed computing. A request is sent to a remote system to execute a designated procedure, using arguments supplied, and the result is returned to the caller.

reverse resolution The process of converting workstation IP addresses to workstation names using the DNS software.

RFC 2307 RFC specifying a mapping of information from the standard NIS maps to DIT entries. By default, the N2L service implements the mapping specified in an updated version RFC 2307bis.

root domain See *domain*.

RPC See remote procedure call (RPC).

SASL The simple authentication and security layer. A framework for negotiating authentication and security layer semantics in application-layer protocols.

schema A set of rules defining what types of data can be stored in any given LDAP DIT.

searchTriple A description of where to look for a given attribute in the DIT. The searchTriple is composed of a 'base dn', 'scope' and 'filter'. This is part of the LDAP URL format as defined in RFC 2255.

Secure RPC password Password required by Secure RPC protocol. This password is used to encrypt the private key. This password should always be identical to the user's login password.

server (1) In NIS+, NIS, DNS, and LDAP a host machine providing naming services to a network.

(2) In the *client-server model* for file systems, the server is a machine with computing resources (and is sometimes called the compute server), and large memory capacity. Client machines can remotely access and make use of these resources. In the client-server model for window systems, the server is a process that provides windowing services to an application, or "client process." In this model, the client and the server can run on the same machine or on separate machines.

(3) A *daemon* that actually handles the providing of files.

server list	*See* preferred server list.
slave server	(1) A server system that maintains a copy of the NIS database. It has a disk and a complete copy of the operating environment. (2) Slave servers are called *replica servers* in NIS+.
source	NIS source files
SSL	SSL is the secure sockets layer protocol. It is a generic transport-layer security mechanism designed to make application protocols such as LDAP secure.
subnet	A working scheme that divides a single logical network into smaller physical networks to simplify routing.
suffix	In LDAP, the distinguished name (DN) of the DIT.
table	In NIS+ a two-dimensional (nonrelational) database object containing NIS+ data in rows and columns. (In NIS an NIS map is analogous to a NIS+ table with two columns.) A table is the format in which NIS+ data is stored. NIS+ provides 16 predefined or system tables. Each table stores a different type of information.
TCP	See *Transport Control Protocol (TCP)*.
TCP/IP	Acronym for Transport Control Protocol/Interface Program. The protocol suite originally developed for the Internet. It is also called the *Internet* protocol suite. Solaris networks run on TCP/IP by default.
Transport Control Protocol (TCP)	The major transport protocol in the Internet suite of protocols providing reliable, connection-oriented, full-duplex streams. Uses IP for delivery. See TCP/IP.
Transport Layer Security (TLS)	TLS secures communication between an LDAP client and the directory server, providing both privacy and data integrity. The TLS protocol is a super set of the Secure Sockets Layer (SSL) protocol.
wide-area network (WAN)	A network that connects multiple local-area networks (LANs) or systems at different geographical sites via phone, fiber-optic, or satellite links.
X.500	A global-level directory service defined by an Open Systems Interconnection (OSI) standard. A precursor to LDAP.
yp	Yellow Pages™. The old name for NIS which is still used within the NIS code.

Index

E

F

G

H

I

K

L

M

N

O

P

R

S

T

U

V

W

X

Y