
Objective 1 **Manage Resources on the Network**

To manage resources on the network, you need to understand the following:

- [Network Information Service \(NIS\)](#)

Network Information Service (NIS)

When multiple Linux/UNIX systems in a network are configured to access common resources, it becomes important that all user and group identities are the same for all computers in that network.

In other words, the network should be transparent to the user. No matter which computer a user logs in to, that user should always see exactly the same environment.

You can make sure this happens by using Network Information Service (NIS) and Network File System (NFS) services.

To configure NIS for your network, you need to know the following:

- [Network Information Service Basics](#)
- [NIS Domain Components](#)
- [NIS Configuration Overview](#)
- [Configure an NIS Master Server with YaST](#)
- [Configure an NIS Master Server Manually](#)
- [Configure Maps Manually](#)
- [Configure a Slave Server](#)
- [Configure an NIS Client with YaST](#)

- [NIS Security Considerations](#)
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Network Information Service Basics

NIS is a database system that allows the centralized administration of configuration files. NIS enables centralized user management and printer administration as well.

In addition, NIS makes it easier to administer large networks by distributing configuration files to individual workstations. NIS is usually installed with the network file system (NFS)—the user's configuration files and home directories are administered centrally on one or more servers.

Linux administrators originally referred to NIS as “YP,” which simply stands for the idea of the network's “yellow pages.” The names of specific components of NIS still use the YP (such as ypbind, ypser, and yppaswd).

The NIS server stores the files to distribute over the whole network in maps. The files are stored in a special database format with the corresponding keys.

For example, the file `/etc/passwd` can be converted to a database using the UID or user name as the key. The respective database files are then called `passwd.byuid` or `passwd.byname`.

Other files that are often converted to map databases for distribution across a network include `/etc/passwd`, `/etc/shadow`, `/etc/group`, `/etc/hosts`, and `/etc/services`.

NIS Domain Components

In an NIS domain, there are three types of computers:

- **Master server.** All important configuration files distributed across the network are stored on the master server. These configuration files are converted to NIS maps (files in DBM format) and distributed to slave servers.

Daemons run on the master server and are responsible for processing the NIS clients' requests. The NIS server program is `yppserv`.

- **Slave servers.** Slave servers help the master server process requests. For example, they can process NIS requests if the master server cannot be accessed.

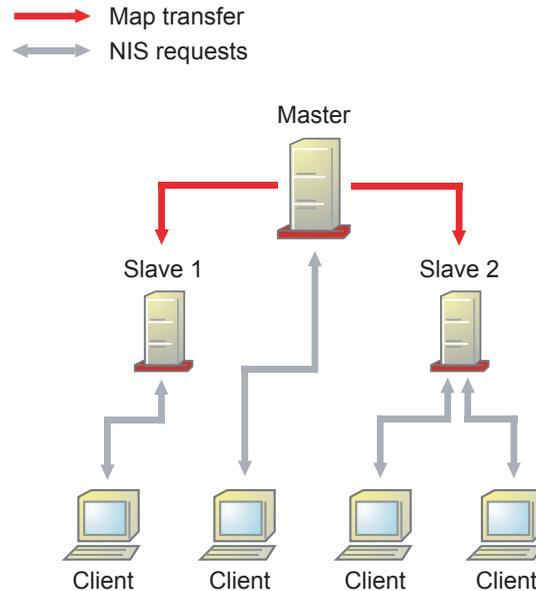
After the maps on the master server have been updated, they are automatically passed to the slave servers. Either a master server or a slave server can respond to requests. The first response that arrives is used.

- **NIS clients.** NIS clients retrieve the configuration files (stored as maps) from the NIS server. You can configure a client to completely ignore local configuration files and to use only the NIS maps.

You can also configure a client to use both local configuration files and NIS maps in any order. This is done in the file `/etc/nsswitch.conf`. The NIS client program is `ypbind`.

The NIS servers, together with their clients, form an NIS domain, that works as illustrated in the following:

Figure 11-1



You can configure these components with YaST or manually.

NIS Configuration Overview

The name of the NIS domain is stored in the file `/etc/defaultdomain` and the server to address is written to the file `/etc/yp.conf`.

If several NIS servers are in the domain (such as a master server and a number of slave servers), it makes sense to enter the slave servers before the master server in `yp.conf`.

On a slave server, the local NIS server should be addressed first, then any other existing slave servers, and finally the master server.

The following is an example of addressing the servers:

```
da10:~ # cat /etc/yp.conf
ypserver 127.0.0.1
ypserver 10.0.0.2
ypserver 10.0.0.254
```

On the slave server, first the local host is queried (127.0.0.1). If this is not available, another slave server (10.0.0.2) is queried. If this does not respond, the master server (10.0.0.254) is contacted.

The NIS client must be configured to use the NIS maps instead of or in addition to the local configuration files. The configuration file you need to modify is `/etc/nsswitch.conf`.

The order of queries is also determined by this configuration file. This file contains an entry for almost every configuration file that can be administered across the network.

The following is an example of setting the order of queries:

```
passwd:      compat
group:       compat

hosts:       files nis dns
services:    files
protocols:   files
```

In this example, the entry for name resolution (**hosts: files nis dns**) means that first the local file `/etc/hosts` is queried, then the corresponding NIS map, and finally the DNS server.

The entry **compat** for `passwd` and `group` means that a compatibility mode should be used for programs linked to older versions of the GNU C Library.

To achieve this, an entry is added automatically by YaST as a last entry in the files `/etc/passwd` and `/etc/group`.

This entry specifies that the contents of the NIS maps should be regarded as an extension of the files and should be evaluated after the local files.

If only the NIS maps should be used, you need to modify the entries for `passwd` and `shadow` in the file `/etc/nsswitch.conf` as follows:

```
passwd: nis
group: nis
```



For more information about `nsswitch.conf`, enter **`man nsswitch.conf`**.

Configure an NIS Master Server with YaST

To use YaST to configure your host as an NIS server, do the following:

1. From the KDE desktop, start the YaST NIS Server module by doing one of the following:
 - Select the **YaST** icon, enter the root password *novell*, and select **OK**; then select **Network Services > NIS Server**.

The following dialog appears:

Figure 11-2



This initial configuration dialog lets you create a master NIS server or a slave NIS server.

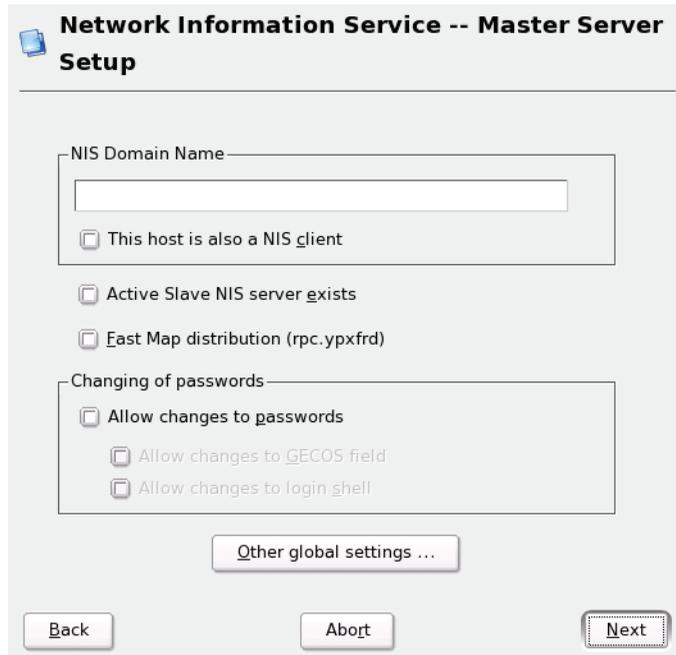
2. Do one of the following:
 - If no NIS server exists in your network, select **Create NIS Master Server**.
 - If you already have an NIS master server in the network, you can add an NIS slave server by selecting **Create NIS Slave Server**.
For example, you might want to create a slave server if you want to configure a new subnetwork.
 - If you want to quit the NIS server setup, select **Do Nothing and Leave Set Up**.

3. Create an NIS master server by doing the following:

- a. Select **Create NIS Master Server**.

The following dialog appears:

Figure 11-3

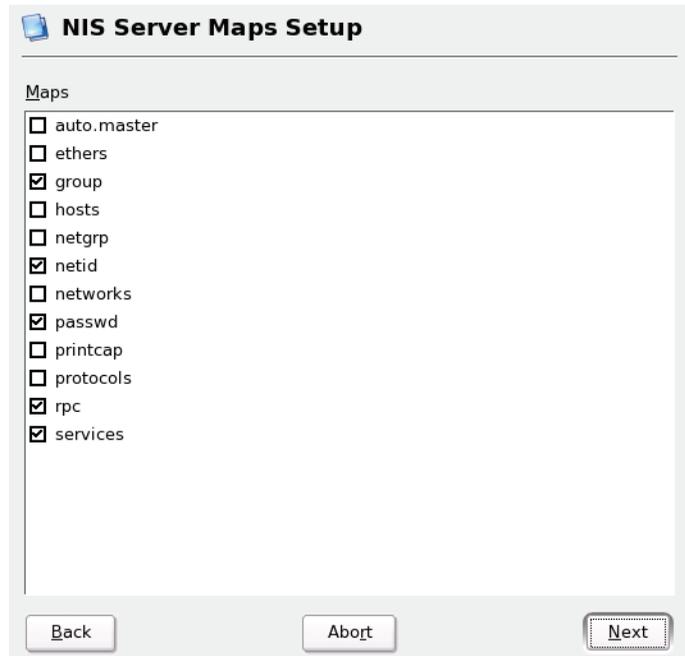


- b. Enter the NIS server *domain name* in the **NIS Domain Name** field.
- c. Select from the following options:
- ❑ **This Host Is Also a NIS Client**. Select this option to indicate that the host should also be an NIS client, enabling users to log in and access data from the NIS server.
 - ❑ **Active Slave NIS Server Exists**. Select this option to configure additional NIS servers (slave servers) in your network later.

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- **Fast Map Distribution.** Select this option to set fast transfer of the database entries from the master to the slave server.
 - **Allow Changes to Passwords.** Select this option to let users in your network (both local users and those managed through the NIS server) to change their passwords on the NIS server (with the command **yppasswd**).
 - **Allow Changes to GECOS Field** and **Allow Changes To Login Shell.** Selecting Allow Changes to Passwords makes these options available. Selecting *GECOS* means that the users can also change their names and address settings with the command **ypchfn**. Selecting *SHELL* allows users to change their default shells with the command **ypchsh** (such as switching from bash to csh).
 - **Other Global Settings.** Select this option to open dialog that lets you perform configuration tasks such as changing the source directory of the NIS server (*/etc/* by default) and merging passwords.
- d. When you finish, continue by selecting **Next**.
- e. (Conditional) If you selected **Active Slave NIS server Exists**, a dialog appears letting you add the host names used as slaves. When you finish adding the names to the list, continue by selecting **Next**.

The following dialog appears:

Figure 11-4



- f. Select the maps (the partial databases) to transfer from the NIS server to the client; then continue by selecting **Next**.



The following dialog appears:

Figure 11-5



This is the last dialog in the NIS server configuration. It lets you specify from which networks requests can be sent to the NIS server. You can add, edit, or delete networks from the list.

Normally, requests will be sent from your internal network. For example, if this is the case, and your network is **10.0.0.0/24**, you only need the following two entries:

255.0.0.0 127.0.0.0

255.255.255.0 10.0.0.0

The entry 127.0.0.0 enables connections from your own host, which is the NIS server. The entry 10.0.0.0 allows all hosts from the network 10.0.0.0/24 to send requests to the server.

- g. (Optional) If you need to change the entry 0.0.0.0, highlight the entry, select **Edit**, make the appropriate changes, and then select **OK**.
- h. Add all networks you want to honor requests from; then save the NIS server configuration settings by selecting **Finish**.
- i. (Optional) If you started YaST from the desktop, close the **YaST Control Center**.

Configure an NIS Master Server Manually

If you want to configure an NIS server manually, do the following:

- Make sure that the following software packages are installed on the NIS server:
 - **ypserv** (on the NIS server)
 - **ypbind** (on the clients and server)
 - **yp-passwd** (allows user to change password from client)
 - **portmap** (RPC port mapper)

-
- If you want the NIS server to be started automatically when the system is booted:

chkconfig ypserv on
chkconfig yppasswdd on

- You also need to set the NIS domain name by using the command `ydomainname`, similar to the following:

ydomainname digi-air

To make sure the domain name is set correctly the next time the system is booted, you need to include it in the file `/etc/defaultdomain`.

- Most configuration files for the NIS server are located in the directory `/var/yp/`. In addition, a number of variables are set in `/etc/sysconfig/ypserv`.

Check the following configuration files:

- **/etc/yp.conf**. This file only exists on the server if it has also been configured as a client. It contains the NIS server for the client to address.
- **/etc/ypserv.conf**. This file is involved with security aspects of the NIS server daemon `ypserv` and the transfer daemon `ypxfrd`.
- **/etc/sysconfig/ypserv**. The following values are stored in this file:
 - **YPPWD_SRCDIR**. The NIS source directory.
 - **YPPWD_CHFN**. Indicates if users can change the GECOS field (Yes or No).
 - **YPPWD_CHSH**. Indicates if users can change their login shell (Yes or No).
- Information about the YP source directory is required to generate the NIS maps.

You create the NIS maps with the command `make`, which creates the database files based on information in the makefile (`/var/yp/Makefile`).

You need to edit the following options in the makefile `/var/yp/Makefile`:

- **NOPUSH**. If you are using slave servers, you must set this option to **FALSE**. This makes sure that after NIS maps are generated, they are transferred (pushed) to the slaves.
- **MINUID and MINGID**. With these options, you can set the lowest UID and GID numbers that are accepted by the NIS maps (such as **MINUID=500** and **MINGID=100**).
- **all**. After the keyword `all`, list all the configuration files that should be presented by the NIS server as maps (such as **all: group netid passwd rpc services**).
- There are additional configuration files in the directory `/var/yp/` that include the following:
 - **securenets**. This file contains the networks from which the server can be queried.
 - **ybservers**. This file lists the slave servers to which the maps should be transferred if they are modified.
 - **nicknames**. This is a preconfigured file providing an allocation of “nicknames” to existing NIS maps. For example, it is evaluated by `ypcat`.

Configure Maps Manually

To create NIS maps, the makefile (`/var/yp/Makefile`) is evaluated. To generate maps using the makefile, the NIS domain name must be set.

You can display the domain name by entering **`ypdomainname`**; you can set the domain name by entering **`ypdomainname domain_name`**.

Once you set the NIS domain name, you can create the NIS maps with the command **make**.

You can run the command from the directory where the Makefile is located, or use the option **-C** followed by the directory where the makefile is located (such as **make -C /var/yp**).

If the daemon `ypserv` is not running or if slave servers were entered that are not yet active, the command `make` gives a series of error messages that you can safely ignore.

The makefile evaluates the NIS domain name and creates a directory in `/var/yp/` with the name of the NIS domain. All NIS maps are stored in DBM format in this directory.

If you want to set up a cron job to regularly regenerate the NIS maps, the option `-s` (silent) is useful. It ensures that `make` does not generate any output.

If you make changes to the server configuration with YaST, the NIS maps are regenerated automatically. Changing password data with `yppasswd` also causes the NIS maps to be updated immediately.

After creating a new user account, you need to run the command `make` (such as **make -C /var/yp -s**) to include the new user in the NIS maps (see the steps in [“Configure an NIS Client with YaST”](#) on 11-18).

Configure a Slave Server

Theoretically, one master server and an unlimited number of slave servers can run in an NIS domain. To spread the load evenly, we recommend using slave servers in networks with a large number of NIS clients.

Only copies of the NIS maps exist on the slave server. The copies are automatically updated if changes are made to the maps on the master server.

To copy the maps from the master server to the slave server, you use the program `/usr/sbin/yppush`.

To configure a slave server, you need to know how to do the following:

- [Inform a Master Server of Existing Slave Servers](#)
- [Configure a Slave Server](#)

Inform a Master Server of Existing Slave Servers

You can inform a master server of existing Slave Servers when you configure the master server with YaST.

By selecting **Active Slave NIS server exists**, the entry for pushing the maps is activated in the Makefile on the server (the option `NOPUSH` is set to false).

By selecting **Fast Map Distribution** on the master, `rpc.ypxfrd` (the YP transfer daemon) is started, which ensures a quicker transfer of the NIS maps to the slave servers.

The slave servers entered in YaST are written to the file `/var/yp/ypservers`. Only the slave servers listed there are sent the NIS maps by the master server.

Configure a Slave Server

You can also configure a slave server with YaST.

After starting the NIS Server module (**Network Services > NIS Server**), select the option **Create NIS Slave Server > Next** and follow the prompts.

As with the master server, the package `ypserv` is needed on the slave server (installed by default). The symbolic links for starting in the corresponding runlevels are also set automatically by YaST.

The slave server is given the name of the NIS domain for which it should be responsible as well as the IP address of the NIS master server. You also need to decide if the slave server should function as an NIS client and which access permission should be configured.

The makefile (`/var/yp/Makefile`) on a slave server does not need to be adjusted, because the maps are only collected from the server and are never generated on the slave server.

When the configuration with YaST is finished, the command `/usr/lib/yp/ypinit -s master-server` is run once in the background. This causes the slave server to request the maps from the master server.

On the slave server, the maps are also stored in the directory `/var/yp/NIS-domain-name`. As soon as the maps have been generated on the master server, the slave will automatically receive the new files.

Configure an NIS Client with YaST

To use YaST to configure your host as an NIS client, do the following:

1. From the KDE desktop, start the YaST NIS Client module by doing one of the following:
 - Select the **YaST** icon, enter the root password *novell*, and select **OK**; then select **Network Services > NIS Client**.

The following dialog appears:

Figure 11-6



2. Make sure **Use NIS** is selected.
3. Do one of the following:
 - If the host gets an IP address through DHCP, select **Automatic Setup (via DHCP)**.
 - or*
 - If the host has a static (fixed) IP address, select **Static Setup**.
4. (Conditional) If you select Static Setup, do the following:
 - a. In the **NIS Domain** field, enter the *NIS domain name*.
 - b. In the **Addresses of NIS Servers** field, enter the *NIS server IP address*.

You can also search for and select NIS servers broadcasting in the network by selecting **Find**. Multiple servers in the field need to be separated with spaces.

- c. If you want NIS to search for additional servers in the local network when the configured servers fail to respond, select **Broadcast**.



We do not recommend selecting this option due to security risks.

- d. Add additional NIS domains (and set a default domain) for the NIS client by selecting **Edit**.
5. (Conditional) If you have configured auto.* files to automatically mount directories (such as user home directories) with the Automounter daemon, select **Start Automounter**.
6. Access additional configuration options (such as **Answer to Local Host Only**) by selecting **Expert**.
7. When you finish configuring the NIS client, save the configuration settings by selecting **Finish**.
8. (Optional) If you started YaST from the desktop, close the **YaST Control Center**.

NIS Security Considerations

An important question when implementing NIS is that of access protection. How can you restrict access to an NIS domain and the information stored there?

You can configure this type of restriction in the file `/var/yp/securenets`. All networks that require access to the NIS server must be listed in this file.

For example, the following `securenets` file provides for the NIS server to be accessible from the network 10.0.0.0/24, from the computer 10.0.1.1, and from itself (with access refused to all other computers):

```
255.0.0.0 127.0.0.0
255.255.255.0 10.0.0.0
255.255.255.255 10.0.1.1
```

Entries for individual computers can also be made with the keyword `host` (such as **host 10.0.1.1**). Although not accepted by YaST, you can use this option when editing the file manually.



For more information about the structure of the file `/var/yp/securenets`, enter **man 8 ypserv**.

Only IP addresses are valid in `/var/yp/securenets`; you cannot use host or network names.



If you are using a version of `ypserv` in which TCP wrapper support is still included, the files `/etc/hosts.allow` and `/etc/hosts.deny` must be modified accordingly.

For more information, enter **man 5 hosts_access** or **man 5 hosts_options**.

NIS Utilities

There are many utilities available for NIS. Some are for diagnostic purposes, but others are normal user programs (such as **yppasswd** for changing the NIS password).

These utilities are in the package `yp-tools`. The following are some of the more commonly-used utilities:

- **`/bin/ypdomainname`**. If you enter **`ypdomainname`** without options, the command displays the name of the current NIS domain.

To set a new domain name, use the command `ypdomainname`. For example, to set the current NIS domain name to `digi-air`, enter **`ypdomainname digi-air`**.

- **`/usr/bin/ypwhich`**. You can use this utility to display the NIS server used by the client.

You can also query the NIS client on other machines for the server addressed by it, as shown in the following:

```
da10:~ # ypwhich
da1.digitalairlines.com
da10:~ # ypwhich da1.digitalairlines.com
localhost
```

In this example, entering `ypwhich` displays the NIS server the local computer is using (**`da1.digitalairlines.com`**). By entering `ypwhich da1.digitalairlines.com` you find out which NIS server `da1.digitalairlines.com` is using (**`localhost`**).

By using the option `-m`, you can display all NIS maps with the NIS master server to which they belong, as shown in the following:

```
da10:~ # ypwhich -m
passwd.byname da1.digitalairlines.com
passwd.byuid da1.digitalairlines.com
services.byname da1.digitalairlines.com
services.byservicename da1.digitalairlines.com
rpc.byname da1.digitalairlines.com
rpc.bynumber da1.digitalairlines.com
group.byname da1.digitalairlines.com
group.bygid da1.digitalairlines.com
ypservers da1.digitalairlines.com
netid.byname da1.digitalairlines.com
```

- **/usr/bin/ypcat.** You can use this utility to display the contents of an NIS map. Include either the nickname (such as passwd) or the name of the map itself (such as passwd.byuid).
- **/usr/bin/ypmatch.** You can use this utility to query the key field of an NIS map such as passwd.byname or passwd.byuid, and have the corresponding entry for the field displayed.

For example, to search in the map passwd.byuid for the user with a UID of 500, you would enter

ypmatch 500 passwd.byuid.

- **/usr/bin/yppasswd.** You can use this utility to change the password of the user on the NIS server.

This command requires that rpc.yppasswdd (the YP password daemon) is running on the NIS master server.

When you use this command, the password in the file /etc/shadow on the NIS server is changed and the corresponding NIS maps are automatically regenerated.

If slave servers exist, the modified maps are also transferred to them automatically.

The same applies for the commands ypchfn and ypchsh, which users can use to change their description field and their standard shell.

If the user has changed her password, it is valid immediately. However, if she logs in again immediately, or logs in on another system, the old password will still be used until the ypserv is restarted.

rcypserv restart.