HEWLETT PACKARD

HP AdvanceNet

Using NFS Services

HP 9000 Computers

Using NFS Services

Customer Order Number: B1013-90008
Printed in England, February 1991

Notice

Hewlett-Packard makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard.

Restricted Rights Legend

Use, duplication or disclosure by the Government is subject to restrictions as set forth in paragraph (b)(3)(B) of the Rights in Technical Data and Software clause in DAR 7-104.9(a).

This software and documentation is based in part on the Fourth Berkeley Software Distribution under license from the Regents of the University of California.

DEC® and VAX® are registered trademarks of Digital Equipment Corp.

NOTICE TO USERS

The Network Information Service (NIS) was formerly known as Yellow Pages (YP). The functionality of the two remains the same, only the name has changed. The name Yellow Pages is a registered trademark in the United Kingdom of British Telecommunications plc.

Hewlett-Packard Company
19420 Homestead Road
Cupertino, CA 95014 U.S.A.

Printing History

First Edition February 1991

Table of Contents

1

Documentation Overview

Before reading this manual, you should be familiar with HP-UX and have access to *HP-UX Reference* manuals.

Note The information contained in this manual applies to the HP 9000 Series 300, 400, 600, 700, and 800 computers. Any differences in the installation, configuration, operation, or troubleshooting of these computers are specifically noted.

You will find this manual helpful if you are using NFS Services but have no administrative responsibilities.

Contents of This Manual

Refer to the following list for a brief description of the information contained in each chapter and appendix.

Chapter 1: Documentation Overview

This chapter describes who should use this manual, what is in this manual, and where to go for more information.

Chapter 2: NFS Services Overview

This chapter provides a brief overview of the NFS Services product, particularly the NFS, RPC, RPCGEN, REX, Network Lock Manager, NIS, and VHE services. It also describes common terms and concepts.

Chapter 3: Common Commands

This chapter provides brief explanations of remote file access via NFS and common NFS and NIS commands.

Appendix A: HP NFS Services vs. Local HP-UX

This appendix describes the basic differences between NFS Services and local HP-UX operations.

Appendix B: Moving from RFA to NFS

This appendix describes how to translate RFA applications to NFS applications.

Conventions

The table below explains the conventions used in this manual.

Conventions	
Notation	**Description**
Boldface	Boldface type is used when a term is defined.
`Computer Text`	Computer type is used for commands and keyboard entries that you must type exactly as shown. It is also used for on-screen prompts and messages.
italics	Italic type is used for emphasis and for titles of manuals and publications. Italic type is also used to represent a variable, such as *user_login_name*.
Key	This font is used to indicate a key on the computer's keyboard. When two or more keys appear together with dashes separating them, such as Ctrl-D, press those keys simultaneously to execute the command.
Softkey	This font is used to represent function softkeys that appear at the bottom of your screen.
`Underlining`	Underlining is used to emphasize a user entry. It distinguishes what you type, such as a command, from other data on the command line, such as the command prompt, a computer response, or a variable. For example: `$ date`
[]	An element inside brackets in a syntax statement is optional.

Documentation Guide

For More Information	Read
ARPA Services: Daily Use	*Using ARPA Services*
ARPA Services: System Administration	*Installing and Administering ARPA Services*
C2 Security	*HP-UX System Security* *HP-UX Beginner's Guide* *A Beginner's Guide to Using Shells*
Commands and System Calls	*HP-UX Reference*
Network Services: Daily Use	*Using Network Services*
Network Services: System Administration	*Installing and Administering Network Services*
Networking: General Information	*Networking Overview*
NFS Services: Common Commands	*Using NFS Services*
NFS Services: Programming and Protocols	*Programming and Protocols for NFS Services*
NFS Services: System Administration - Configuration - Installation - Maintenance - Network Lock Manager - Remote Execution Facility (REX) - Troubleshooting - Virtual Home Environment (VHE) - Network Information Service (NIS)	*Installing and Administering NFS Services*

2

NFS Services Overview

HP's NFS (Network File System) Services product allows many systems to share the same files. It is an independent networking product, not a distributed operating system. NFS differs from distributed operating systems by not limiting its use to specific hardware and software. Rather, it operates on heterogeneous nodes and in operating systems from a variety of vendors. Explicit file transfers across the network to your local node are unnecessary. Since access techniques are transparent, remote file access remains similar to local file access.

With NFS all network nodes are either clients or servers or both.

- A **client** is any node or process that accesses a network service.

  An NFS client can also be configured as any combination of an NFS server, NIS (Network Information Service) client, or NIS server. (An NIS server must also be configured as an NIS client.)

- A **server** is any node that provides one of the network services. A single node can provide more than one service.

  An NFS server can also be configured as any combination of an NFS client, NIS client, or NIS server. (An NIS server must also be configured as an NIS client.)

  Servers are passive in that they always wait for clients to call them. The degree to which clients **bind** to their server varies with each of the network services. However, the client always initiates the binding. The server completes the binding subject to access control rules specific to each service.

  NFS servers are **stateless**; they do not maintain information relating to each client being served. Each file request goes to the appropriate server with the parameters attached to it locally (e.g., read and write privileges). An advantage of servers being stateless is that you can reboot servers without adverse consequences to the client.

Components of the NFS Services

The NFS Services product includes the following components:

- NFS remote file access.
- Remote Execution Facility (REX).
- Remote Procedure Calls (RPC).
- Remote Procedure Call protocol compiler (RPCGEN).
- External Data Representation (XDR).
- Network Lock Manager.
- Network Status Monitor.
- Network Information Service (NIS).
- Virtual Home Environment (VHE).

The NFS, REX, Lock Manager, and NIS functionalities are built on top of RPC and XDR library routines.

NFS Remote File Access

Before the client can access remote files, the following steps must be done:

- On the server, the superuser must export the file system (i.e., make it available) to the client.
- On the client, the superuser must mount (import) the file system.

Note

Like local HP-UX operations, if you copy files from a long file name file system to a short file name file system, then file names longer than 14 characters will be truncated after the 14th character.

Long and short file name file systems are set up by the System Administrator.

Access to remote files is the same as for local files. You need to include either the complete path name starting with / (slash) or the path name relative to the current directory. The following figure and steps explain how NFS remote file access works.

EXAMPLE:

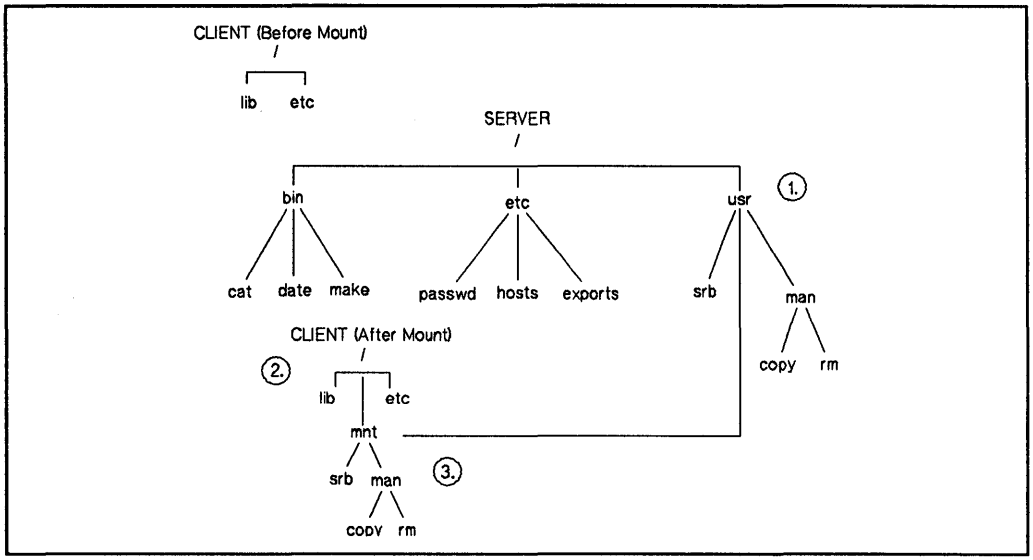


Figure 2-1. NFS Remote File Access

1. The superuser edits the server's `/etc/exports` file to make the `/usr` file system available to the client.

   ```
   server superuser% cat /etc/exports
   /usr client_name
   ```

2. On the client, the superuser creates a mount point `/mnt` (empty directory) and mounts the file system.

   ```
   client superuser% mkdir /mnt
   client superuser% mount server:/usr /mnt
   ```

3. The client reads the files in the `/mnt` directory.

   ```
   client% more /mnt/man/copy
   ```

Two very important features of NFS Remote File Access are **named pipes** and **device files**. The following sections explain the details of these two features.

Named Pipes

A named pipe is a special type of object in the HP-UX file system. A named pipe is one of the many ways in HP-UX that unrelated processes can communicate. HP-UX processes executing on the same client system are able to communicate using named pipes. You can use named pipes via normal file operations, e.g. `open()`, `close()`, `read()`, `write()`. Typically, one process will open the named pipe for reading and another process will open it for writing.

To illustrate named pipes, consider the following example:

EXAMPLE:

> C1 and C2 are processes executing on system C. Also assume host C has mounted file system / from host S on `/mnt`. C1 opens `/mnt/FIFO` for reading and C2 opens `/mnt/FIFO` for writing. C1 can now read what C2 wrote to the named pipe.
>
> Next, assume a third process (process D3) is running on another client D which also has / from S mounted on `/mnt` (on system D), and it opened `/mnt/FIFO` for reading. Is process D3 able to read what process C2 wrote to this named pipe? No, because no actual NFS activity occurs between the NFS client and NFS server for named pipe reads and writes. These are handled entirely by the client.

Note In certain cases there would be NFS activity. For example, if you do a `chown` on the named pipe, the request will go to the server to change the owner.

---

mknod()

Named pipes are created with `mknod()`. Any user can create a named pipe with `mknod()`. (Use of `mknod()` to create device files requires superuser privileges.)

Note If you attempt to make a directory or a network special file over NFS, `mknod()` will fail and will return with `errno` set to EINVAL (invalid argument).

Device Files

Device files are another type of object in the file system, and are used to access physical or conceptual devices attached to the system. NFS device files always refer to a device attached to the local system and can generally be used where a local device file would be used. Like named pipes, device files are operated on through normal file system operations. For example, to write to the system console, you can write to the file `/dev/console`.

To illustrate the use of device files, consider the following:

EXAMPLE:

> System C is an NFS client of the NFS server system S, and has mounted file system / from host S on `/mnt` (a superuser on system C executed the command `mount S: / /mnt`). If a process on system C attempts to write to `/mnt/dev/console`, a device file representing the system console on system S, the output will go to the system console on system C, not on system S. If a process on system S attempts to write to `/dev/console`, which is the same "file" that system C wrote to, it will actually write to the console on system S.

NFS Mounts: Turning Off Device File Access

NFS device files are not secure. Therefore, the system administrator has the option of turning off device file access on a per-NFS mount basis. The administrator uses the `-o nodevs` option to the `mount` command to turn off device file access.

EXAMPLE:

```
mount -o nodevs nfserver:/servermountpoint /clientmountpoint
```

Note The `nodevs` option does not turn off support of named pipes.

NFS Mounts: Mounting From NFS Device Files

You may mount a local disk that is represented by a remote NFS device file.

EXAMPLE:

```
mount /mnt/nfs/dev/dsk/0s0 /localmntpt
```

Access to the newly mounted file system will proceed as if the disk had been mounted from a local device file.

Note Access to the local disk's mounted file system will not be affected even if the NFS file system is unmounted.

Normally when unmounting a file system, you can give either the name of the device file or the name of the mount point. However, if the NFS server is down or the NFS file system is down, you must give the mount point to unmount the local disk.

EXAMPLE: You would enter the following to unmount a local disk:

```
umount /localmntpt
```

instead of:

```
umount /mnt/nfs/dev/dsk/0s0
```

The latter case will not fail if the NFS server is down, but it will hang until the server comes back up as any other NFS access does.

Remote Execution Facility (REX)

The Remote Execution Facility allows you to execute commands on a remote host. REX is similar to the Berkeley Service remote shell (`remsh`) with two major differences:

- Your environment is simulated on the remote host.
- You can execute interactive commands on the remote host.

Remote Procedure Call (RPC)

NFS Services consists of remote programs composed of remote procedures called from the client nodes on the network. Optimally, a remote procedure computes results based entirely on its own parameters. Thus, the procedure (and therefore, the network service) is not tied to any particular operating system or hardware.

NFS clients access server information and processes by making a remote procedure call. RPC allows a client process to execute functions on a server via a server process. Though these processes can reside on different network nodes, the client process does not need to know about the networking implementations.

The client first calls an RPC function to initiate the RPC transaction. The client system then sends an encoded message to the server. This message includes all the data needed to identify the service and user authentication information. If the message is valid (i.e., calls an existing service and the authentication passes) the server performs the requested service and sends a result message back to the client.

Remote Procedure Call Protocol Compiler (RPCGEN)

RPCGEN is a Remote Procedure Call compiler. You use it to convert applications running on a single computer to ones that run over a network. It is also used to assist in writing Remote Procedure Call applications simply and directly. With RPCGEN, your development time will be reduced and you will spend less time coding and debugging network interface code.

You produce three of the files required to convert an application to run on a network. These files are:

- Protocol description file.
- Client side file.
- Server side function file.

RPCGEN accepts remote program interface definitions (the protocol description file) written in RPC and produces the following C output files, which you may use as a starting point, rewriting as necessary:

- Header file.
- Client side subroutine file.
- Server side skeleton file.
- XDR (External Data Representation) routine file.

If you wish to use the RPCGEN compiler to write RPC applications, refer to the "RPCGEN Programming Guide" chapter in the *Programming and Protocols for NFS Services* manual.

External Data Representation (XDR)

RPC uses the eXternal Data Representation functionality to translate machine dependent data formats (i.e., internal representations) to a universal format used by all network nodes using RPC/XDR. Thus, XDR enables heterogeneous nodes and operating systems to communicate with each other over the network.

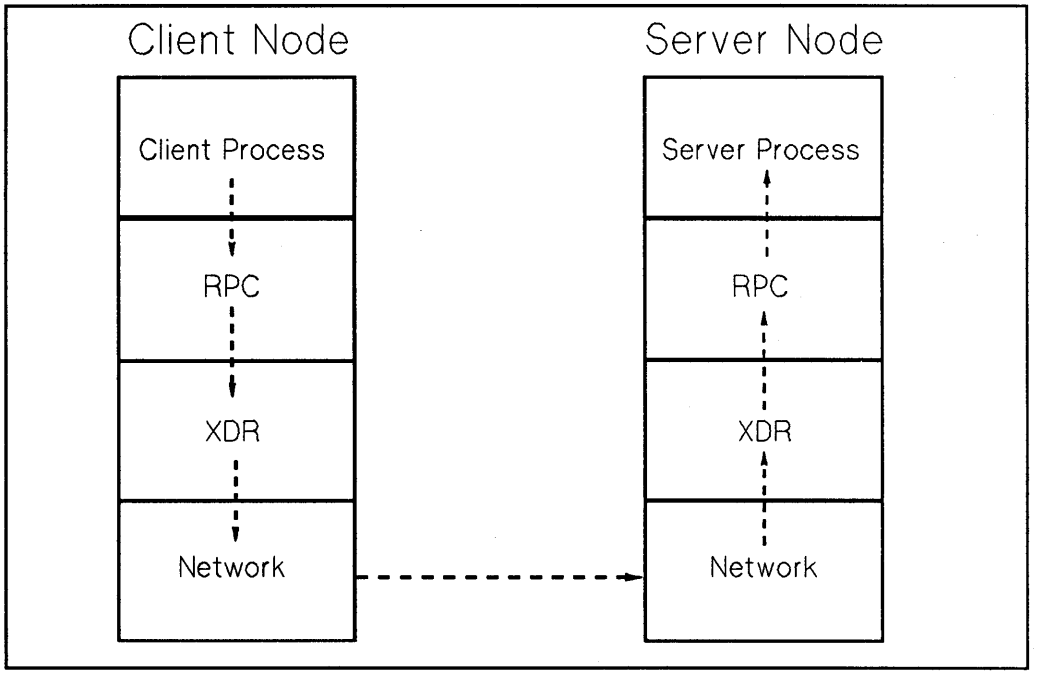


Figure 2-2. RPC and XDR Data Transfer

Note This figure does not correspond to the ISO Model.

Network Lock Manager and Network Status Monitor

NFS Services includes the Network Lock Manager (`rpc.lockd`) and the Network Status Monitor (`rpc.statd`). The Network Lock Manager supports file locking and synchronized access to shared files via `lockf` and `fcntl` for NFS. The Network Status Monitor is used by the Network Lock Manager to maintain the stateful locking service within the stateless NFS environment. It allows applications to monitor the status of other computers and systems.

Network Information Service (NIS)

The Network Information Service (NIS) is an optional service containing a collection of cooperating NIS server processes that provide NIS clients access to data. (NIS was formerly known as Yellow Pages (YP) which is a registered trademark of British Telecommunications.) You can administer all the databases from one NIS *master server* since it propagates data across the network to other NIS servers. NIS includes the following features:

- NIS manages unlimited databases. Typically these include files in `/etc/group`, `/etc/hosts`, `/etc/netgroup`, `/etc/networks`, `/etc/passwd`, `/etc/protocols`, `/etc/rpc`, and `/etc/services`.

  For example, programs previously read `/etc/hosts` to find an Internet address that corresponds to a host name. When you added a new node to the network, you had to add a new entry to every node's `/etc/hosts` file. Now programs can use NIS to obtain information from other NIS servers.

- Since the NIS master server propagates all *maps* (databases) to the **slave servers**, an NIS client receives consistent information regardless of which NIS server it accesses.

- If a remote node running an NIS server process crashes, NIS client processes can obtain NIS services from another NIS server.

- Since the NIS interface uses RPC and XDR, the service is available to other vendors.

NIS Advantages

NIS has several advantages:

- NIS enables you to automatically keep user IDs and group IDs consistent among all the nodes participating in NFS file sharing.

  Without NIS, you have to manually keep these IDs consistent for NFS.

- NIS provides the convenience of centrally administering the `/etc` files: `group`, `hosts`, `netgroup`, `networks`, `passwd`, `protocols`, `rpc`, and `services`.

  Without NIS, you must administer these files on each node individually.

NIS Disadvantages

NIS has the following disadvantages:

- If a network grows beyond 2000 nodes, NIS may begin to exhibit poor performance or failures. (This limit is based on todays system capacity.)
- Since NIS provides NIS clients access to data via the network, NIS clients may observe slower performance than if the data were accessed from local files. For example, with NIS, logging in may take more time if the NIS server is busy.
- If any of the NIS servers are unstable, remote access to files may be slower since the NIS client may have to rebind to another NIS server. If no other NIS server is available, users may not be able to login to their nodes without access to the NIS's `passwd` map.
- NIS does not make changes visible to all users unless the changes are made on the NIS master server.
- The NIS slave servers do not immediately see the changes made to the NIS master server maps. The updated maps become consistent among all NIS servers only after each slave server successfully copies the maps via `ypxfr`.

Note If you configure the BIND Name Server, it will be used instead of NIS for host name and address resolution. NIS will still be used for all other information such as passwords. See "Configuring and Maintaining the BIND Name Server" in the *Installing and Administering ARPA Services* manual.

NIS Concepts

Refer to the following figure and subsections for a summary of how components within the Network Information Service work together: maps, NIS domains, NIS servers (masters and slaves), and NIS clients.

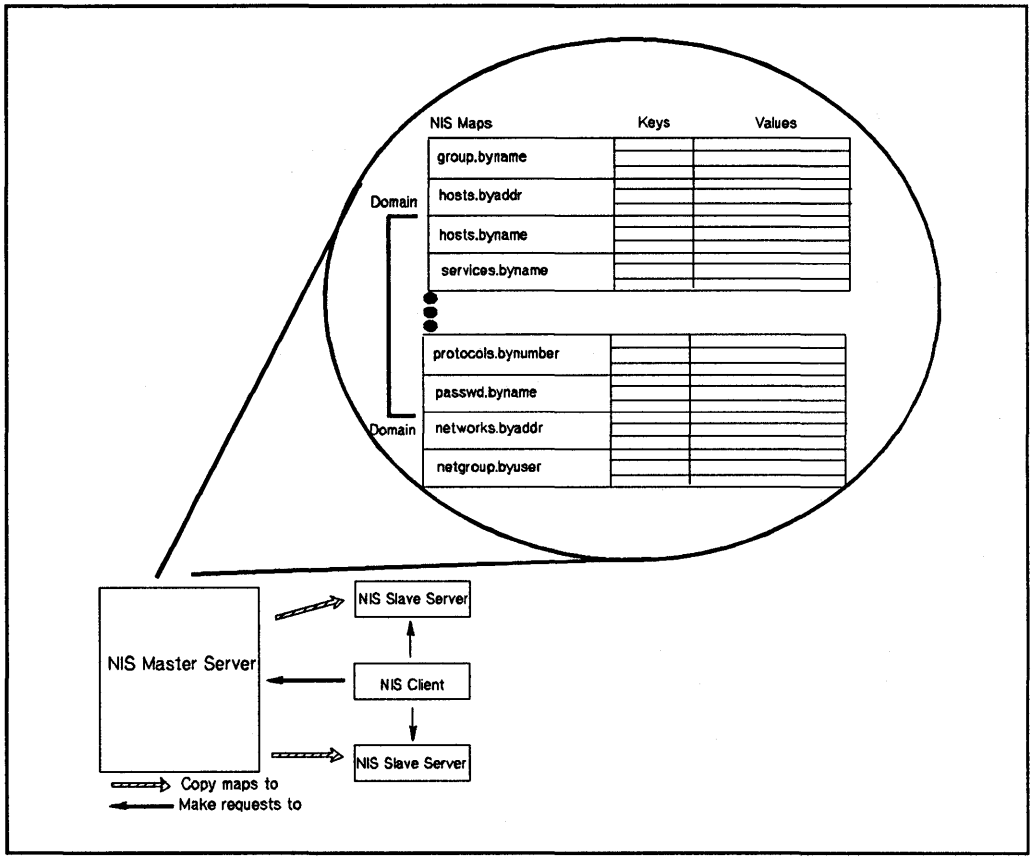


Figure 2-3. Network Information Service Structure

NIS Maps

The NIS system stores information in NIS maps (databases). Each map contains a set of keys and associated values: one key per value and one value per key. (A value may be a string of characters with imbedded blanks or tabs). For example, in the `passwd.byname` map, all the login names are the keys and their matching lines from `/etc/passwd` are the values.

Each map has a unique **map name** that programs use to access the map. Programs must know the format of the data in the map. Many of the maps are derived from ASCII files such as `/etc/hosts`, `/etc/group`, and `/etc/passwd`. The map format is usually identical to the ASCII file format.

NIS Servers and NIS Clients

NIS servers are nodes that provide access to NIS maps via the network. These maps are in `/usr/etc/yp` subdirectories named after the appropriate NIS domains. (See the next section, "NIS Domains.")

NIS clients are nodes that request access to NIS maps from an NIS server as follows:

1. An NIS client that is not bound sends a broadcast to all NIS servers on the network.
2. The NIS client binds to the first NIS server that responds. (Each NIS client binds to one NIS server per NIS domain.)
3. If the request is the NIS client's first attempt to access data, the NIS client remembers which NIS server responded to the request. Subsequent requests by this NIS client go directly to this NIS server.
4. If the bound NIS server is down or unavailable, the NIS client automatically rebinds to the first NIS server that responds to another broadcast.

Note An NIS client can also be configured as any combination of an NIS server, NFS client, or NFS server.

An NIS server must also be configured as an NIS client. It can also be configured as an NFS server, NFS client, or both.

NIS Domains

An **NIS domain** is a logical grouping of the set of maps contained on NIS servers. The following rules apply to NIS domains:

- Nodes that belong to the same NIS domain have the same domain name.
- An NIS domain has only one master server.
- An NIS domain may have zero or more slave servers.
- Maps with the same name in different NIS domains can have different contents.

You implement an NIS domain as a subdirectory of `/usr/etc/yp` on each NIS server; the name of this subdirectory is the name of the NIS domain. For example, maps in the `research` NIS domain would be in `/usr/etc/yp/research`. (Note that NIS domain names are case sensitive.) All directories that appear under `/usr/etc/yp` are assumed to be domains that an NIS server serves. To remove a domain being served, you must delete that domain's subdirectory name from `/usr/etc/yp` on all of its servers.

The `/etc/netnfsrc` file usually contains the default NIS domain name. You can change the default by executing the `domainname` command or by editing `/etc/netnfsrc` and then rebooting the system.

NIS Master and NIS Slave Servers

Only two types of nodes have NIS databases: master and slave servers.

The **NIS master server** is the node on which NIS maps are built from ASCII files; it, therefore, contains the master databases (maps) which other NIS servers (slaves) copy. Note that the NIS master server may also provide NIS clients access to NIS maps.

Note You should create and modify NIS databases only on the NIS master server; otherwise, all NIS databases will not be consistent across the NIS servers.

The **NIS slave servers** are the nodes that receive the propagated maps from the NIS master server. In turn, they provide NIS clients access to NIS maps.

An NIS server can be the master or slave of many domains. However, an NIS server can only be either the master or a slave of a given domain.

Though an NIS server may be master for one map and slave for another, random assignment of maps to NIS master servers may cause confusion. Therefore, only one NIS server should be the master for all maps within an NIS domain.

Virtual Home Environment (VHE)

Virtual Home Environment (VHE) is an HP-developed service that allows you to configure your login environment on remote nodes to mirror the login environment on your home node. (Home node refers to the node on which your home directory physically resides.) VHE is an optional service that is available to any HP-UX system that has the NFS product. It may also be used with other UNIX systems that support symbolic links and NFS.

If you find that you never need to work from a remote node, you may want to skip this section.

VHE Advantages

VHE's major advantage is that you can sit down at any remote node (assuming you have login permission), login, and enter into the work environment that is associated with the login on your home node (your home directory as specified in `/etc/passwd`). This includes:

- Home shell configuration (i.e., whichever shell you are configured to use on your home node appears when you login to a remote node).
- Access to files on the file systems exported for VHE on any computers connected with VHE on the network to which you have a login and file access permission.
- Use of previously defined aliases (only for C or K shells) and shell variables.
- Use of customized shell scripts (assuming shells operate similarly on your home node and the node you are currently using).
- Use of compiled files under your home directory from your home node (assuming your home node and the node you are logged into are of the same architecture and operating system).

Thus, VHE allows you to minimize the number of computer interfaces you must learn to be productive on the various computers that are running NFS on your network and you are no longer tied to a particular computer to complete your work tasks.

Another advantage of VHE is that it distributes computational work more efficiently between nodes than ARPA/Berkeley terminal emulation services such as `telnet` or

`rlogin`. Unlike `telnet` or `rlogin`, VHE does not return to your home node, that contains your home environment login, to execute tasks.

Instead, VHE takes advantage of the computing capacity of the machine you are currently using. For example, if you use VHE on a node other than the home node and perform an `ls` command of a directory on the home node, the `ls` command is executed from the local `/bin` directory. VHE does not return to your home node's `/bin` directory to execute the `ls` command. The following figure illustrates this concept.

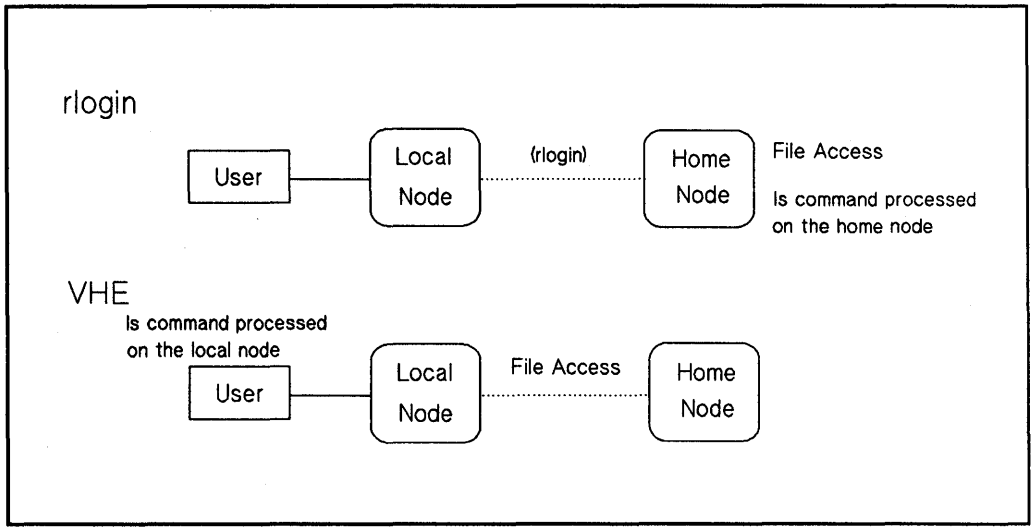


Figure 2-4. VHE vs. rlogin Performing ls Command

VHE Disadvantages

VHE has the following disadvantages:

- Though you can edit source code files originating from different types of computers on the network, you will not be able to execute object code files from a computer of a different architecture using VHE. For example, consider the following: You are currently working on an HP 9000 Series 300 and running VHE, and your home node is an HP 9000 Series 800 computer. If you try to execute an object code file on the HP 9000 Series 300 from the Series 800 computer it will not succeed. However, you can execute a script from the Series 800 computer.
- If you specify pathnames or hardware attributes in your node's `.profile` or `.login` files, you may have to modify these files to use VHE effectively. For example, the `.login` file needs to prompt for the terminal type if you plan to use VHE from more than one terminal or display type. If you do not already have this capability, then look in the sample `/etc/d.login` or `/etc/d.profile` files for samples of how to do this.
- When you are in your home environment, you may execute set-uid root programs that access files in your home directory. These files must allow access for the user "nobody." If this is not done, set-uid root programs will fail. The same applies for root access via set-uid. For example, your home directory is accessed via VHE and you execute set-uid to gain superuser privileges. If your shell happens to be `ksh`, your root `ksh` may hang if your `.history` file does not allow access for user "nobody."

How VHE Works

The following diagram illustrates the directory structure of nodes in a network using VHE.

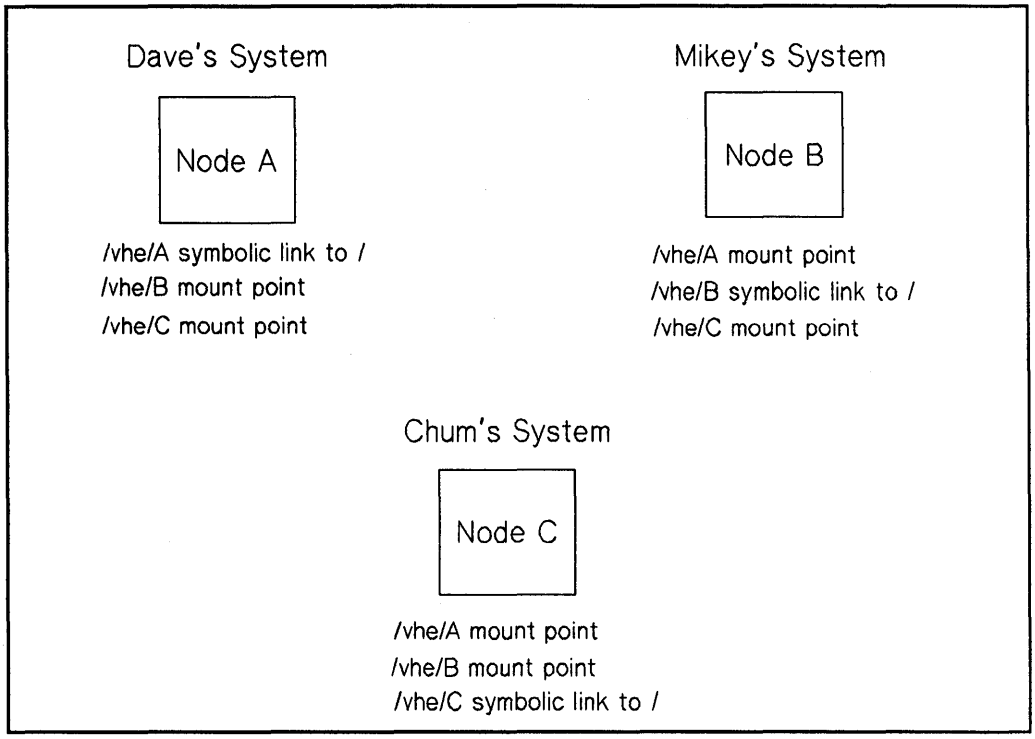


Figure 2-5. Directory Structures of Nodes Using VHE

Each node is connected to the others via NFS Services. In the picture, each node is a home node for a different user (Dave, Mikey and Chum). Each user has a customized work environment set up by the login process. Directories on each home node correspond to each of the remote nodes. For example, on node A there is a directory `/vhe/B` that corresponds to node B. Using these directories as mount points, a mount is done by each node to each remote node. (The definitions of mounts and mount points are included in the "Glossary." More detailed information is contained in the "NFS Configuration and Maintenance" chapter in the *Installing and Administering NFS Services* manual).

Using VHE gives each node access to file systems located on the remote nodes. To maintain consistency when you log into your home node, a symbolic link (a pointer) points to the host's root directory.

In a single node HP-UX configuration, the `/etc/passwd` file contains the directory that becomes the home directory for the user upon logging in. For use with VHE, `/etc/passwd` is edited such that all of the home directories are prefixed with a mount point or a symbolic link. When the login program performs a `cd` to the user's home directory, the `cd` and subsequent requests are made to the user's home node via NFS Services unless logging in on your home node.

Example Grouping

In the `/etc/passwd` file, the appropriate mount point or symbolic link is added to the beginning of the pathname of the home directory for each user. The example below shows how the lines in `/etc/passwd` would look for the users Dave, Mikey, and Chum as shown in Figure 2-5:

```
dave::117:100:Dave:/vhe/A/users/dave:/bin/csh
mikey::118:100:mikey Pom :/vhe/B/users/mikey:/bin/sh
chum::119:200:chum Pom:/vhe/C/users/chum:/bin/ksh
```

No matter which node Dave logs in on, his home directory is `/users/dave` on node A. When scripts such as `.login` or `.cshrc` are executed, they define the execution environment as customized by Dave. His files, shell variables and aliases are available just as if he had physically logged in on node A.

Because VHE is not a virtual terminal program, when Dave executes processes, they are executed on the node he is logged into. If he is on node B, processes are executed on node B, not his native host A. For example, consider the following. Dave is working at node B and his system administrator has configured VHE to be running. Dave enters the following command on node B:

```
cc testfile.c
```

The `cc` from node B's `/bin` directory is executed, but `testfile.c` is used from Dave's current working directory on node A.

3

Common Commands

This chapter describes how to access files using NFS. It also explains how to use common NFS and Network Information Service (NIS) commands.

Note All references to *servers* and *clients* apply to NFS servers and clients unless preceded by NIS.

Key Terms

Term	Definition
Client	Can be defined in two ways: - A node that requests data or services from other nodes (servers). - A process that requests other processes to perform operations. *Note*: An NFS client can also be configured as any combination of an NFS server, NIS client, or NIS server. (An NIS server must also be configured as an NIS client.)
Cluster	One or more workstations linked together with a local area network (LAN), but consisting of only one root file system. For more information on cluster concepts, see *Managing Clusters of HP9000 Computers: Sharing the HP-UX Filing System*.
Cluster Auxiliary Server	A cluster client with a disk drive that contains files shared by the other members of the cluster.
Cluster Client	A node in an HP-UX cluster that uses networking capabilities to share file systems, but does not have its root file system directly attached. For HP-UX 8.0, cluster clients can have locally mounted disks for local data storage.
Cluster Node (Cnode)	Any node operating in an HP-UX cluster environment, including cluster clients and cluster servers.
Cluster Root Server	The only node in an HP-UX cluster that has the root file system directly attached to it.
Context Dependent File (CDF)	A hidden directory that contains all the versions of a file needed by the different cnodes.
Export	To make a file system available to remote nodes via NFS.
File System	A directory structure used to organize files.

Term	Definition
Host	A node that has primary functions other than switching data for the network.
Internet Address	A four-byte quantity that is distinct from a link-level address and is the network address of a computer node. This address identifies both the specific network and the specific node on the network.
Key (NIS)	A string of characters (no imbedded blanks or tabs) that indexes the values within a map so the system can easily retrieve information. For example, in the `passwd.byname` map, the users' login names are the keys and the matching lines from `/etc/passwd` are the values.
Map (NIS)	A file consisting of logical records; a search key and related value form each record. NIS clients can request the value associated with any key within a map. **NIS map** is synonymous with **NIS database.**
Map Nickname (NIS)	A synonym for the NIS map name when using certain NIS commands.
Master Server (NIS)	The node on which one or more NIS maps are constructed from ASCII files. These maps are then copied to the NIS slave servers for the NIS clients to access.
Mount	To obtain access to a remote or local file system or directory (import).
Mount Point	The name of the directory on which a file system or part of a file system is mounted.
Network Information Service (NIS)	An optional network service composed of databases (maps) and processes that provide NIS clients access to the maps. The NIS service enables you to administer these databases from one node. NIS may or may not be active; check with your system administrator.

Term	Definition
NIS Client	Can be defined in two ways: - A node that requests data or services from NIS servers. - An NIS process that requests other NIS processes to perform operations. *Note*: An NIS client can also be configured as any combination of an NIS server, NFS client, or NFS server. (An NIS server must also be configured as an NIS client.)
NIS Database	See "Map (NIS)."
NIS Domain	A logical grouping of NIS maps (databases) stored in one location. NIS domains are specific to the NIS network service and are not associated with other network domains.
NIS Map	See "Map (NIS)."
NIS Password	The password for a user's login ID that exists in the NIS `passwd` map. The password is the same one as the user password, but is administered through the NIS. You do not have to have a password to access the NIS databases.
NIS Server	Can be defined in two ways: - A node that provides data (maps) or services to other nodes (NIS clients) on the network using NIS. - An NIS process that performs operations as requested by other NIS processes. *Note*: An NIS server must also be configured as an NIS client. It can also be configured as an NFS server, NFS client, or both.
Node	A computer system that is attached to or is part of a computer network.

Term	Definition
Server	Can be defined in two ways: - A node that provides data or services to other nodes (clients) on the network. - A process that performs operations as requested by other processes. *Note*: An NFS server can also be configured as any combination of an NFS client, NIS client, or NIS server. (An NIS server must also be configured as an NIS client.)
Value (NIS)	A unit of information stored in NIS maps; each value has a corresponding key (index) so the system can easily retrieve it. For example, in the `passwd.byname` map, the users' login names are the keys and the matching lines from `/etc/passwd` are the values.

NFS Commands

This section explains how to access files via NFS and how to use the following NFS commands. The parenthetical comments refer to the *HP-UX Reference* sections where you can go for more information about these commands:

- *rpcinfo*(1M)
- *rup*(1)
- *rusers*(1)
- *showmount*(1M)
- *on*(1)

NFS Remote File Access

NFS allows many users to share the same files. Since access techniques are transparent, remote file access remains similar to local file access.

The superuser must perform two actions before you can access remote files via NFS:

- On the server, export the file system (i.e., make it available) to the client.
- On the client, mount (import) the file system.

Access to remote files is the same as for local files. You need to include either the complete path name starting with slash (/) or the path name relative to the current directory.

Note If operating in an HP-UX cluster environment and accessing a CDF (context dependent file) via an NFS mount, the CDF member is chosen based on the context of the NFS server, not the client node. Since this access method may return unexpected results, HP recommends you *do not* use CDFs with NFS.

EXAMPLE:

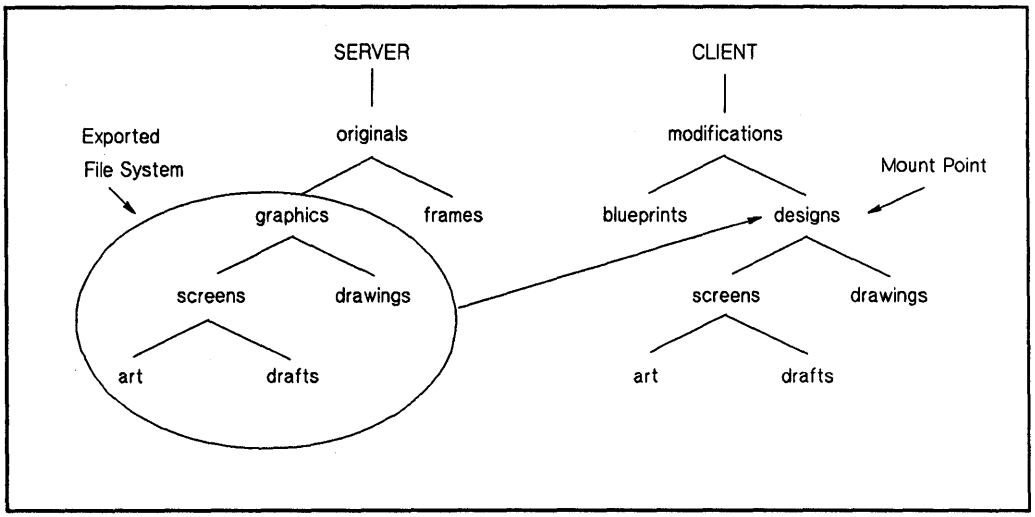


Figure 3-1. Using Commands with NFS Remote File Access

Example NFS Remote File Access	Example Entry
Edit the `drafts` file on the *server*.	`server% vi /originals/graphics/screens/drafts`
Edit the `drafts` file on the *client*.	`client% vi /modifications/designs/screens/drafts`
While in the `frames` directory, the *server* copies the `art` file from the `screens` directory.	`server% cp /originals/graphics/screens/art art`
While in the `blueprints` directory, the *client* copies the `art` file from the `screens` directory.	`client% cp /modifications/designs/screens/art art`
While in the `screens` directory, the *server* copies the `art` file to the `frames` directory.	`server% cp art /originals/frames`

Example NFS Remote File Access	Example Entry
While in the `screens` directory, the *client* copies the `art` file to the `blueprints` directory.	`client% cp art /modifications/blueprints`

rpcinfo

Execute `rpcinfo` to determine which remote programs are registered with a system's `portmap` daemon.

By providing a host name, you can list the registered RPC programs on a specific node. If you do not specify a host name, `rpcinfo` defaults to the local host.

Example Using -p Option

To list the program, version, port numbers, and the protocol, use the `-p` option.

When you execute:

```
rpcinfo -p node_7
```

The system responds:

```
program    vers    proto    port
100003     2       udp      2049   nfs
100004     2       udp      1028   ypserv
100004     2       tcp      1027   ypserv
100004     1       tcp      1027   ypserv
100007     2       tcp      1028   ypbind
100007     1       udp      1037   ypbind
100001     3       udp      1069   rstatd
100002     1       udp      1073   rusersd
100002     2       udp      1073   rusersd
100005     1       udp      1076   mountd
100008     1       udp      1078   walld
100012     1       udp      1080   sprayd
```

Example Using -u Option

To see if a particular remote program and version is available using UDP, use the `-u` option. See the following example:

When you execute:

```
rpcinfo -u node_2 mountd 1
```

The following system response indicates that the `portmap` daemon on `node_2` knows about program 100005 and that it is available:

```
program 100005 version 1 ready and waiting
```

rup

Execute `rup` to list host information, including how long they have been running, how many users are logged on to them, and their load average. By providing a host name, you can list information about a specific host.

Example of Executing rup

When you execute:

```
rup node_1 node_2 node_3 node_4
```

The last three columns of the system response show the load averages for 1, 5, and 15 minute intervals:

```
node_1     up              15:53,    load average: 0.11, 0.17, 0
.15
node_2     up   2 days,    19:42,    load average: 0.00, 0.01, 0
.01
node_3     up  21 days,    11:34,    load average: 1.66, 1.68, 1
.60
node_4     up              19:24,    load average: 0.14, 0.18, 0
.14
```

Executing `rup` without providing a host name causes an RPC broadcast. The local node collects responses until the RPC times out (quits). This process generally takes about two minutes.

Example Using -t Option

To sort the display by "up time," use the `-t` option.

When you execute:

```
rup -t
```

The system responds:

```
collecting responses...
node_7          up 21 days,     11:28,   load average: 1.16, 1.
42, 1.52
11.2.33.44      up 12 days,     22:15,   load average: 1.08, 0.
82, 0.57
node_8          up  7 days,     18:27,   load average: 0.12, 0.
09, 0.09
node_12         up  6 days,     21:20,   load average: 0.10, 0.
08, 0.09
55.6.77.88      up  3 days,     3 mins,  load average: 0.00, 0.
01, 0.01
node_6          up  2 days,     22:49,   load average: 0.00, 0.
00, 0.02
99.0.11.22      up              18:14,   load average: 0.00, 0.
00, 0.05
33.4.55.66      up              0 min    load average: 0.14, 0.
04, 0.02
```

rusers

Execute `rusers` to list the host names and users logged in for all remote nodes. By providing a host name, you can list information about a specific remote node.

Executing `rusers` without providing a host name causes an RPC broadcast. The local node collects responses until the RPC times out (quits). This process generally takes about two minutes.

Example of Executing rusers

When you execute:

```
rusers
```

The system response displays the host name or internet address in the first column and the users in the second column:

```
77.8.99.00          root
node_6              user_4 user_3 user_8 user_11
node_3              u_2
node_1              u_7
11.2.33.44          root root
node_2              root u_5 root
node_16             test user
node_9              rootx root u_7 root
node_7              root
```

Example Using -l Option

You can list more extensive information by using the `-l` command: user, host, tty (terminal), login date and time, idle time (in minutes and seconds). In some cases, you can list the host that initiated the login session.

When you execute:

```
rusers -l node_8 node_4
```

The third and fourth columns of the system response show the login date and time followed by the idle time:

```
rootx       node_8:console        Apr 07 14:00     20:29
user_3      node_4:ttyp03         Apr 12 08:09       :23   (node_
5)
user_9      node_4:ttya00         Apr 08 09:24     10:42   (node_
9:0.0)
```

In this example, the second line represents an `rlogin` or `telnet` session initiated from `node_5`. The third line represents an `hpterm` session displayed on the `0.0` display of `node_9`.

showmount

Execute `showmount` to list all the clients that have remotely mounted a file system. By providing a host name, you can specify the host. If you do not specify a host name, `showmount` defaults to the local host. For example, you might want to determine which nodes have your file systems mounted.

Example Using -a Option

To print all remote mounts in a `client:directory` format, use the `-a` option. The directory listed is the root of the file system that was mounted.

When you execute:

```
showmount -a
```

The system response displays the client followed by the directory:

```
node_4:/tmp
node_7:/
node_2:/tmp
node_12:/usr/tmp/sys_rick
node_6:/tmp/y
node_8:/
```

Example Using -e Option

To print a list of exported file systems, use the `-e` option.

When you execute:

```
showmount -e node_7
```

The system responds:

```
export list for    node_7:
/                  node_31 node_32  node_1 node_6
/users/proj        node_8 node_12
```

on

Use the on command to execute commands on a remote host. When executing the on command, you specify:

- A host on which to run the remote command.
- The command to run.
- Arguments for the command.

The on command then simulates your current environment on the server by passing your environment variables and information about your current working directory to the remote host. The rexd daemon on the server mounts the file system that contains your current working directory if it is not already mounted on the server. After the environment is simulated, the command executes in the simulated environment on the remote host.

Note Your environment is simulated on the remote host but not completely recreated. Execution of a given command on a remote host will not always produce the same results as the executing the command on your local computer. The simulated environment and the environment's limitations are discussed in the "Environment Simulation" in the *Installing and Administering NFS Services* manual.

The syntax of the on command is as follows:

```
on [-i | -n] [-d] host [ command [argument ] ....]
```

Host specifies the name of the host on which to execute *command*. There must be an entry for *host* in the local computer's host data base.

Command specifies the command to execute on *host*. If *command* is not specified, on will start a shell on *host*.

You may specify three options (-i, -n, -d). The -i option must be used when invoking interactive commands, the -n option must be used when running commands in the

background with job control, and the `-d` option is used when you wish to receive diagnostic messages.

Use of the `-d` option with either `-i` or `-n` is permitted. See the following examples:

```
on -i -d host

on -n -d host
```

You *cannot* use the `-i` and `-n` options at the same time.

The -i Option (Interactive Mode)

The `-i` option invokes the interactive mode. This option must be specified for all interactive commands (commands which expect to be communicating with a terminal). Examples of interactive commands are `vi`, `csh`, and `more`. If this option is specified with a non-interactive command such as `sort`, it will be executed as an interactive command, but there may be no difference in behavior.

Example:

```
on -i node_7 vi file
```

The -n Option (No Input Mode)

The `-n` option sends the remote program an end-of-file when the program reads from standard input instead of connecting the standard input (`stdin`) of the `on` command to the standard input (`stdin`) of the remote command. The `-n` option is necessary when running commands in the background with job control.

The -d Option (Debug Mode)

The `-d` option allows you to receive diagnostic messages during the start up of the `on` command. The messages may be useful in detecting configuration problems if the `on` command is failing while connecting to a given host.

Network Information Service Overview

The Network Information Service (NIS) is an optional network database service that enables NIS clients to access information from any correctly configured NIS server on the network. (NIS was formerly known as Yellow Pages (YP), which is a registered trademark of British Telecommunications.) One NIS master server can automatically propagate modifications across the network.

NIS Maps

The NIS system stores information in NIS maps (databases) that are consistent across the nodes. Each map has a unique, case-sensitive map name that is used for accessing maps.

Each map consists of keys (for indexing) and values (data). You can use NIS commands for querying for values associated with a particular key within a map and for retrieving key-value pairs within a map.

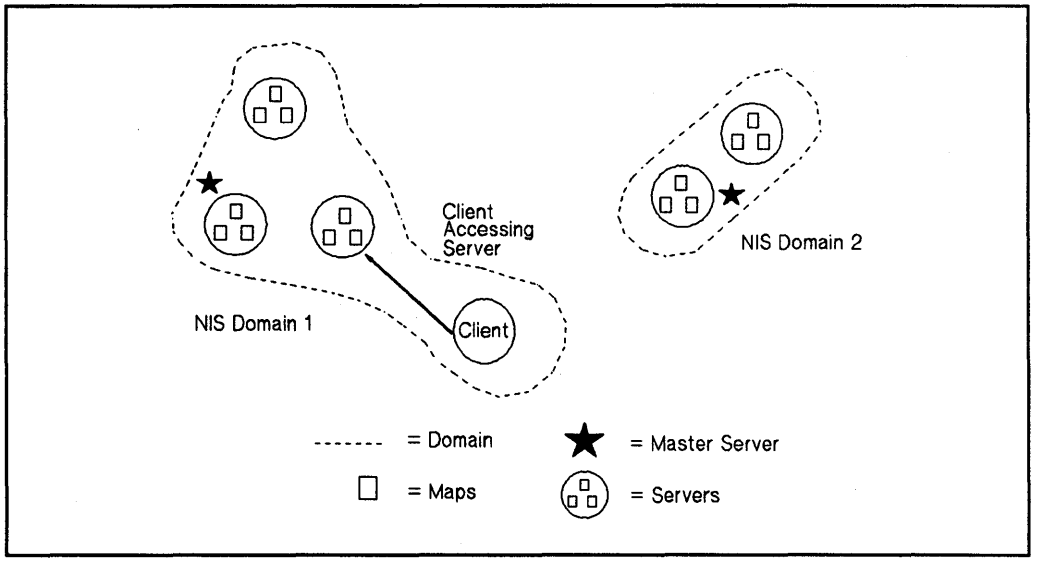


Figure 3-2. Overview of NIS

NIS Servers and NIS Clients

NIS servers store and provide access to the NIS maps (databases); **NIS clients** request data from the maps residing on NIS servers. Since different NIS servers have consistent NIS maps, responses are identical no matter which NIS server answers a request. When doing NIS client and server configurations, keep the following information in mind:

- An NIS client can also be configured as any combination of an NIS server, NFS client, or NFS server.
- An NIS server must also be configured as an NIS client. It can also be configured as an NFS server, NFS client, or both.

NIS Domains

A **NIS domain** is a logical grouping of NIS maps; each NIS server contains a set of maps for at least one NIS domain.

NIS domains enable maps with the same names to exist on one LAN; the maps are made unique by belonging to separate NIS domains. With NIS domains, you need not worry about the maps interfering with each other because of the following:

- Each of the nodes within an NIS domain has the same NIS domain name.
- Maps using the same name in different NIS domains can have different contents.

NIS domains are implemented as subdirectories of `/usr/etc/yp` on the NIS servers only; the name of each subdirectory is the name of an NIS domain. For example, maps in the *research* NIS domain would be in `/usr/etc/yp/research`. (Note, NIS domain names are case sensitive.)

NIS Master and Slave Servers

Only two types of nodes have NIS databases: master servers and slave servers.

The NIS **master server** is the node on which all NIS maps within a particular NIS domain are created and modified. As modifications occur, the NIS **slave servers** copy the maps to ensure all NIS databases are alike; in turn, they provide resources to the NIS clients.

NIS clients can bind to either the NIS master server or to a slave server.

NIS Commands

Since NIS hides the details of how and where data is stored, you do not need to know all the configuration details to access information. You can, however, use the following commands to determine the location and content of NIS information. The parenthetical comment refers to the section in the *HP-UX Reference* where you can go for more information:

- *domainname*(1)
- *ypcat*(1)
- *ypmatch*(1)
- *yppasswd*(1)
- *ypwhich*(1)

domainname

Execute `domainname` to display the current NIS domain name:

```
domainname
```

For example, you might need to determine the current NIS domain name to define a netgroup in `/etc/netgroup`. (Netgroups are network-wide groups of nodes and users defined in `/etc/netgroup` on the master server.)

ypcat

Execute `ypcat` to list the contents of a specified NIS map. You can use either the map name or map nickname to specify the desired map.

Example of Executing ypcat

When you execute:

```
ypcat group.byname
```

(or)

```
ypcat group
```

The system response displays the group name, the group ID (GID), and the members of the group:

```
daemon::5:notes,anon,uucp
users::23:window,nowindow
other::1:root,daemon,uucp,who,date,dooley,sync
root::0:root
mail::6:root
sys::3:root,bin,sys,adm
rje::8:rje,shqer
bin::2:root,bin,daemon,lp
adm::4:root,adm,daemon
```

Example Using -x Option

To list the map nicknames applicable to the `ypcat` command, use the `-x` option.

When you execute:

```
ypcat -x
```

The system responds:

```
Use     "passwd"  for  map  "passwd.byname"
Use     "group"  for  map  "group.byname"
Use     "networks"  for  map  "networks.byaddr"
Use     "hosts"  for  map  "hosts.byaddr"
Use     "protocols"  for  map  "protocols.bynumber"
Use     "services"  for  map  "services.byname"
Use     "aliases"  for  map  "mail.aliases"
Use     "ethers''  for  map  "ethers.byname"
```

ypmatch

Execute `ypmatch` to print the data (values) associated with one or more keys in a specified NIS map. You can use either the map name or map nickname to specify the desired map.

To list the map nicknames applicable to the `ypmatch` command, use the `-x` option. For example, when you execute:

```
ypmatch my_node hosts.byname
```

The system response displays the internet address (value) associated with the `hosts.byname` map for the node `my_node`:

```
11.2.33.44     my_node
```

yppasswd

The NIS password is the password for a user's login ID that exists in the NIS `passwd` map. It is used as the user password, but is administered through NIS. Note, you are not required to have a password to access the NIS databases.

If you change your password with the `passwd` command, you will change only the entry in your local `/etc/passwd` file if the entry exists. If your password is not in the file, the following error message occurs when using `passwd`:

```
Permission denied.
```

If this error occurs, execute `yppasswd`.

NIS Password Guidelines

Execute `yppasswd` to change or install a password associated with a specified login name in the NIS `passwd` map.

The following list provides the requirements for creating and changing NIS passwords. *Note*: These guidelines are different from those of the `passwd` command (refer to the "HP NFS Services vs. Local HP-UX" appendix in this manual):

- Only the owner or superuser can change an NIS password. The superuser must know the current NIS password to change another user's NIS password.
- Only the first eight characters of the NIS password are significant; the rest are truncated.
- An NIS password must contain at least five characters if it includes a combination of *either one* of the following:
  - Uppercase and lowercase letters.
  - Numeric and special characters.
- An NIS password must contain at least four characters if it includes a combination of uppercase letters, lowercase letters, and numeric characters.
- An NIS password must contain at least six characters if it includes only monocase letters.

NIS Password

Follow these steps to create or change your NIS password in the NIS `passwd` map:

1. Execute the `yppasswd` command.

   `yppasswd` *user_login_name*

2. The system prompts you for the old NIS password even if one does not exist. If it exists, enter the old NIS password; otherwise, press RETURN.

Note The NIS password may be different from the one in your local `/etc/passwd` file.

---

3. The system prompts you for the new NIS password twice to ensure you enter the correct response. Enter your new NIS password twice, pressing RETURN after each entry. The system now updates the master server `passwd` map.

Example of Executing yppasswd

When you execute:

```
yppasswd
```

The system responds:

```
Old NIS password:
New password:
Retype new password:
The NIS passwd has been changed on host_name, the master NIS
passwd server.
```

ypwhich

Execute `ypwhich` to print the host name of the NIS server supplying NIS services to an NIS client.

To list all available maps and their NIS master server host names, use the `-m` option. You can use either the map name or map nickname to determine which NIS server is the master server for a specified NIS map.

To list the map nicknames applicable to the `ypwhich` command, use the `-x` option. For example, when you execute:

```
ypwhich -m
```

The system response displays the available maps and their NIS master server host names:

```
services.byname          node_1
rpc.bynumber             node_1
protocols.bynumber       node_1
protocols.byname         node_1
passwd.byuid             node_1
passwd.byname            node_1
networks.byname          node_1
networks.byaddr          node_1
netgroup.byuser          node_1
netgroup.byhost          node_1
netgroup                 node_1
hosts.byname             node_1
hosts.byaddr             node_1
group.byname             node_1
group.bygid              node_1
vhe_list                 node_1
ypservers                node_1
```

A

HP NFS Services vs. Local HP-UX

If you have applications running on HP-UX, they may behave differently over NFS Services. Use this appendix to understand the basic differences between NFS Services and local HP-UX operations.

HP NFS Services Networking Operation	Local HP-UX Operation
Append Mode	
If two processes operating on different clients open the same file using `O_APPEND`, the `write` operation may not append data to the file.	If two processes open the same file using `O_APPEND`, the `write` operation should append information to the file.
chacl(1)	
You can only use the `-F` option. The other options of `chacl` are not supported over NFS.	You can use all options locally.
Device Files	
NFS does not support remote access to device files, but does support local access to device files via NFS.	HP-UX supports local access to device files.
File Locking	
NFS supports remote file locking for NFS reads and writes in advisory mode only.	HP-UX supports local file locking in advisory and enforcement modes.

HP NFS Services Networking Operation	Local HP-UX Operation
getacl(2) system call	
Is not supported over NFS.	Is supported locally.
Group Membership	
A user may be a member of eight groups. If a user who is a member of more than eight groups attempts to access a file, the system accesses only the first eight groups for permission checking.	A user may be a member of up to 20 groups.
lseek(2)	
If two processes operating on different clients write to the same file, `lseek` with `whence=SEEK_END` may not set the file pointer to the desired location.	If two processes write to the same file, `lseek` with `whence=SEEK_END` should set the file pointer to the desired location.
mknod(1M) Command	
The `mknod` command will work only with named pipes over NFS.	You can use the `mknod` command locally for all file types.
Mount Points	
When operating in an HP-UX cluster environment, only file systems mounted on the cluster root server can contain mount points for NFS mounts. File systems mounted on cluster auxiliary servers cannot contain NFS mount points.	NFS mount points can exist on any mounted file system.
Named Pipes	
NFS named pipes cannot be used to communicate between machines in the same diskless cluster.	Named pipes can be used to communicate among clients in a diskless cluster.

HP NFS Services Networking Operation	Local HP-UX Operation
Reading Directories	
You cannot use the `read` call to read a remote directory, rather you should use `readdir`.	You can use the `read` call to read a local directory. However, to do so can restrict migration of programs to future HP-UX versions.
setacl(2) system call	
Is not supported over NFS.	Is supported locally.
setaclentry(3) library routine	
Is not supported over NFS.	Is supported locally.
Superuser Permission	
The superuser UID 0 is mapped to -2 by default. Anything requiring superuser permission may not work over NFS. For example, a superuser may not be able to perform the following tasks: - Link and unlink directories. - Alter directories such as /, `/etc`, and `/bin`. - Use `chmod` to set sticky or setuid bits. - Do a `mknod` of device files.	Superuser has permission to perform any operation locally (by definition).

HP NFS Services Networking Operation	Local HP-UX Operation
System Time	
Commands that access clocks on different systems may not provide consistent times since system clocks differ. For example, if you give the `utime` command a `NULL` pointer for the times value, the following process occurs: 1. The system sets the access time and modification time according to the client node clock. 2. It then sends these times over to the server which changes the inode to reflect the new access and modification times. 3. The server node identifies the change in the inode and thus, modifies the inode's status change time according to its own clock. The result is a high probability of differing times between the server's access and modification times versus its status change time. *Note*: If operating in an HP-UX cluster environment, all nodes in the cluster have the same time as the root server's clock. Therefore, clock skew problems exist only if the root server's clock is different from other NFS servers.	Commands that access clocks on the local system provide consistent times.

HP NFS Services Networking Operation	Local HP-UX Operation
Unlinking	
The server does not keep state information and does not know if a process has a file open. See the following explanation: - The server will unlink a file if it receives a request to do so; thus, subsequent requests for the file will result in an error. - If a process opens a file and then unlinks it, the client renames the file so it appears to be gone. When the process quits, the client then unlinks the renamed file. - If the unlink request comes from a different node than from where the open request came from, the file is deleted.	If you open a local file and unlink it before you close the file, the file descriptor for the open file will still be valid to access the file.
yppasswd(1) Command vs. passwd(1) Command	
This command does not have a *password aging* feature. The superuser must know the current password to change another user's password. The password must contain: - At least five characters if it includes special characters and any combination of lowercase letters, uppercase letters, and numbers. Also, any combination that includes numbers, lowercase letters, and uppercase letters.	This command has a *password aging* feature. Superuser does not have to know the password to change another user's password. The following rules apply to the password: - Each password must have six or more characters: at least two alpha characters and at least one numeric or special character.

HP NFS Services Networking Operation	Local HP-UX Operation
yppasswd(1) Command vs. passwd(1) Command *(continued)*	
- At least six characters if it includes lowercase letters and numbers, uppercase letters and numbers, or a combination of lowercase and uppercase letters. - At least seven characters if it includes all lowercase letters or all uppercase letters.	- Each password must differ from the user's login name and any reverse or circular shift of that name. - New passwords must differ from the old by at least three characters.
pathconf/fpathconf	
The following variables for the `pathconf/fpathconf` system calls are not supported over NFS: _PC_CHOWN_RESTRICTED variable _PC_LINK_MAX variable _PC_NAME_MAX variable _PC_NO_TRUNC variable _PC_PATH_MAX variable The following variables for the `pathconf/fpathconf` system calls return local information over NFS: _PC_MAX_CANON variable _PC_MAX_INPUT variable _PC_VDISABLE variable The following variable for the `pathconf/fpathconf` systems calls is supported over NFS: _PC_PIPE_BUF variable	All variables are supported locally for the `pathconf/fpathconf` system calls: _PC_CHOWN_RESTRICTED variable _PC_LINK_MAX variable _PC_NAME_MAX variable _PC_NO_TRUNC variable _PC_PATH_MAX variable _PC_MAX_CANON variable _PC_MAX_INPUT variable _PC_VDISABLE variable _PC_PIPE_BUF variable

B

Moving from RFA to NFS

Remote File Access (RFA), one of the Network Services, has been discontinued. When you used networks consisting of all HP systems, RFA provided distributed file access among HP 9000 computers. In order to maintain distributed file access, you must move to NFS Services.

Why Move to NFS Services?

Using NFS Services in place of the RFA service has several advantages:

- NFS works with other vendors' equipment and other operating systems.
- NFS is a defacto industry standard.
- NFS allows transparent file access.
- NFS with the Network Information Service (NIS) provides centrally administered databases.

Use this appendix to translate your RFA applications to NFS applications.

Similarities

HP NFS Services and RFA have the following similarities:

- No remote device access.
- Not all UNIX® semantics are fully supported.

Differences

Refer to the following table for a list of differences between HP NFS and RFA.

NFS Services	RFA (Discontinued)
You can run `setuid` programs accessing data on remote file systems.	You cannot run `setuid` programs accessing data on remote file systems.
NFS operates in a heterogeneous operating system environment.	RFA operates on HP-UX operating systems only.
Only the superuser can perform remote NFS mounts.	All users can establish access to remote file systems.
You can centrally administer your databases using NIS.	You have no centrally administered database.
All users with read access to the mount point can read the remote file system.	Only users performing `netunam` can access the remote file systems.
Read and write file caching occurs on the clients; read caching occurs on the servers.	Read and write file caching occurs on the servers; caching does not occur on the clients.
The servers are stateless (do not remember client activities) and therefore, can be rebooted without interfering with client activities. (The client can resume access to the server when it is rebooted.)	The servers have state and therefore, remember the activities in which the client is involved.
One mount gives you access to only one file system.	One `netunam` gives you access to all file systems under the root directory.

Changing Scripts from RFA to NFS

Changing RFA scripts to NFS requires only minor changes. You can change both shell scripts that accept different path names and those that use hard-coded path names.

Shell Scripts that Accept Different Paths

Shell scripts that accept different paths require the following modifications:

- You must perform a remote mount of a file system or directory in *one* of the following ways:
  - As part of the script.
  - Before executing the script.

  Since superuser must execute mounts, the script must be `setuid root` if the mount is performed as part of the script.

Caution Having setuid root scripts is a potential security problem.

  If the script's owner does not have superuser permissions, the superuser can configure `/etc/checklist` to automatically mount the remote file systems at boot time. This process allows users to execute scripts without checking to see if the remote file system is accessible.

- Remove all calls to `netunam` from the script. Removing these calls prevents `netunam` failures from causing the scripts to fail.

Shell Scripts with Hard-Coded Paths

You can handle shell scripts with hard-coded path names in two ways:

- Change the path name in the script to correspond to the NFS mount point.
- Create a path name for the NFS mount point which corresponds to the path name in the script.

To mount the remote file system either as part of the script or automatically via `/etc/checklist`, you must modify the shell scripts as described in the previous section, "Shell Scripts that Accept Different Paths."

Change Pathnames

Change the path name in the script to correspond to the NFS mount point.

EXAMPLE: The script has a hard-coded path name of `/net/systemB/project`. Mount the remote directory `/project` on `/user/project` as follows:

```
mount systemB:/project /user/project
```

Now change the script to use the path name `/user/project` in place of `/net/systemB/project`.

Create New Pathnames

Create a path name for the NFS mount point that corresponds to the path name in the script.

EXAMPLE: The script has a hard-coded path name of `/net/systemB/project` which accesses the remote directory `/project`. To keep the path name the same:

1. Remove the network special file `/net/systemB`.

2. Create the directories `/net/systemB` and `/net/systemB/project`:

```
mount systemB:/project /net/systemB/project
```

Note

For RFA, access to the remote system occurred via a network special file. Creating an NFS mount point with the same name as the network special file for the remote system could cause confusion. Problems will not occur if you remove the network special file.

All remote access will then be via mount points that have the same names as the network special files that were removed.

Glossary

Alias

A term for referencing alternate networks, hosts, and protocols names.

ARPA

Advanced Research Projects Agency

A U.S. government agency that was instrumental in developing and using the original ARPA Services networking standards.

Bind

Process by which a client locates and directs all requests for data to a specific server.

Process of establishing the address of a socket that allows other sockets to connect to it or to send data to it.

CDF (Context Dependent File)

A hidden directory that contains all the versions of a file needed by the different cnodes.

Client

A node that requests data or services from other nodes (servers).

A process that requests other processes to perform operations.

Note: An NFS client can also be configured as any combination of an NFS server, NIS client, or NIS server. (An NIS server must also be configured as an NIS client.)

Clock Skew

A difference in clock times between systems.

Cluster

One or more workstations linked together with a local area network (LAN), but consisting of only one root file system.

Cluster Auxiliary Server

A cluster client with a disk drive that contains files shared by the other members of the cluster.

Cluster Client

A node in an HP-UX cluster that uses networking capabilities to share file systems,, but does not have its root file system directly attached. For HP-UX 8.0,, cluster clients can have locally mounted disks for local data storage.

Cluster Root Server

The only node in an HP-UX cluster that has the root file system directly attached to it.

Cnode (Cluster Node)

Any node operating in an HP-UX cluster environment, including diskless nodes, auxiliary servers, and the root server.

Daemon

Background programs that are always running, waiting for a request to perform a task.

Escape Sequence (NIS)

Characters used within files to force inclusion and exclusion of data from NIS databases. The escape sequences are as follows:

- + (plus)
- - (minus)
- +@netgroup_name
- -@netgroup_name

Export

To make a file system available to remote nodes via NFS.

External Data Representation (XDR)

A protocol that translates machine-dependent data formats (i.e., internal representations) to a universal format used by other network hosts using XDR.

File System

A directory structure used to organize files.

GID

A value that identifies a group in HP-UX.

Global (NIS)

A means of access in which the system always reads NIS maps rather than the local ASCII files.

Hard Mount

A mount that causes NFS to retry a remote file system request until it succeeds, you interrupt it (default option), or you reboot the system.

Home Node

A term used in Virtual Home Environment (VHE) to refer to the machine on which a user's home directory physically resides.

Host

A node that has primary functions other than switching data for the network.

Host Node

A term used in Virtual Home Environment (VHE) to refer to the node a user is logged in to. This node environment is set up from the configuration files found on the user's home node.

Import

To obtain access to a remote file system from an outside source; to mount.

Internet Address

A four-byte quantity that is distinct from a link-level address and is the network address of a computer node. This address identifies both the specific network and the specific host on the network.

Interrupt-able Mount

A mount that allows you to interrupt an NFS request by pressing an interrupt key. (Though the interrupt key is not standardized, common ones include CTRL - C and BREAK.)

Key (NIS)

A string of characters (no imbedded blanks or tabs) that indexes the values within an NIS map so the system can easily retrieve information. For example, in the `passwd.byname` map, the users' login names are the keys and the matching lines from `/etc/passwd` are the values.

Local (NIS)

A means of access in which the system first reads the local ASCII file. If it encounters an escape sequence, it then accesses the NIS databases.

Map (NIS)

A file consisting of logical records; a search key and related value form each record. NIS clients can request the value associated with any key within a map.

NIS map is synonymous with **NIS database.**

Map Nickname (NIS)

A synonym for the NIS map name when using certain NIS commands.

Master Server (NIS)

The node on which one or more NIS maps are constructed from ASCII files. These maps are then copied to the NIS slave servers for the NIS clients to access.

Mount

To obtain access to a remote or local file system or directory (import).

Mount Point

The name of the directory on which a file system is mounted.

Netgroup

A network-wide group of nodes and users defined in `/etc/netgroup`.

NFS

Network File System.

Network Information Service (NIS)

An optional network service composed of databases (maps) and processes that provide NIS clients access to the maps. The NIS service enables you to administer these databases from one node.

NIS may or may not be active; check with your system administrator.

Network Lock Manager

A facility for locking files and synchronizing access to shared files.

Network Status Monitor

A daemon running on all network computers to maintain stateful locking service within NFS. It also allows applications to monitor the status of other computers.

NIS Client

A node that requests data or services from NIS servers.

An NIS process that requests other NIS processes to perform operations.

Note: An NIS client can also be configured as any combination of an NIS server, NFS client, or NFS server. (An NIS server must also be configured as an NIS client.)

NIS Database

See Map (NIS).

NIS Domain

A logical grouping of NIS maps (databases) stored in one location. NIS domains are specific to the NIS network service and are not associated with other network domains.

NIS Map

See Map (NIS).

NIS Password

The password for a user's login ID that exists in the NIS `passwd` map. The NIS password is the same one as the user password, but is administered through the NIS.

You do not have to have an NIS password to access the NIS databases.

NIS Server

A node that provides data (maps) or services to other nodes (NIS clients) on the network using NIS.

An NIS process that performs operations as requested by other NIS processes.

Note: An NIS server must also be configured as an NIS client. It can also be configured as an NFS server, NFS client, or both.

Node

A computer system that is attached to or is part of a computer network.

Propagate

To copy maps (data) from one NIS server to another.

Protocol

The rules and steps by which servers and clients exchange data and control information.

Remote Execution Facility (REX)

A facility which allows a user to execute commands on a remote node.

Remote Procedure Call (RPC)

A call made by clients either to access server information or to request action from servers.

Remote Procedure Call Protocol Compiler (RPCGEN)

A remote procedure call compiler used to help programmers write RPC applications by automatically generating necessary programs and code fragments.

Server

A node that provides data or services to other nodes (clients) on the network.

A process that performs operations as requested by other processes.

Note: An NFS server can also be configured as any combination of an NFS client, NIS client, or NIS server. An NIS server must also be configured as an NIS client.

Slave Server (NIS)

A node that copies NIS maps from the NIS master server and then provides NIS clients access to these maps.

Soft Mount

An optional mount that causes access to remote file systems to abort requests after one NFS attempt.

Stateless Server

Servers do not maintain (preserve) information relating to each file being served. Each file request moves across the network with the parameters attached to it locally (e.g., read and write privileges).

Steady State

Servers maintain (preserve) information relating to each file being served.

For NIS, the information contained in an NIS map is consistent among all NIS servers within a given NIS domain (i.e., is not in the process of being updated).

UID

A value that identifies a user in HP-UX.

Unmount

To remove access rights to a file system or disk that was mounted via the `mount` command.

Update

The HP-UX command that installs software onto the system.

Value (NIS)

A unit of information stored in NIS maps; each value has a corresponding key (index) so the system can easily retrieve it. For example, in the `passwd.byname` map, the users' login names are the keys and the matching lines from `/etc/passwd` are the values.

VHE

See Virtual Home Environment.

Virtual Home Environment (VHE)

A network service that allows users to log in at host nodes and utilize their home nodes' execution environments.

XDR

See External Data Representation.

Index

S

V

X

Y

SALES OFFICES
Arranged alphabetically by country

Please send directory corrections to:
Test & Measurement Catalog
Hewlett-Packard Company
3200 Hillview Avenue
Palo Alto, CA 94304
Tel: (415) 857-4706
Fax: (415) 857-3880

HEADQUARTERS OFFICES

If there is no sales office listed for your area, contact one of these headquarters offices.

ASIA
Hewlett-Packard Asia Ltd.
22/F Bond Centre, West Tower
89 Queensway, Central
HONG KONG
G.P.O. Box 863, Hong Kong
Tel: 5-8487777
Telex: 76793 HPA HX
Cable: HPASIAL TD

CANADA
Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Fax: (416) 678-9421

EASTERN EUROPE
Hewlett-Packard Ges.m.b.h.
Lieblgasse 1
P.O. Box 72
A-1222 **VIENNA,** Austria
Tel: (222) 2500
Telex: 1 3 4425 HEPA A

NORTHERN EUROPE
Hewlett-Packard S.A.
V. D. Hooplaan 241
P.O. Box 999
NL-118 LN 15 **AMSTELVEEN**
The Netherlands
Tel: 20 5479999
Telex: 18919 hpner

SOUTH EAST EUROPE
Hewlett-Packard S.A.
World Trade Center
110 Avenue Louis-Casai
1215 Cointrin, **GENEVA,** Switzerland
Tel: (022) 98 96 51
Telex: 27225 hpser
Mail Address:
P.O. Box
CH-1217 Meyrin 1
GENEVA
Switzerland

MIDDLE EAST AND CENTRAL AFRICA
Hewlett-Packard S.A.
International Sales Branch
Middle East/Africa
7, rue du Bois-du-Lan
P.O. Box 364
CH-1217 Meyrin 1
GENEVA
Switzerland
Tel: (41/22) 780 7111
Fax: 783 7535

European Operations
Hewlett-Packard S.A.
150, Route du Nant d'Avril
1217 Meyrin 2
GENEVA, Switzerland
Tel: (41/22) 780 .8111
Fax: (41/22) 780 .8542

UNITED KINGDOM
Hewlett-Packard Ltd.
Nine Mile Ride
WOKINGHAM
Berkshire, RG113LL
Tel: 0344 773100
Fax: (44/344) 763526

UNITED STATES OF AMERICA
Customer Information Center
(800) 752-0900
6:00 AM to 5:00 PM Pacific Time

EASTERN USA
Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 670-4300

MIDWESTERN USA
Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800

SOUTHERN USA
Hewlett-Packard Co.
2015 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500

WESTERN USA
Hewlett-Packard Co.
5161 Lankershim Blvd.
NORTH HOLLYWOOD, CA 91601
Tel: (818) 505-5600

OTHER INTERNATIONAL AREAS
Hewlett-Packard Co.
Intercontinental Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304
Tel: (415) 857-5027
Telex: 034-8300
Cable: HEWPACK

Hewlett-Packard Trading S.A.
Bureau de Liaison/Bureau de Spport
Villa des Lions
9, Hai Galloul
DZ-BORDJ EL BAHRI
Tel: 76 02 07
Fax: 281 0387

ANGOLA
Telectra Angola LDA
Empresa Técnica de Equipamentos
16 rue Cons. Julio de Vilhema
LUANDA
Tel: 35515,35516
Telex: 3134

ARGENTINA
Hewlett-Packard Argentina S.A.
Montaneses 2140/50
1428 **BUENOS AIRES**
Tel: (54/1) 781 4059
(54/1) 781-4090

Laboratorio Rodriguez
Corswant S.R.L.
Misiones, 1156 - 1876
Bernal, Oeste
BUENOS AIRES
Tel: 252-3958, 252-4991

Argentina Esanco S.R.L.
A/ASCO 2328
1416 **BUENOS AIRES**
Tel: 541-58-1981, 541-59-2767
Telex: 22796 HEW PAC-AR

AUSTRALIA
Customer Information Centre
Tel: (008) 033821

Adelaide, South Australia Office
Hewlett-Packard Australia Ltd.
PARKSIDE, S.A. 5063
153 Greenhill Road
ADELAIDE (Parkside) Sales
Tel: (61-8-) 272-5911
Fax: (61/8) 373-1398

Brisbane, Queensland Office
Hewlett-Packard Australia Ltd.
10 Payne Road
THE GAP, Queensland 4061
Tel: 61-7-300-4133
Telex: 42133
Cable: HEWPARD Brisbane

Canberra, Australia Capital Territory Office
Hewlett-Packard Australia Ltd.
Thynne Street, Fern Hill Park
BRUCE, A.C.T. 2617
P.O. Box 257,
JAMISON, A.C.T. 2614
Tel: 61-62-51-6999
Telex: 62650
Cable: HEWPARD Canberra

Melbourne, Victoria Office
Hewlett-Packard Australia Ltd.
31-41 Joseph Street
P.O. Box 221
BLACKBURN, Victoria 3130
Tel: (61/3) 895-2895
Fax: (61/3) 898-7831
Cable: HEWPARD Melbourne

Perth, Western Australia Office
Hewlett-Packard Australia Ltd.
Herdsman Business Park
Cnr. Hasler & Gould Strs.
Osborne Park
CLAREMONT, W.A. 6017
Tel: (61/9) 242 1414
Fax: (61/9) 242-1682
Cable: HEWPARD Perth

Sydney, New South Wales Office
Hewlett-Packard Australia Ltd.
17-23 Talavera Road
P.O. Box 308
NORTH RYDE, N.S.W. 2113
Sydney, Australia
Tel: (61/2) 888-4444
Fax: (61/2) 888-9072
Cable: HEWPARD Sydney

AUSTRIA
Hewlett-Packard GmbH
Verkaufsbuero Graz
Grottenhofstrasse 94
A-8052 **GRAZ**
Tel: 43-316-291-5660
Telex: 312375

Hewlett-Packard GmbH
Lieblgasse 1
P.O. Box 72
A-1222 **VIENNA**
Tel: (43/222) 2500
Fax: (48/222) 2500 Ext 444

BAHRAIN
Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
RIYADH 11495
SAUDI ARABIA
Tel: (966/1) 4763030
Telex: 595 (0495) 202049

Wael Pharmacy
P.O. Box 648
MANAMA
Tel: 256123
Telex: 8550 WAEL BN

BELGIUM
Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
1200 **BRUSSELS**
Tel: (32/2) 761.31.11
Fax: (32/2) 763.06.13

BENIN
S.I.T.E.L.
Immeuble le General
Av. General de Gaulle
P.O. Box 161
ABIDJAN 01
Ivory Coast
Tel: 32 12 27
Telex: 22149

BERMUDA
Applied Computer Technologies
Atlantic House Building
P.O. Box HM 2091
Par-La-Ville Road
HAMILTON 5
Tel: 295-1616
Telex: 380 3589/ACT BA

BOLIVIA
Arrellano Ltda
Av. 20 de Octubre #2125
Casilla 1383
LA PAZ
Tel: 368541

Siser Ltda. (Sistemas de Importacion y Servicios Ltda.)
Gabriel Gozalvez 221
Casilla 4084
LA PAZ
Tel: (591/2) 340962/
363365/343245
Fax: 35-9268

BRAZIL
Hewlett-Packard do Brasil S.A.
Praia de Botafago 228-A-614
6. AND.-CONJ. 601
Edificio Argentina - Ala A
22250 **RIO DE JANEIRO, RJ**
Tel: (55/21) 552-6422
Telex: 21905 HPBR BR
Cable: HEWPACK Rio de Janeiro

BRUNEI
Komputer Wisman Sdn Bhd
G6, Chandrawaseh Cmplx,
Jalan Tutong
P.O. Box 1297,
BANDAR SERI BEGAWAN
NEGARA BRUNI DARUSSALAM
Tel: 673-2-2000-70/26711

BURKINA FASSO
S.I.T.E.L.
Immeuble le General
Avenue General de Gaulle
P.O. Box 161
ABIDJAN 01
Ivory Coast
Tel: 32 12 27
Telex: 22149

CAMEROON
R.T.I.
175 Rue Biomet
75015 **PARIS**
France
Tel: (1) 45 31 0906
Telex: 203376
Fax: (1) 45 31 09 18

CANADA

Alberta
Hewlett-Packard (Canada) Ltd.
3030 3rd Avenue N.E.
CALGARY, Alberta T2A 6T7
Tel: (1/403) 235-3100
Fax: (1/403) 272-2299

Hewlett-Packard (Canada) Ltd.
11120-178th Street
EDMONTON, Alberta T5S 1P2
Tel: (1/403) 486-6666
Fax: (1/403) 489-8764

SALES OFFICES
Arranged alphabetically by country (cont'd)

CANADA (Cont'd)

British Columbia
Hewlett-Packard (Canada) Ltd.
10691 Shellbridge Way
RICHMOND,
British Columbia V6X 2W8
Tel: (1/604) 270-2277
Fax: (1/604) 270-0859

Manitoba
Hewlett-Packard (Canada) Ltd.
1825 Inkster Blvd.
WINNIPEG, Manitoba R2X 1R3
Tel: (204) 694-2777

New Brunswick
Hewlett-Packard (Canada) Ltd.
814 Main Street
MONCTON, New Brunswick E1C 1E6
Tel: (506) 855-2841

Nova Scotia
Hewlett-Packard (Canada) Ltd.
201 Brownlow Avenue
DARTMOUTH, Nova Scotia B3B 1W2
Tel: (1/902) 469-7820
Fax: (1/902) 468-2817

Hewlett-Packard
(Canada) Ltd.
475 Hood Rd., Unit #2
MARKHAM, L3R 8H1
Tel: (416) 479-1770

Ontario
Hewlett-Packard (Canada) Ltd.
552 Newbold Street
LONDON, Ontario N6E 2S5
Tel: (1/519) 686-9181
Fax: (1/519) 686-9145

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (1/416) 678-9430
Fax: (1/416) 673-7253

Hewlett-Packard (Canada) Ltd.
2670 Queensview Dr.
OTTAWA, Ontario K2B 8K1
Tel: (1/613) 820-6483
Fax: (1/613) 820-0377

Hewlett-Packard (Canada) Ltd.
3790 Victoria Park Ave.
WILLOWDALE, Ontario M2H 3H7
Tel: (1/416) 499-2550

Quebec
Hewlett-Packard (Canada) Ltd.
17500 Trans Canada Highway
South Service Road
KIRKLAND, Quebec H9J 2X8
Tel: (1/514) 697-4232
Fax: (1/514) 697-6941

Saskatchewan
Hewlett-Packard (Canada) Ltd.
#1, 2175 Airport Rd.
SASKATOON, Saskatchewan S7L 7E1
Tel: (306) 242-3702

CHILE
Ricardo Borzutsky
Avanzados Sistemas de
Conocimientos S. A.
Austria 2041
SANTIAGO
America del Sur
Tel: (562) 223-5946/6148

CHINA, People's Republic of
China Hewlett-Packard Co., Ltd.
22/F Bond Centre, West Tower
89 Queensway, Central
HONG KONG
Tel: (852/5) 8487777
Fax: (852/5) 868 4997

China Hewlett-Packard Co., Ltd.
P.O. Box 9610, Beijing
38 Bei San Huan X1 Road
Shuang Yu Shu, Hai Dian District
BEIJING
Tel: 256-6888
Fax: 256-3207

China Hewlett-Packard Co., Ltd.
23/F Shanghai Union Building
100 Yan An Road
SHANG-HAI
Tel: 203-240
Fax: 202-149

COLOMBIA
Instrumentación
H. A. Langebaek & Kier S.A.
Carrerra 4A No. 52A-26
Apartado Aereo 6287
BOGOTA 1, D.E.
Tel: 212-1466
Telex: 44400 INST CO
Cable: AARIS Bogota

CONGO
Sema-Metra
16-18 Rue Barbes
92126 Montrouge Cedex
FRANCE
Tel: (1) 657/300
Telex: 200601 Semetra
Fax: (1) 46 56 96 53

COSTA RICA
Cientifica Costarricense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
SAN JOSÉ
Tel: 9-011-506-243-820
Telex: 3032367 GALGUR CR

Continex S.A.
Avenida 10C
Apartado 746-1000
34-36 **SAN JOSE**
Tel: (506) 33-0933
Telex: 2310 Continex CR
Fax: 21-6905

O. Fischel R. Y. Cia. S.A.
Apartados 434-10174
SAN JOSE
Tel: 23-72-44
Telex: 2379
Cable: OFIR

CYPRUS
Hellamco - M. Cotoyannis
2, Sikelianou St. & Kifissias Av.
P.O. Box 65074
N. Psyhiko 15410
ATHENS
Greece
Tel: 647 79 426, 647 79 427
Telex: 224903

Telerexa Ltd.
P.O. Box 1152
Valentine House
8 Stassandrou St.
NICOSIA
Tel: 45 628, 62 698
Telex: 5845 tlrx cy

DEMSTAR Ltd.
P.O. Box 2260
NICOSIA
Cyprus
Tel: 44 10 64
Telex: 3085
Fax: 46 46 35

DENMARK
Hewlett-Packard A/S
Kongevejen 25
3460 **BIRKEROD**
Tel: (45/42) 816640
Fax: (45/42) 815810

Hewlett-Packard A/S
Rolighedsvej 32
DK-8240 **RISSKOV,** Aarhus
Tel: 45-06-17-6000
Telex: 37409 hpas dk

DOMINICAN REPUBLIC
Microprog S.A.
Juan Tomás Mejía y Cotes No. 60
Arroyo Hondo
SANTO DOMINGO
Tel: 565-6268
Telex: 4510 ARENTA DR (RCA)

ECUADOR
CYEDE Cia. Ltda.
Avenida Eloy Alfaro 1749
y Belgica
Casilla 6423 CCI
QUITO
Tel: 9-011-593-2-450975
Telex: 39322548 CYEDE ED

EGYPT
International Engineering Associates
6 El Gamea Street
Agouza
CAIRO
Tel: 71-21-681 348 0904
Telex: 93830 IEA UN
Cable: INTEGASSO

EL SALVADOR
IPESA de El Salvador S.A.
29 Avenida Norte 1223
SAN SALVADOR
Tel: 9-011-503-266-858
Telex: 301 20539 IPESA SAL

ETHIOPIA
R.T.I.
175 rue Blomet
75016 **PARIS**
France
Tel: (1) 45 31 09 06
Telex: 203376
Fax: (1) 45 31 09 18

FINLAND
Hewlett-Packard Finland
Field Oy
Niittylanpolku IO
00620 **HELSINKI**
Tel: (90) 757-1011
Telex: 122022 Field SF

Hewlett-Packard Oy
Piispankalliontie 17
02200 **ESPOO**
Tel: (358/0) 88721
Fax: (358/0) 887 2277

Hewlett-Packard Oy
Väinönkatu 9 C
40100 **JYVÄSKYLÄ**
Tel: (358/41) 21 85 11

Hewlett-Packard Oy
Valtatie 57
90500 **OULU**
Tel: (358/81) 340 144

FRANCE
Hewlett-Packard France
Z.I. Mercure B
Rue Berthelot
13763 Les Milles Cedex
AIX-EN-PROVENCE
Tel: 33-42-59-41-02
Telex: 410770F

Hewlett-Packard France
ZA Kergaradec
Rue Fernand Forest
29239 **GOUESNOU** (Brest)
Tel: (98) 41-87-90

Hewlett-Packard France
Chemin des Mouilles
Boite Postale 162
69131 **ECULLY** Cedex (Lyon)
Tel: (33) 72-29-32-93
Telex: 310617F

Hewlett-Packard France
Z.I. Mercure B
Rue Berthelot
F-13763 **LES MILLES** Cédex
Aix-en-Provence
Tel: (33/42) 59-41-02
Telex: 410770
Fax: 594872

Hewlett-Packard France
Parc Club des Tanneries
Batiment B4
4, Rue de la Faisanderie
67381/**LINGOLSHEIM** (Strasbourg)
Tel: (88) 76-15-00
Telex: 890141F

Hewlett-Packard France
Parc d'activités Cadéra
Quartier Jean-Mermoz
Avenue du Président JF Kennedy
33700 **MÉRIGNAC** (Bordeaux)
Tel: (33) 56-34-00-84
Telex: 550105F

Hewlett-Packard France
Miniparc-ZIRST
Chemin du Vieux Chêne
38240 **MEYLAN** (Grenoble)
Tel: (76) 90-38-40

Hewlett-Packard France
Ru de l'Hôtellerie
Le Petit Bel Air
44470 **CARQUEFOU** (Nantes)
Tel: 40-30-38-38
Telex: 711085F

Hewlett-Packard France
Parc Tertiaire Héliopolis
Route de Micy
45380 **La CHAPELLE ST MESMIN**
(Orléans)
Tel: 38-43-93-56
Telex: 783 497F

Hewlett-Packard France
Zone Industrielle de Courtaboeuf
1, av. du Canada
91947 **LES ULIS** Cedex (Orsay)
Tel: 69-82-60-60
Telex: 600048F

R.T.I. (Realisations
Telematiques Internationales)
175, rue Blomet
F-75015 **PARIS**
Tel: (33/1) 45310906
Telex: 42/203376

Hewlett-Packard France
Parc d'activités de la Poterie
Rue Louis Kerautel-Botmel
35000 **RENNES**
Tel: 99-51-42-44
Telex: 740912F

Hewlett-Packard France
45, rue des 3 Soeurs
Centre d'Affaires Paris Nord II
F-93420 Villepinte
B.P. 60020
F-95971 **ROISSY**
CHARLES DE GAULLE Cédex
Tel: (33/48) 91-68-00
Telex: 232366
Fax: 632183

Hewlett-Packard France
P.A.T. Lavatine
3, rue Jacques Monod
BP 185
76136 **MONT-ST-AIGNAN** (Rouen)
Tel: 35-59-19-20
Telex: 770035F

Hewlett-Packard France
Innoparc
BP 167 - Voie n°7
31328 **LABEGE** Cedex (T[illegible]ouse)
Tel: 61-39-11-40
Telex: 531639F

Hewlett-Packard France
Les Cardoulines
Batiment B2
Route des Dolines
Parc d'activite de Valbonne
Sophia Antipolis
06560 **VALBONNE** (Nice)
Tel: 93-65-39-40

Hewlett-Packard France
Parc d'activité des Prés
1, Rue Papin Cedex
59658 **VILLENEUVE D'ASCQ**
Tel: 20-91-41-25
Telex: 160124F

FRENCH WEST INDIES (Antilles)

R.T.I.
175, Rue Blomet
75015 **PARIS**
FRANCE
Tel: (1) 45 31 09 06
Telex: 203376
Fax: (1) 45 31 09 18

GABON

R.T.I. Cameroon
Distribution/Services
B.P. 3899
DOULA, CAMEROON
(Please contact R.T.I. France.)
Tel: (237) 423291
Telex: 970/5385

R.T.I.
175, rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Telex: 203376
Fax: (1) 45 31 09 18

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Vertriebzentrale Deutschland
Hewlett-Packard-Strasse
Postfach 1641
D-6380 **BAD HOMBURG v.d.H**
Tel: (06172) 400-0
Telex: 410 844 hpbhg

Hewlett-Packard GmbH
Geschäftsstelle
Keithstrasse 2-4
D-1000 **BERLIN** 30
Tel: (030) 21 99 04-0
Telex: 018 3405 hpbln d

Hewlett-Packard GmbH
Verbindungsstelle Bonn
Friedrich-Ebert-Allee 26
5300 **BONN**
Tel: (0228) 234001
Telex: 8869421

Hewlett-Packard GmbH
Vertriebszentrun Südwest
Schickardstrasse 2
D-7030 **BÖBLINGEN**
Postfach 1427
Tel: (49/7031) 645
Fax: (49/7031) 645-429

Hewlett-Packard GmbH
Zeneralbereich Mktg
Herrenberger Strasse 130
D-7030 **BÖBLINGEN**
Tel: (49/7031) 14-0
Fax: (49/7031) 14-2999

Hewlett-Packard GmbH
Geschäftsstelle
Schleefstr. 28a
D-4600 **DORTMUND-41**
Tel: (0231) 45001
Telex: 822858 hepdod

Hewlett-Packard gmbH
Reparaturzentrum Frankfurt
Berner Strasse 117
6000 **FRANKFURT/MAIN 60**
Tel: (069) 500001-0
Telex: 413249 hpffm

Hewlett-Packard GmbH
Vertriebszentrum Nord
Kapstadtring 5
D-2000 **HAMBURG** 60
Tel: 49-40-63-804-0
Telex: 021 63 032 hphh d

Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 **HANNOVER** 61
Tel: (49/511) 5706-0
Fax: (49/511) 5706-126

Hewlett-Packard GmbH
Geschäftsstelle
Rosslauer Weg 2-4
D-6800 **MANNHEIM**
Tel: 49-0621-70-05-0
Telex: 0462105 hpmhm

Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 **NEU ULM**
Tel: 49-0731-70-73-0
Telex: 0712816 HP ULM-D

Hewlett-Packard GmbH
Geschäftsstelle
Emmericher Strasse 13
D-8500 **NÜRNBERG** 10
Tel: (0911) 5205-0
Telex: 0623 860 hpnbg

Hewlett-Packard GmbH
Vertriebszentrum Ratingen
Berliner Strasse 111
D-4030 **RATINGEN**
Postfach 31 12
Tel: (02102) 494-0
Telex: 589 070 hprad

Hewlett-Packard GmbH
Vertriebszentrum Muchen
Eschenstrasse 5
D-8028 **TAUFKIRCHEN**
Tel: 49-89-61-2070
Telex: 0524985 hpmch

Hewlett-Packard GmbH
Geschäftsstelle
Ermlisallee
7517 **WALDBRONN** 2
Postfach 1251
Tel: (07243) 602-0
Telex: 782 838 hepk

GREAT BRITAIN

See United Kingdom

GREECE

Hewlett-Packard Hellas
32, Kiffissias Avenue
15125 Amaroussion
ATHENS
Greece
Tel: 6828811
Telex: 216588 hpat gr
Fax: 6832978

GUATEMALA

IPESA DE GUATEMALA
Avenida Reforma 3-48, Zona 9
GUATEMALA CITY
Tel: 316627, 317853,66471/5
9-011-502-2-316627
Telex: 3055765 IPESA GU

GUINEA

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Telex: 203376
Fax: (1) 45 31 09 18

HONG KONG

Hewlett-Packard Asia, Ltd.
22/F, West Tower Bond Centre
89 Queensway Central
HONG KONG
Tel: (852/5) 848-7777
Fax: (85215) 868-4997
Cable: HEWPACK HONG KONG

ICELAND

Hewlett-Packard Iceland
Hoefdabakka 9
112 **REYKJAVIK**
Tel: 354-1-67-1000
Telex: 37409
Fax: 354-1-673031

INDIA

Computer products are sold through Blue Star Ltd. All computer repairs and maintenance service is done through Computer Maintenance Corp.

Blue Star Ltd.
B. D. Patel House
Near Sardar Patel Colony
AHMEDABAD 380 014
Tel: 403531, 403532
Telex: 0121-234
Cable: BLUE FROST

Blue Star Ltd.
40/4 Lavelle Road
BANGALORE 560 001
Tel: 57881, 867780
Telex: 0845-430 BSLBIN
Cable: BLUESTAR

Blue Star Ltd.
Sahas
414/2 Vir Savarkar Marg
Prabhadevi
BOMBAY 400 025
Tel: 422-6155
Telex: 011-71193 BSSS IN
Cable: FROSTBLUE

Blue Star Ltd.
Kalyan, 19 Vishwas Colony
Alkapuri, **BARODA,** 390 005
Tel: 65235, 65236
Cable: BLUE STAR

Blue Star Ltd.
7 Hare Street
P.O. Box 506
CALCUTTA 700 001
Tel: 230131, 230132
Telex: 031-61120 BSNF IN
Cable: BLUESTAR

Blue Star Ltd.
13 Community Center
New Friends Colony
NEW DELHI 110 065
Tel: 682547
Telex: 031-2463
Cable: BLUEFROST

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
SECUNDERABAD 500 003
Tel: 72057, 72058
Telex: 0155-459
Cable: BLUEFROST

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthunkuzhi
TRIVANDRUM 695 013
Tel: 65799, 65820
Telex: 0884-259
Cable: BLUESTAR

Hewlett-Packard India
Meridian Commercial Complex
6th Floor
8 Windsor Place
Janpath
NEW DELHI 110 001
Tel: 91-11384911
Telex: 31-4935 HPNDIN

INDONESIA

BERCA Indonesia P.T.
P.O.Box 496/Jkt.
Jl. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL IA
Cable: BERSAL JAKARTA

BERCA Indonesia P.T.
P.O.Box 2497/Jkt
Antara Bldg., 12th Floor
Jl. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 21-340417
Telex: 46748 BERSAL IA

BERCA Indonesia P.T.
Jalan Kutai 24
SURABAYA
Tel: 67118
Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA

IRAQ

Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 609/10/7
BAGHDAD
Tel: 551-49-73
Telex: 212-455 HEPAIRAQ IK

IRELAND

Hewlett-Packard Ireland Ltd.
Temple House, Temple Road
Blackrock, Co. **DUBLIN**
Tel: (353/1) 883399
Telex: 30439

Hewlett-Packard Ltd.
75 Belfast Rd, Carrickfergus
Belfast BT38 8PH
NORTHERN IRELAND
Tel: 09603-67333
Telex: 747626

ISRAEL

Eldan Electronic Instrument Ltd.
P.O. Box 1270
JERUSALEM 91000
16, Ohaliav St.
JERUSALEM 94467
Tel: 533 221, 553 242
Telex: 25231 AB/PAKRD IL

Computation and Measurement
Systems (CMS) Ltd.
11 Masad Street
67060
TEL-AVIV
Tel: 388 388
Telex: 33569 Motil IL

ITALY

Hewlett-Packard Italiana Spa
Via G. di Vittorio 10
20094 **CORSICO (MI)**
Tel: 02/4408351
Fax: 02/4409964

Hewlett-Packard Italiana Spa
Via Nuova Rivoltana 95
20090 **LIMITO (MI)**
Tel: 02/75761
Fax: 02/7576230

Hewlett-Packard Italiana Spa
Via Emilia 51/C
40011 **ANZOLA**
DELL'EMILIA (BO)
Tel: 051/731061

Hewlett-Packard Italiana Spa
Via M. Ricci 17 - Palombina Nuova
60100 **ANCONA**
Tel: 071/883782

Hewlett-Packard Italiana Spa
Traversa 99C Giulio Petroni 19
70124 **BARI**
Tel: 080/410744
Fax: 080/417891

Hewlett-Packard Italiana Spa
Via Principe Nicola 43G/C
95126 **CATANIA**
Tel: 095/371087
Fax: 095/388569

Hewlett-Packard Italiana Spa
Via G. Di Vittorio 9
20063 **CERNUSCO S/N (MI)**
Tel: 02/923691
Fax: 02/9237746

Hewlett-Packard Italiana Spa
Via Sacco e Vanzetti 1/A
50145 **FIRENZE**
Tel: 055/318533
Fax: 055/373965

Hewlett-Packard Italiana Spa
Viale Brigata Bisagno 2
16129 **GENOVA**
Tel: 010/541141
Fax: 010/591733

Hewlett-Packard Italiana Spa
Via Orazio 16
80122 **NAPOLI**
Tel: 081/7611444
Fax: 081/680164

Hewlett-Packard Italiana Spa
Via Pellizzo 15
35128 **PADOVA**
Tel: 049/8070166
Fax: 049/773097

Hewlett-Packard Italiana Spa
Via Del Tintoretto 200
00144 **ROMA**
Tel: 06/54831
Fax: 06/5408710

SALES OFFICES
Arranged alphabetically by country (cont'd)

ITALY (Cont'd)

Hewlett-Packard Italiana Spa
Corso Svizzera 185
10149 **TORINO**
Tel: 011/744044
Fax: 011/7710815

IVORY COAST

Ste Ivoirienne des Techniques
de l'Informatique
Immeuble C.N.A. - 5e etage
Avenue General de Gaulle
P.O. Box 161
ABIDJAN 01
Tel: 32 12 27
Telex: 22149

Engineering Business Concept (E.B.C.)
Angle Avenue J. Anoma et Bd.
République
08 B.P. 323 **ABIDJAN** 08
Tel: 32 50 24, 41 48 70
Fax: 35 37 90

JAPAN

Yokogawa-Hewlett-Packard Ltd.
Nihon-Seimei Akita
Chuo-Dori Bldg.
4-2-7 Naka-dori
AKITA, 010
Tel: (81/188) 36-5021

Yokogawa-Hewlett-Packard Ltd.
152-1, Onna
ATSUGI, Kanagawa, 243
Tel: (81/462) 25-0031
Fax: (81/462) 25-0064

Yokogawa-Hewlett-Packard Ltd.
3-1 Motochiba-Cho
CHIBA, 280
Tel: (81/472) 25-7701
Fax: (81/472) 21-0382

Yokogawa-Hewlett-Packard Ltd.
Dai-3 Hakata-Kaisei Bldg.
1-3-6 Hakata-eki Minami
Hakata-Ku, **FUKUOKA** 812
Tel: (81/92) 472-8731

Yokogawa-Hewlett-Packard Ltd.
Nihon-Dantai-Seimei-
Koriyama Bldg.
21-10 Toramaru-Cho,
Koriyama **FUKUSHIMA,** 963
Tel: (81/249) 39-7111

Yokogawa-Hewlett-Packard Ltd.
Yasuda-Seimei Hiroshima Bldg.
6-11, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: (81/82) 241-0611
Fax: (81/82) 241-0619

Yokogawa-Hewlett-Packard Ltd.
Issei Bldg.
2-3-17 Takezono, Tsukuba
IBARAGI, 305

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg.
1-4-73, Sanno-maru
Mito, **IBARAKI** 310
Tel: (81/292) 25-7470

Yokogawa-Hewlett-Packard Ltd.
Towa Building 2-2-3
Kaigan-dori, Chuo-ku
KOBE, 650
Tel: (81/78) 392-4791
Fax: (81/78) 392-4839

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi 82 Bldg.
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (81/485) 24-6563
Fax: (81/485) 24-9050

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614 Higashi-Shiokoji-cho
Karasuma-Nishi-Iru, Shiokoji-Dori
Shimogyo-Ku, **KYOTO,** 600
Tel: (81/75) 343-0921
Fax: (81/75) 343-4356

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg.
1-4-73, Sanno-Maru
MITO, Ibaraki 310
Tel: (81/292) 25-7470
Fax: (81/292) 31-6589

Yokogawa-Hewlett-Packard Ltd.
Nagano-Tokyokaiiyo Bldg.
1081, Minamiagata-Machi
Nagano-Shi, **NAGANO,** 380
Tel: (81/262) 24-8012
Fax: (81/262) 24-8016

Yokogawa-Hewlett-Packard Ltd.
Nagoya Kokusai Center Building
1-47-1, Nagono, Nakamura-ku
NAGOYA, AICHI 450
Tel: (81/52) 571-5171
Fax: (81/52) 565-0896

Yokogawa-Hewlett-Packard Ltd.
Sai-Kyo-Ren Building
1-2 Dote-cho
OOMIYA-SHI SAITAMA 330
Tel: (0486) 45-8031

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg., 5-4-20 Nishi-Nakajima
4-20 Nishinakajima, 5 Chome,
Yodogawa-ku
OSAKA, 532
Tel: (81/6) 304-6021
Fax: (81/6) 304-0216

Yokogawa-Hewlett-Packard Ltd.
1-27-15, Yabe
SAGAMIHARA Kanagawa, 229
Tel: (81/427) 59-1311

Yokogawa-Hewlett-Packard Ltd.
Hamamtsu Motoshiro-Cho Daichi
Seimei Bldg 219-21, Motoshiro-Cho
Hamamatsu-shi
SHIZUOKA, 430
Tel: (81/534) 56-1771
Fax: (81/534) 552371

Yokogawa-Hewlett-Packard Ltd.
Shinjuku Daiichi Seimei Bldg.
Nishi Shinjuku 2-7-1,
Shinjuku-ku,**TOKYO** 163
Tel: (81/3) 348-4611
Fax: (81/3) 348-7969

Yokogawa-Hewlett-Packard Ltd.
9-1, Takakura-cho
Hachioji-shi, **TOKYO,** 192
Tel: 81-426-42-1231

Yokogawa-Hewlett-Packard Ltd.
Tokyo-Nissam-Minato Bldg.
1-6-34 Konan, Minato-Ku
TOKYO 108
Tel: (81/3) 458-5411

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaido-Higashi, 3-chome
Suginami-ku **TOKYO** 168
Tel: (03) 331-6111
Telex: 232-2024 YHPTOK

Yokogawa Hokushin Electric Corp.
(YEW)
Shinjuku-NS Bldg. 10F
9-32 Nokacho 2 Chome
Shinjuku-ku
TOKYO, 163
Tel: (03) 349-1859
Telex: J27584

Yokogawa-Hewlett-Packard Ltd.
Toyoda-Tokyo-Kaijo Bldg.
1-179 Miyuki-Hon-Cho
TOYODA 473
Tel: (81/565) 27-5611

Yokogawa-Hewlett-Packard Ltd.
Chiyodaseimei-Utsunomiya Bldg.
2-3-1, Ohdori, **UTSUNOMIYA,** Tochigi-
Shi 320
Tel: (81/286) 33-1153
Fax: (81/286) 33-1175

Yokogawa-Hewlett-Packard Ltd.
No. 2 Yasuda Bldg.
2-32-12, Tsuruyo-cho
Kanagawa-ku, **YOKOHAMA** 221
Tel: (81/45) 312-1252
Fax: (81/45) 311-8328

KENYA

ADCOM Ltd., Inc., Kenya
P.O. Box 30070
NAIROBI
Tel: 331955
Telex: 22639

KOREA

Samsung Hewlett-Packard Co. Ltd.
Dongbang Yeoeuido Building
36-1 Yeoeui Do-Dong
Youngdeungpo-Ku
SEOUL, 150
Tel: (82/2) 784-4666, 784-2666
Fax: (82/2) 784-7084
Telex: 25166 SAMSAN K

KUWAIT

Al-Khaldiya Trading & Contracting
P.O. Box 830
SAFAT 13009
Tel: 242 49 10, 241 17 26
Telex: 22481 AREEG KT
Cable: VISCOUNT

LEBANON

Computer Information Systems S.A.L.
Chammas Building
P.O. Box 11-6274
DORA BEIRUT
Tel: 89 31 13, 58 18 35
Telex: 42309 chacis le
Fax: 58 18 34

LUXEMBOURG

Hewlett-Packard Belgium S.A./N.V.
Blvd de la Woluwe, 100
Woluwedal
B-1200 **BRUSSELS**
Tel: (32/2) 761-3111
Telex: 23-494 paloben bru

MADAGASCAR

R.T.I.
175, Rue Blomet
75015 Paris
FRANCE
Tel: (1) 45 31 09 06
Tlx: 203376
Fax: (1) 45 31 09 18

MALAWI

Systron (Private) Ltd.
Manhattan Court
61 Second Street
P.O. Box 3458
HARARE
Zimbabwe
Tel: 739881/739885
Telex: 4122
Fax: 70 20 08

MALAYSIA

Hewlett-Packard Sales (Malaysia)
Sdn. Bhd.
9th Fioor
Chung Khiaw Bank Building
46, Jalan Raja Laut
50350 **KUALA LUMPUR, MALAYSIA**
Tel: (60/3) 298-6555
Fax: (60/3) 291-5495

Protel Engineering
P.O.Box 1917
Lot 6624, Section 64
23/4 Pending Road
Kuching, **SARAWAK**
Tel: 36299
Telex: 70904 PROMAL MA
Cable: PROTELENG

MALTA

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Telex: 203376
Fax: (1) 45 31 09 18

MAURITANIA

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Tlx: 203376
Fax: (1) 45 31 09 18

MAURITIUS

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Telex: 203376
Fax: (1) 45 31 09 18

MEXICO

Hewlett-Packard de Mexico,
S.A. de C.V.
Rio Nio No. 4049 Desp. 12
Fracc. Cordoba
JUAREZ, Mexico
Tel: 161-3-15-62

Hewlett-Packard de Mexico,
S.A. de C.V.
Condominio Kadereyta
Circuito del Mezon No. 186 Desp. 6
Col. Del Prado - 76030
QRO, Mexico
Tel: 463-6-02-71

Hewlett-Packard de Mexico,
S.A. de C.V.
Monti Morelos No. 299
Fraccionamiento Loma Bonita 45060
GUADALAJARA, Jalisco
Tel: (52/36) 31 46 00
Telex: 0684 186 ECOME

Hewlett-Packard de Mexico,
S.A. de C.V.
Monte Pelvoux No. 111
Lomas de Chapultepec
11000 **MEXICO, D.F.**
Tel: (52/5) 596 79 33
Fax: (52/5) 596 42 08 (Ext 3231)

Hewlett-Packard de Mexico,
S.A. de C.V.
Czda. del Valle
409 Ote. 4th Piso
Colonia del Valle
Municipio de Garcia
66220 **NUEVO LEON**
Tel: 83-78-42-40
Telex: 382410 HPMY

Hewlett-Packard Co.
Latin America Region
Customer Support Center
7208 N.W. 31st St.
MIAMI, FL 33122
United States
Tel: (305) 599-0465
Telex: 441603 HPMIAMI
Fax: 599-0277

Hewlett-Packard de Mexico,
S.A. de C.V.
Blvd. Independencia No. 2000 Ote.
Ote Zerpiso
Co 1 Estrella
27010 **TORREON, COA.**
Tel: (52/171) 8 22 01

MOROCCO

Sicotel
Complexe des Habous
Tour C, avenue des Far
CASABLANCA 01
Tel: 31 22 70
Telex: 27604

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Tlx: 203376
Fax: (1) 45 31 09 18

Socofren Maroc
164, Boulevard D' Anfa
CASABLANCA
Tel: 36 08 84, 36 01 77
Telex: 23940

NETHERLANDS

Hewlett-Packard Nederland
Startbaan 16
1187 XR **AMSTELVEEN**
Tel: (31/20) 5476911
Telex: 13 216 HEPA NL
Fax: (31/20) 471825

Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2900AA **CAPELLE A/D IJSSEL**
Tel: 31-20-51-6444
Telex: 21261 HEPAC NL

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
P.O. Box 2342
NL 5600 CH **EINDHOVEN**
Tel: 31-40-32-6911
Telex: 51484 hepae nl
Fax: (31/40) 446546

NEW ZEALAND

Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, **AUCKLAND**
Tel: (64/9) 605-651
Fax: (64/9) 600-507

Hewlett-Packard (N.Z.) Ltd.
186-190 Willis Street
P.O. Box 9443
WELLINGTON
Tel: (64/4) 820-400
Fax: (64/4) 843-380

NIGER

S.I.T.E.L.
Immeuble le General
Avenue General de Gaulle
PO Box 161
ABIDJAN 01
Ivory Coast
Tel: 32 12 27
Telex: 22149

NIGERIA

Management Information Systems Ltd.
3 Gerrard Road, Ikoyi
LAGOS
Tel: 68 08 87
Telex: 23582
Fax: 68 54 87

NORTHERN IRELAND

See United Kingdom

NORWAY

Hewlett-Packard Norway A/S
Oesterndalen 16-18
P.O. Box 34
N-1345 **OESTERAAS**
Tel: (47/2) 24-6090
Telex: 76621 HPNAS N

Hewlett-Packard Norway A/S
Boemergt. 42
Box 2470
N-5037 **SOLHEIMSVIK**
Tel: (5/29) 10 72

OMAN

Suhail & Saud Bahwan
P.O.Box 169
MUSCAT/SULTANATE OF OMAN
Tel: 79 37 41
Telex: 3585 mb
Fax: 79 61 58

Imtac LLC
P.O. Box 9196
MINA AL FAHAL/SULTANATE OF OMAN
Tel: 70-77-27, 70-77-23
Telex: 3865 Tawoos On

PAKISTAN

Mushko & Company Ltd.
House No. 16, Street No. 16
Sector F-6/3
ISLAMABAD
Tel: 824545
Telex: 54001 Muski Pk
Cable: FEMUS Islamabad

Mushko & Company Ltd.
Oosman Chambers
Abdullah Haroon Road
KARACHI 0302
Tel: 524131, 524132
Telex: 2894 MUSKO PK
Cable: COOPERATOR Karachi

PANAMA

Electronico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA CITY
Tel: 9-011-507-636613
Telex: 368 3483 ELECTRON PG

PERU

Cia Electro Médica S.A. (ERMED)
Los Flamencos 145, Ofc. 301/2
San Isidro
Casilla 1030
LIMA 1 Peru
Tel: 9-011-511-4-414325, 41-3705
Telex: 39425257 PE PB SIS

PHILIPPINES

The Online Advanced Systems Corp.
2nd Floor, Electra House
115-117 Esteban Street
P.O. Box 1510
Legaspi Village, Makati
Metro **MANILA**
Tel: 815-38-10 (up to 16)
Telex: 63274 ONLINE PN

PORTUGAL

Mundinter Intercambio
Mundial de Commercio
Avenida Antonio 2761
LISBON
Tel: 53 21 31, 53 21 37
Telex: 16691

CPC Instrumentacao
Torre de Santo Antonio
rue Gregorio Lopes, Lote
Restelo
1400 **LISBON**
Tel: 617343/44/45/46
Telex: 27432/26054
Fax: 617345

C.P.C.S.I.
Rua de Costa Cabral 575
4200 **PORTO**
Tel: 493122
Telex: 26054, 27432
Fax: 48 87 21

PUERTO RICO

Hewlett-Packard Puerto Rico
Box 4048
Aguadilla, PR 00605
Tel: (809) 891-5235

Hewlett-Packard Puerto Rico
101 Munoz Rivera Avenue
Esu. Calle Ochoa
HATO REY, 00918
Tel: (809) 754-7800

QATAR

Qatar Datamation Systems
P.O. Box 350
DOHA
Tel: 41 32 82
Tlx: 4833
Fax: 42 63 78

REUNION ISLAND

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (33/1) 45310906
Telex: 42/203376

RWANDA

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (33/1) 45310906
Telex: 42/203376
Fax: (1) 45 31 09 18

SAUDI ARABIA

Modern Electronics Establishment
P.O. Box 281
Thuobah
AL-KHOBAR 31952
Tel: 895-1760, 895-1764
Telex: 671 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR

Modern Electronics Establishment
P.O. Box 1228
Redec Plaza, 6th Floor
JEDDAH
Tel: 644 96 28
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH

Modern Electronics Establishment
P.O.Box 22015
RIYADH 11495
Tel: 4763030
Telex: 402040 MEERYD SJ

SCOTLAND

See United Kingdom

SENEGAL

2SC
10, rue Tolbiac
B.P. 3716
DAKAR R.P.
(Please contact R.T.I. France.)
Tel: (221) 222248
Telex: 906/671

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: 45310906
Telex: 203376
Fax: (1) 45 31 09 18

SINGAPORE

Hewlett-Packard Singapore Ltd.
1150 Depot Road
SINGAPORE, 0410
Tel: (65) 273 7388
Fax: (65) 278 8990

SOUTH AFRICA

Hi Performance Systems (Pty.) Ltd.
P.O. Box 120, Howard Place
CAPE TOWN 7450
Tel: (27/21) 53-7954
Fax: (27/21) 53-5119

Hi Performance Systems (Pty.) Ltd.
Private Bag Wendywood
SANDTON 2144
Tel: (27/11) 802-5111
Fax: (27/11) 802-6332

SPAIN

Hewlett-Packard Española, S.A.
Avda. Diagonal, 605
08028-**BARCELONA**
Tel: (34/3) 401 91 00
Telex: 52603 hpbee

Bilbao (Vizcaya) Sales
Hewlett-Packard Español, S.A.
Avda. Zugazarte, 8
48930 - Las Arenas - **VIZCAYA**

Hewlett-Packard Española, S.A.
Crta. N-VI, Km. 16, 500
Las Rozas
E-MADRID
Tel: (34/1) 6370011
Telex: 23515 HPE

Hewlett-Packard Española, S.A.
Avda. S. Francisco Javier, S/N
Planta 10. Edificio Sevilla 2
E-SEVILLA 5, SPAIN
Tel: (34/54/64) 4454
Telex: 72933

Hewlett-Packard Española, S.A.
Isabel La Catolica, 8
46004 **VALENCIA**
Tel: (34/6) 351 59 44
Telex: 63435
Fax: (34/6) 351 59 44

Hewlett-Packard Española, S.A.
Avda. de Zugazarte, 8
48930 - Las Arenas
VIZCAYA
Tel: (34/4) 464 32 55
Telex: 33032

SUDAN

Mediterranean Engineering &
Trading Co., Ltd.
P.O. Box 1025
KHARTOUM
Tel: (249) 41184
Telex: 24052

R.T.I.
175, Rue Blomet
75015 **PARIS**
France
Tel: (1) 45 31 09 06
Tlx: 203376
Fax: (1) 45 31 09 18

SWEDEN

Hewlett-Packard Sverige AB
Östra Tullgatan 3
20011 **MALMÖ**
Box 6132
Tel: (46/40) 702 70
Telex: (854) 17886 (via Spånga office)
Fax: (46/40) 97 74 18

Hewlett-Packard Sverige AB
Elementvagen 16
S-7022 7 **ÖREBRO**
Tel: (49/19) 10 48 80
Telex: (854) 17886 (via Spånga office)

Hewlett-Packard Sverige AB
Skalholtsgatan 9, Kista
P.O. Box 19
S-16493 **KISTA**
Tel: 46/8/750-200
Telex: (854) 17886
Telefax: (08) 7527781

Hewlett-Packard Sverige AB
Box 266
Topasgatan 1A
S-42123 **VÄSTRA-FRÖLUNDA**
(Gothenburg)
Tel: (031) 891000
Telex: (854) 17886 (via Spånga office)

SWITZERLAND

Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 **BASEL**
Tel: (41/61) 681 59 20
Fax: (41/61) 681 98 59

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case postale 365-1366
CH-1217 **MEYRIN** 1
Tel: (41/22) 7804111
Telex:27333 HPAG CH

Hewlett-Packard (Schweiz) AG
Allmend
CH-8967 **WIDEN**
Tel: (41/57) 321 111
Telex: 53933 HPAG CH
Fax: (41/57) 321 475

SYRIA

Middle East Electronics
P.O.Box 2308
Abu Rumaneh
DAMASCUS
Tel: 33 45 92
Telex: 411 771 Meesy

TAIWAN

Hewlett-Packard Taiwan Ltd.
Taipei Office
8th Floor, Hewlett-Packard Building
337 Fu Hsing North Road
TAIPEI
Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable: HEWPACK Taipei

Hewlett-Packard Taiwan Ltd.
THM Office
2, Huan Nan Road
CHUNG LI, Taoyuan
Tel: (034) 929-666

SALES OFFICES
Arranged alphabetically by country (cont'd)

TAIWAN (Cont'd)

Hewlett-Packard Taiwan Ltd.
Taichung Office
5FL, 67, Sec. 3,
Wen-Hsin Road,
TAICHUNG
Tel: (04) 254-1201

Hewlett-Packard Taiwan Ltd.
Kaohsiung Office
11/F, 456, Chung Hsiao 1st Road
KAOHSIUNG
Tel: (07) 2412318

TANZANIA

Adcom Ltd, Inc. Kenya
P.O. Box 30070
NAIROBI
Kenya
Tel: 33 19 55
Telex: 22639

THAILAND

Unimesa Co. Ltd.
2540 Sukumwit Avenue
Bangna
BANGKOK 10260
Tel: 662-398-6953
Telex: 84439 Simonco TH
Cable: UNIMESA Bangkok

TOGO

S.I.T.E.L.
Immeuble le General
Avenue General de Gaulle
P.O. Box 161
ABIDJAN 01
Ivory Coast
Tel: 32 12 27
Telex: 22149

Societe Africaine De Promotion
Immeuble Sageb
Rue d'Atakpame
P.O. Box 4150
LOME
Tel: 21-62-88
Telex: 5357

TRINIDAD & TOBAGO

Caribbean Telecoms Ltd.
Corner McAllister Street &
Eastern Main Road, Laventille
P.O. Box 732
PORT-OF-SPAIN
Tel: 624-4213
Telex: 22561 CARTEL WG
Cable: CARTEL, PORT OF SPAIN

Computer and Controls Ltd.
P.O. Box 51
1 Taylor Street
PORT-OF-SPAIN
Tel: (809) 622-7719/622-7985
Telex: 38722798 COMCON WG
LOOGO AGENCY 1264

TUNISIA

Precision Electronique
5, rue de Chypre
Mutuelleville
1002 **TUNIS BELVEDERE**
Tunisia
Tel: 78 50 37
Tlx: 13238

TURKEY

E.M.A.
Mediha Eldem Sokak No. 41/6
Yenisehir
ANKARA
Tel: 131 4695, 131 9175
Telex: 46912n emsetr
Cable: EMATRADE ANKARA

Hewlett-Packard Bilgisayar Ve Olcum Sistemleri A.S. (Headquarter)
Mesrutiyet Mah. 19 Mayis Cad.
Nova-Baran Plaza Kat: 11-12
SISLI / ISTANBUL
Tel: 175 29 70
Telex: 39150
Fax: 175 29 92

Hewlett-Packard Bilgisayar Ve Olcum Sistemleri A.S.
Paris Caddesi No 3
Diare 9
06670 **ANKARA**
Tel: 125 83 13
Telex: 46180
Fax: 125 47 45

UGANDA

Adcom Ltd, Inc. Kenya
P O Box 30070
NAIROBI
Kenya
Tel: 33 19 55
Telex: 22639

UNITED ARAB EMIRATES

Emitac Ltd.
P.O. Box 1641
SHARJAH
Tel: 591181
Telex: 48710 EMITAC EM
Cable: EMITAC SHARJAH

Emitac Ltd.
P.O. Box 2711
ABU DHABI
Tel: 820419-20
Cable: EMITACH ABUDHABI

Emitac Ltd.
P.O. Box 8391
DUBAI,
Tel: 377591

Emitac Ltd.
P.O. Box 473
RAS AL KHAIMAH
Tel: 28133, 21270

UNITED KINGDOM

ENGLAND

Hewlett-Packard Ltd.
Customer Information Centre
King St. Lane
Winnersh, Wokingham
GB-**BERKSHIRE** RG11 5AR
Tel: (44/734) 784774
Telex: 847178
Fax: 777285

Hewlett-Packard Ltd.
Miller House
The Ring, **BRACKNELL**
Berkshire RG12 1XN
Tel: (44/344) 424-898
Fax: (44/344) 860015, Ext 56023

Hewlett-Packard Ltd.
Customer Sales & Support
Building 1, Filton Road
Stoke Gifford
BRISTOL, BS12 6QZ
Tel: (44/272) 236000

Hewlett-Packard Ltd.
Oakfield House, Oakfield Grove
Clifton **BRISTOL,** Avon BS8 2BN
Tel: 44-272-736 806
Telex: 444302

Hewlett-Packard Ltd.
9 Bridewell Place
LONDON EC4V 6BS
Tel: (44/583) 6565
Fax: (44/583) 6565, Ext 4713

Hewlett-Packard Ltd.
Heathside Park Rd.
Cheadle Heath, Stockport
GB-**MANCHESTER** SK3 ORB
Tel: (44/61) 428-0828
Telex: 668068
Fax: 4955009

Hewlett-Packard Ltd.
Harman House
No. 1 George St.
Uxbridge,
GB-**MIDDLESEX** UB8 1YH
Tel: (44/895) 72020
Telex: 893135
Fax: 73684

Hewlett-Packard Ltd.
Pontefract Road
NORMANTON,
West Yorkshire WF6 1RN
Tel: (44/924) 895-566
Fax: (44/924) 896-691
Telex: 557355

Hewlett-Packard Ltd.
The Quadrangle
106-118 Station Road
REDHILL, Surrey RH1 1PS
Tel: 44-737-686-55
Telex: 947234

Hewlett-Packard Ltd.
Avon House
435 Stratford Road
Shirley, **SOLIHULL,** West Midlands
B90 4BL
Tel: 44-21-745-8800
Telex: 339105

Hewlett-Packard Ltd.
Heathside Park Road
Cheadle Heath, Stockport
Cheshire SK3 ORB
Tel: (44/61) 428-0828
Fax: (44/61) 495-5009
Telex: 668068

Hewlett-Packard Ltd.
Harman House
No. 1 George Street
UXBRIDGE, Middlesex UB8 1YH
Tel: (44/895) 72020
Fax: (44/895) 73684

Hewlett-Packard Ltd.
King Street Lane
Winnersh, **WOKINGHAM**
Berkshire RG11 5AR
Tel: (44/734) 784774
Fax: (44/734) 777285 Ext 52285

NORTHERN IRELAND

Hewlett-Packard (Ireland) Ltd.
Carrickfergus Industrial Centre
75 Belfast Road, Carrickfergus
CO. ANTRIM BT38 8PM
Tel: 09603 67333

Unit 5
Bridgewood House
Newforge Lane
Malone Road
BELFAST BT95 NW
Tel: (353/232) 664-851
Fax: (353/232) 665-619

SCOTLAND

Hewlett-Packard Ltd.
1/3 Springburn Place
College Milton North
EAST KILBRIDE, G74 5NU
Tel: 035-52-49261
Fax: 03552-35929
Telex: 779615

Hewlett-Packard Ltd.
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031-331-1188
Fax: 031-331-7412

UNITED STATES

Hewlett-Packard Co.
Customer Information Center
Tel: (800) 752-0900
Hours: 6:00 AM to 5:00 PM
Pacific Time

Alabama

Hewlett-Packard Co.
2100 Riverchase Center
Building 100 - Suite 118
BIRMINGHAM, AL 35244
Tel: (205) 988-0547
Fax: (205) 988-5308

Hewlett-Packard Co.
620 Discovery Dr.
HUNTSVILLE, AL 35806
Tel: (205) 830-2000
Fax: (205) 830-1427

Alaska

Hewlett-Packard Co.
4000 Old Seward Highway
Suite 101
ANCHORAGE, AK 99503
Tel: (907) 563-8855
Fax: (907) 561-7409

Arizona

Hewlett-Packard Co.
8080 Pointe Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000
Fax: (602) 273-8080

Hewlett-Packard Co.
3400 East Britannia Dr.
Bldg. C, Suite 124
TUCSON, AZ 85706
Tel: (602) 573-7400
Fax: (602) 573-7429

Arkansas

Hewlett-Packard Co.
10816 Executive Center Dr
Conway Bldg. Suite 116
LITTLE ROCK, AR 72211
Tel: (501) 225-7178
Fax: (501) 221-3614

California

Hewlett-Packard Co.
26701 W. Argoura Rd.
CALABASAS, CA 91302
Tel: (818) 880-3400
Fax: (818) 880-3437

Hewlett-Packard Co.
353 Lakeside Dr
FOSTER CITY, CA 94404
Tel: (415) 378-8400
Fax: (415) 378-8405

Hewlett-Packard Co.
1907 North Gateway Blvd.
FRESNO, CA 93727
Tel: (209) 252-9652
Fax: (209) 456-9302

Hewlett-Packard Co.
1421 S. Manhattan Av.
FULLERTON, CA 92631
Tel: (714) 999-6700
Fax: (714) 778-3033

Hewlett-Packard Co.
7408 Hollister Ave. #A
GOLETA, CA 93117
Tel: (805) 685-6100
Fax: (805) 685-6163

Hewlett-Packard Co.
9800 Muirlando Ave.
IRVINE, CA 92718
Tel: (714) 472-3000
Fax: (714) 581-3607 (Direct Dial only)

Hewlett-Packard Co.
2525 Grand Avenue
LONG BEACH, CA 90815
Tel: (213) 498-1111
Fax: (213) 494-1986

Hewlett-Packard Co.
5651 West Manchester Ave.
LOS ANGELES, CA 90045
Tel: (213) 337-8000
Fax: (213) 337-8338

Hewlett-Packard Co.
321 E. Evelyn Ave.
Bldg. 330
MOUNTAIN VIEW, CA 94039
Tel: (415) 694-2000
Fax: (415) 694-0600

Hewlett-Packard Co.
5161 Lankershim Blvd.
NORTH HOLLYWOOD, CA 91601
Tel: (818) 505-5600
Fax: (818) 505-5875

Hewlett-Packard Co.
5725 W. Las Positas Blvd.
PLEASANTON, CA 94566
Tel: (415) 460-0282
Fax: (415) 460-0713

Hewlett-Packard Co.
4244 So. Market Court, Suite A
SACRAMENTO, CA 95834
Tel: (916) 929-7222
Fax: (916) 927-7152

Hewlett-Packard Co.
9606 Aero Drive
SAN DIEGO, CA 92123
Tel: (619) 279-3200
Fax: (619) 268-8487

Hewlett-Packard Co.
50 Fremont St. Suite 200
SAN FRANCISCO, CA 94105
Tel: (415) 882-6800
Fax: (415) 882-6805

Hewlett-Packard Co.
3003 Scott Boulevard
SANTA CLARA, CA 95054
Tel: (408) 988-7000
Fax: (408) 988-7103

Hewlett-Packard Co.
5280 Valentine Rd. Suite 205
VENTURA, CA 93003
Tel: (805) 658-6898
Fax: (805) 650-0721

Colorado

Hewlett-Packard Co.
2945 Center Green Court South
Suite A
BOULDER, CO 80301
Tel: (303) 938-3065
Fax: (303) 938-3025

Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000
Fax: (303) 649-5787

Connecticut

Hewlett-Packard Co.
3 Parkland Dr.
DARIEN, CT 06820
Tel: (203) 656-0040
Fax: (203) 656-5563

Hewlett-Packard Co.
115 Glastonbury Blvd
GLASTONBURY, CT 06033
Tel: (203) 633-8100
Fax: (203) 659-6087

Florida

Hewlett-Packard Co.
5900 N. Andrews, Suite 100
FORT LAUDERDALE, FL 33309
Tel: (305) 938-9800
Fax: (305) 938-2293

Hewlett-Packard Co.
6800 South Point Parkway
Suite 301
JACKSONVILLE, FL 32216
Tel: (904) 636-9955
Fax: (904) 636-9955

Hewlett-Packard Co.
255 East Drive, Suite B
MELBOURNE, FL 32901
Tel: (407) 729-0704
Fax: (407) 723-4557

Hewlett-Packard Co.
6177 Lake Ellenor Drive
ORLANDO, FL 32809
Tel: (407) 859-2900
Fax: (407) 826-9309

Hewlett-Packard Co.
4700 Bayou Blvd.
Building 5
PENSACOLA, FL 32503
Tel: (904) 476-8422
Fax: (904) 476-4116

Hewlett-Packard Co.
5550 Idlewild, #150
TAMPA, FL 33634
Tel: (813) 884-3282
Fax: (813) 889-4445

Georgia

Hewlett-Packard Co.
2015 South Park Place
ATLANTA, GA 30339
Tel: (404) 955-1500
Fax: (404) 980-7669

Hewlett-Packard Co.
3607 Parkway Lane
Suite 300
NORCROSS, GA 30092
Tel: (404) 448-1894
Fax: (404) 246-5206

Hawaii

Hewlett-Packard Co.
Pacific Tower
1001 Bishop St.
Suite 2400
HONOLULU, HI 96813
Tel: (808) 526-1555
Fax: (808) 536-7873

Idaho

Hewlett-Packard Co.
11309 Chinden Blvd.
BOISE, ID 83714
Tel: (208) 323-2700
Fax: (208) 323-2528

Illinois

Hewlett-Packard Co.
2205 E. Empire St.
BLOOMINGTON, IL 61704
Tel: (309) 662-9411
Fax: (309) 662-0351

Hewlett-Packard Co.
525 W. Monroe St., Suite 1308
CHICAGO, IL 60606
Tel: (312) 930-0010
Fax: (312) 930-0986

Hewlett-Packard Co.
1200 East Diehl Road
NAPERVILLE, IL 60566
Tel: (312) 357-8800
Fax: (312) 357-9896

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800
Fax: (312) 259-5878

Indiana

Hewlett-Packard Co.
11911 N. Meridian St.
CARMEL, IN 46032
Tel: (317) 844-4100
Fax: (317) 843-1291

Hewlett-Packard Co.
111 E. Ludwig Road
Suite 108
FT. WAYNE, IN 46825
Tel: (219) 482-4283
Fax: (219) 482-9907

Iowa

Hewlett-Packard Co.
4050 River Center Court
CEDAR RAPIDS, IA 52402
Tel: (319) 393-0606
Fax: (319) 378-1024

Hewlett-Packard Co.
4201 Corporate Dr.
WEST DES MOINES, IA 50265
Tel: (515) 224-1435
Fax: (515) 224-1870

Kansas

Hewlett-Packard Co.
North Rock Business Park
3450 N. Rock Rd.
Suite 300
WICHITA, KS 67226
Tel: (316) 636-4040
Fax: (316) 636-4504

Kentucky

Hewlett-Packard Co.
305 N. Hurstbourne Lane,
Suite 100
LOUISVILLE, KY 40222
Tel: (502) 426-0100
Fax: (502) 426-0322

Louisiana

Hewlett-Packard Co.
160 James Drive East
ST. ROSE, LA 70087
Tel: (504) 467-4100
Fax: (504) 467-4100 x 291

Maryland

Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 644-5800
Fax: (301) 362-7650

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370
Fax: (301) 948-5986

Massachusetts

Hewlett-Packard Co.
1775 Minuteman Road
ANDOVER, MA 01810
Tel: (508) 682-1500
Fax: (508) 794-2619

Hewlett-Packard Co.
29 Burlington Mall Rd.
BURLINGTON, MA 01803-4514
Tel: (617) 270-7000
Fax: (617) 221-5240

Michigan

Hewlett-Packard Co.
3033 Orchard Vista S.E.
GRAND RAPIDS, MI 49546
Tel: (616) 957-1970
Fax: (616) 956-9022

Hewlett-Packard Co.
39550 Orchard Hill Place Drive
NOVI, MI 48050
Tel: (313) 349-9200
Fax: (313) 349-9240

Hewlett-Packard Co.
560 Kirts Rd.
Suite 101
TROY, MI 48084
Tel: (313) 362-5180
Fax: (313) 362-3028

Minnesota

Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100
Fax: (612) 641-9787

Mississippi

Hewlett-Packard Co.
800 Woodland Parkway, Suite 101
RIDGELAND, MS 39157
Tel: (601) 957-0730
Fax: (601) 957-2515

Missouri

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON 63044
Tel: (314) 344-5100
Fax: (314) 344-5273

Hewlett-Packard Co.
6601 Winchester Ave.
KANSAS CITY, MO 64133
Tel: (816) 737-0071
Fax: (816) 737-4690

Montana

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MT 63044
Tel: (314) 344-5100
Fax: (314) 344-5273

Nebraska

Hewlett-Packard
11626 Nicholas St.
OMAHA, NE 68154
Tel: (402) 493-0300
Fax: (402) 493-4334

New Jersey

Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07653
Tel: (201) 599-5000
Fax: (201) 599-5382

Hewlett-Packard Co.
10 Sylvan Way
PARSIPPANY, NJ 07054
Tel: (201) 682-4000
Fax: (201) 682-4031

Hewlett-Packard Co.
20 New England Av.
PISCATAWAY, NJ 08854
Tel: (201) 562-6100
Fax: (201) 562-6246

New Mexico

Hewlett-Packard Co.
7801 Jefferson N.E.
ALBUQUERQUE, NM 87109
Tel: (505) 823-6100
Fax: (505) 823-1243

Hewlett-Packard Co.
1362-C Trinity Dr.
LOS ALAMOS, NM 87544
Tel: (505) 662-6700
Fax: (505) 662-4312

New York

Hewlett-Packard Co.
5 Computer Drive South
ALBANY, NY 12205
Tel: (518) 458-1550
Fax: (518) 458-1550 x 0393

Hewlett-Packard Co.
130 John Muir Dr.
AMHERST, NY 14228
Tel: (716) 689-3003
Fax: (716) 636-7034

Hewlett-Packard Co.
200 Cross Keys Office Park
FAIRPORT, NY 14450
Tel: (716) 223-9950
Fax: (716) 223-6331

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820
Fax: (315) 451-1820 x 255

Hewlett-Packard Co.
No. 1 Pennsylvania Plaza
55th Floor
34th Street & 7th Avenue
MANHATTAN NY 10119
Tel: (212) 971-0800
Fax: (212) 330-6967

Hewlett-Packard Co.
2975 Westchester Ave
PURCHASE, NY 10577
Tel: (914) 935-6300
Fax: (914) 935-6497

Hewlett-Packard Co.
Executive Square Office Bldg.
66 Middlebush Rd.
WAPPINGERS FALLS, NY 12590
Tel: (914) 298-9125
Fax: (914) 298-9154

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 682-7800
Fax: (516) 682-7806 (2)

North Carolina

Hewlett-Packard Co.
305 Gregson Dr.
CARY, NC 27511
Tel: (919) 467-6600
Fax: (919) 460-2296
(919) 460-2297

Hewlett-Packard Co.
P.O. Box 240318
CHARLOTTE, NC 28224
Tel: (704) 527-8780
Fax: (704) 523-7857

Hewlett-Packard Co.
7029 Albert Pick Rd. #100
GREENSBORO, NC 27409
Tel: (919) 665-1800
Fax: (919) 668-1797
Mailing Address
PO Box 26500
Greensboro, NC 27426

Ohio

Hewlett-Packard Co.
2717 S. Arlington Rd.
AKRON 44312
Tel: (216) 644-2270
Fax: (216) 644-7415

Hewlett-Packard Co.
4501 Erskine Road
CINCINNATI, OH 45242
Tel: (513) 891-9870
Fax: (513) 891-0033

SALES OFFICES
Arranged alphabetically by country (cont'd)

UNITED STATES (Cont'd)

Hewlett-Packard Co.
Moutroffe West Ave.
COPLEY, OH 44321
Tel: (216) 666-7711
Fax: (216) 666-6054

Hewlett-Packard Co.
7887 Washington Village Dr.
DAYTON, OH 45459
Tel: (513) 433-2223
Fax: (513) 433-8633

Hewlett-Packard Co.
9080 Springboro Pike
MIAMISBURG 45342
Tel: (513) 433-2223
Fax: (513) 433-3633

Hewlett-Packard Co.
15885 Sprague Road
STRONGSVILLE, OH 44136
Tel: (216) 243-7300
Fax: (216) 234-7230

Hewlett-Packard Co.
One Maritime Plaza, 5th Floor
720 Water Street
TOLEDO, OH 43604
Tel: (419) 242-2200
Fax: (419) 241-7655

Hewlett-Packard Co.
675 Brooksedge Blvd.
WESTERVILLE, OH 43081
Tel: (614) 891-3344
Fax: (614) 891-1476

Oklahoma

Hewlett-Packard Co.
3525 N.W. 56th St.
Suite C-100
OKLAHOMA CITY, OK 73112
Tel: (405) 946-9499
Fax: (405) 942-2127

Hewlett-Packard Co.
6655 South Lewis,
Suite 105
TULSA, OK 74136
Tel: (918) 481-6700
Fax: (918) 481-2250

Oregon

Hewlett-Packard Co.
9255 S. W. Pioneer Court
WILSONVILLE, OR 97070
Tel: (503) 682-8000
Fax: (503) 682-8155

Pennsylvania

Hewlett-Packard Co.
Heatherwood Industrial Park
50 Dorchester Rd.
P.O. Box 6080
HARRISBURG, PA 17112
Tel: (717) 657-5900
Fax: (717) 657-5946

Hewlett-Packard Co.
111 Zeta Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400
Fax: (412) 963-1300

Hewlett-Packard Co.
2750 Monroe Boulevard
VALLEY FORGE, PA 19482
Tel: (215) 666-9000
Fax: (215) 666-2034

South Carolina

Hewlett-Packard Co.
Brookside Park, Suite 122
1 Harbison Way
COLUMBIA, SC 29212
Tel: (803) 732-0400
Fax: (803) 732-4567

Hewlett-Packard Co.
545 N. Pleasantburg Dr.
Suite 100
GREENVILLE, SC 29607
Tel: (803) 232-8002
Fax: (803) 232-8739

Tennessee

Hewlett-Packard Co.
One Energy Center Suite 200
Pellissippi Pkwy.
KNOXVILLE, TN 37932
Tel: (615) 966-4747
Fax: (615) 966-8147

Hewlett-Packard Co.
889 Ridge Lake Blvd.,
Suite 100
MEMPHIS, TN 38119
Tel: (901) 763-4747
Fax: (901) 762-9723

Hewlett-Packard Co.
44 Vantage Way,
Suite 160
NASHVILLE, TN 37228
Tel: (615) 255-1271
Fax: (615) 726-2310

Texas

Hewlett-Packard Co.
9050 Capital of Texas Highway, North
#290
AUSTIN, TX 78759
Tel: (512) 346-3855
Fax: (512) 338-7201
Mailing Address
PO Box 9431
Austin, TX 78766-9430

Hewlett-Packard Co.
5700 Cromo Dr
EL PASO, TX 79912
Tel: (915) 833-4400
Fax: (915) 581-8097

Hewlett-Packard Co.
10535 Harwin Drive
HOUSTON, TX 77036
Tel: (713) 776-6400
Fax: (713) 776-6495

Hewlett-Packard Co.
3301 West Royal Lane
IRVING, TX 75063
Tel: (214) 869-3377
Fax: (214) 830-8951

Hewlett-Packard Co.
109 E. Toronto, Suite 100
McALLEN, TX 78503
Tel: (512) 630-3030
Fax: (512) 630-1355

Hewlett-Packard Co.
930 E. Campbell Rd.
RICHARDSON, TX 75081
Tel: (214) 231-6101
Fax: (214) 699-4337

Hewlett-Packard Co.
14100 San Pedro Ave., Suite 100
SAN ANTONIO, TX 78232
Tel: (512) 494-9336
Fax: (512) 491-1299

Utah

Hewlett-Packard Co.
3530 W. 2100 South
SALT LAKE CITY, UT 84119
Tel: (801) 974-1700
Fax: (801) 974-1780

Virginia

Hewlett-Packard Co.
840 Greenbrier Circle
Suite 101
CHESAPEAKE, VA 23320
Tel: (804) 424-7105
Fax: (804) 424-1494

Hewlett-Packard Co.
4401 Water Front Dr.
GLEN ALLEN, VA 23060
Tel: (804) 747-7750
Fax: (804) 965-9297

Hewlett-Packard Co.
2800 Electric Road Suite 100
ROANOKE, VA 24018
Tel: (703) 774-3444
Fax: (703) 989-8049

Washington

Hewlett-Packard Co.
15815 S.E. 37th Street
BELLEVUE, WA 98006
Tel: (206) 643-4000
Fax: (206) 643-8748

Hewlett-Packard Co.
N. 1225 Argonne Rd
SPOKANE, WA 99212-2657
Tel: (509) 922-7000
Fax: (509) 927-4236

West Virginia

Hewlett-Packard Co.
501 56th Street
CHARLESTON, WV 25304
Tel: (304) 925-0492
Fax: (304) 925-1910

Wisconsin

Hewlett-Packard Co.
275 N. Corporate Dr.
BROOKFIELD, WI 53005
Tel: (414) 792-8800
Fax: (414) 792-0218

URUGUAY

Pablo Ferrando S.A.C. e I.
Avenida Italia 2877
Casilla de Correo 370
MONTEVIDEO
Tel: 59-82-802-586
Telex: 398802586

Olympia de Uruguay S.A.
Maquines de Oficina
Avda. del Libertador 1997
Casilla de Correos 6644
MONTEVIDEO
Tel: 91-1809, 98-3807
Telex: 6342 OROU UY

VENEZUELA

Analytical Supplies, CA
Quinta #103 Impermes
Av El Centro
Los Chorros
Apartado 75472
CARACAS
Tel: 364904, 2394047
Telex: 26274 CABIC

Hewlett-Packard de Venezuela C.A.
Residencias Tia Betty Local 1
Avenida 3 Y con Calle 75
MARACAIBO, Estado Zulia
Apartado 2646
Tel: 586175669
Telex: 62464 HPMAR

YUGOSLAVIA

Do Hermes
General Zdanova 4
YU-11000 **BEOGRAD**
Tel: (011) 342 641
Telex: 11433

Do Hermes
Celovska 73
YU-61000 **LJUBLJANA**
Tel: (061) 553 170
Telex: 31583

ZAIRE

C.I.E.
Computer & Industrial Engineering
25 Ave. de la Justice Gombe
Boite Postale 10976
KINSHASA
Tel: 32 063, 32 633, 28 251
Telex: 21552
Fax: 22 850

ZAMBIA

R.J. Tilbury (Zambia) Ltd.
P.O. Box 32792
LUSAKA
Tel: 21 55 80
Telex: 40128

ZIMBABWE

Field Consolidated (Private) Ltd.
Systron Division
Manhattan Court
61 Second Street
P.O. Box 3458
HARARE
Tel: 73 98 81
Telex: 26241
Fax: 70 20 08

Please send directory corrections to:
Test & Measurement Catalog
Hewlett-Packard Company
3200 Hillview Avenue
Palo Alto, CA 94304
Tel: (415) 857-4706
Fax: (415) 857-3880

September 1989

Reader Comment Card

HP 9000 Computers
Using NFS Services
B1013-90008 E0291

We welcome your evaluation of this manual. Your comments and suggestions will help us improve our publications. Please tear this card out and mail it in. Use and attach additional pages if necessary.

Please circle the following Yes or No:

• Is this manual well organized?	Yes	No
• Is the information technically accurate?	Yes	No
• Are instructions complete?	Yes	No
• Are concepts and wording easy to understand?	Yes	No
• Are examples and pictures helpful?	Yes	No
• Are there enough examples and pictures?	Yes	No

Comments:_____

_____

_____

_____

_____

Name:_____

Title:_____

Company:_____

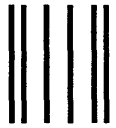
Address:_____

City & State: _____

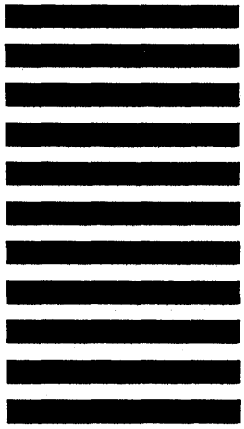
Zip:_____

HEWLETT PACKARD

Printed in USA



NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO.

POSTAGE WILL BE PAID BY ADDRESSEE

Hewlett–Packard Company
Information Networks Division
19420 Homestead Road
Cupertino, CA 95014

ATTN: Network Usability Department

Fold Here

Tape Please do not staple Tape

Printed in England 02/91

Customer Order No.
B1013-90008

Manufacturing No.
B1013-91008
Mfg. number is for HP internal use only

B1013-91008