Configuring and Managing MPE/iX Internet Services

HP e3000 MPE/iX Computer Systems

Edition 6

Manufacturing Part Number : 32650-90906
E0802

U.S.A. August, 2002

Notice

Restricted Rights Legend

Acknowledgments

Hewlett-Packard Company
3000 Hanover Street
Palo Alto, CA 94304 U.S.A.

Tables

Preface

This manual describes how to configure and operate Internet Services on the HP e3000. It is written for members of the system administration staff who have been assigned system manager (SM) or system supervisor (OP) capability and who are responsible for installing, configuring and managing system and network software. As such, it presumes a good understanding of networking concepts and familiarity with HP e3000 system operations. *Configuring and Managing Internet Services* is *not* intended for the end user of Internet Services such as `tftp` and `telnet`.

This manual is organized into the following chapters:

Chapter 1, "Introduction to Internet Services," describes in summary fashion each of the utilities that comprise the Internet Services product. It also includes instructions for installing and configuring the services file and protocols file.

Chapter 2, "Internet Daemon," describes the function and configuration of the Internet daemon inetd and provides troubleshooting guidelines.

Chapter 3, "Telnet Service," explains how to configure the telnet server and offers troubleshooting guidelines.

Chapter 4, "BOOTP Service," describes how to configure the Bootstrap Protocol daemon, provides examples that show how to add bootp clients and routing instructions to the HP e3000, and offers troubleshooting guidelines.

Chapter 5, "TFTP Service," describes how to configure the Trivial File Transfer Protocol daemon and explains tftpd security considerations and troubleshooting guidelines.

Chapter 6, "REMESH Service," describes how remsh or remote shell is used to connect to a specified host and execute a command on that host. This remote shell or remsh is available with version C.60.00 of the MPE/iX operating system.

Chapter 7, "Samba for MPE/iX Services," describes how the suite of programs work together to allow clients to access a server's file space and printers, via the Server Message Block (SMB) file server.

Chapter 8, "DNS BIND/iX," describes BIND and its implementation of Domain Name System (DNS).

Chapter 9, "HP Web Wise MPE/iX Secure Web Server," Describes how WebWise Webserver, HP e3000 users can do business over the Internet.

Chapter 10, "Sendmail for MPE/iX,"Describes how to send and receive email.

Appendix A, "Samba for MPE/iX Sample Configuration File," shows and example of the samp-smb.conf configuration file.

Appendix B, "BIND 8 Configuration File," describes the BIND 8 configuration file.

Appendix C, "BIND 8.1 Enhanced Features," describes the options and enhanced features available.

Appendix D, "Server Configuration Migration," describes configuration migration utilities.

Appendix E, "Configure and Run Syslog/iX," describes the parameters in a syslog configuration file.

Glossary

1 Introduction to Internet Services

The HP e3000 Internet Services consist of a set of programs that help the HP e3000 computer exchange information with other nodes on the **internet**. The Internet Services offered on the HP e3000 are a subset of the Internet Services available on the HP 9000, which were previously called the ARPA Services. This introductory chapter:

- Provides an overview of the Internet Services
- Lists the system requirements for using Internet Services
- Shows how to verify the installation of the set of configuration and program files for Internet Services that were delivered with the MPE/iX Fundamental Operating Software.
- Lists configuration files
- Describes two configuration files that all of the Internet Services use, the **protocols** file and the **services** file, and how to install and edit them.

At the end of this introductory chapter, there is a list of additional manuals that may be helpful.

By and large, the subset of Internet Services running on an MPE/iX system are identical to those available on UNIX machines. There are, however, some differences between them. If you are an experienced HP-UX system administrator and you plan to skim the information in this manual, pay attention to the "Implementation differences" sections at the end of each chapter. They describe the important differences between MPE/iX version of Internet Services and the HP-UX version of Internet Services.

Overview of Internet Services

Internet Services on the HP e3000 consist of eight individual services that enable the HP e3000 to communicate with other nodes on an internetwork. The program and configuration files needed to run Internet Services is part of the MPE/iX Fundamental Operating Software. No separate software product is necessary to use Internet Services.

The services are briefly described in Table 1-1.

Summary of HP e3000 Internet Services

Table 1-1 Summary of HP e3000 Internet Services

Service	Description
`inetd`	The Internet **daemon** `inetd` is the master server for the group of Internet Services rather than an individual network service. You must install and configure `inetd` on your system to use the other services as listed below.
`telnet`	The telnet server uses the standard virtual terminal protocol to allow users on a remote node that supports Internet Services to log on and run most applications on the host HP e3000.
`bootpd`	The Bootstrap Protocol daemon, or `bootpd`, is used to boot, or start, devices such as routers, printers, X-terminals and diskless workstations. Client systems use `bootpd` to find their own IP address and the name of the boot file to load into memory and execute.
`tftpd`	The Trivial File Transfer Protocol daemon `tftpd` is used to transfer the boot files needed to start network devices. In this implementation of Internet Services, `tftpd` enables an HP e3000 to boot network printers.
`remsh`	The remote shell client allows a user on an HP e3000 to access a remote UNIX host and execute a UNIX command or script without logging on.
`ftp`	The File Transfer Protocol (FTP) is an ARPA service that allows users to transfer files among other networked systems. FTP is the file transfer program that uses the ARPA standard File Transfer Protocol. FTP can be used with systems supporting the ARPA FTP service such as other HP systems, UNIX systems, and non-UNIX systems.
Samba	Samba for MPE/iX is a suite of programs which allow clients to access a server's file space and printers via the Server Message Block (SMB) protocol. It allows the MPE/iX shell operating system to act as a file and printer server for SMB clients, which are primarily, Windows NT, Windows 95 and Windows for Workgroups.
DNS	BIND (Berkeley Internet Name Domain) is an implementation of the Domain Name System (DNS). A complete implementation of DNS BIND/iX is available on MPE/iX. DNS BIND/iX will enable MPE/iX host to act as a DNS server, both responding to queries as well as communicating with other DNS servers on the local network and the Internet.

NOTE Throughout this manual, the term **daemon**, which is familiar to UNIX users, and the term **server** are used interchangeably.

System Requirements

The Internet Services program and configuration files come with version C.55.00 or greater, of the MPE/iX Fundamental Operating Software (FOS). (The exception to this is the Telnet Client, which was made available to customers on the earlier version of MPE/iX, C.50.00.) As part of MPE/iX FOS, Internet Services can run on any Precision Architecture-RISC model of the HP e3000. They are not available on earlier "classic" HP e3000 computers running MPE V.

To run Internet Services, you must:

- Configure one or more network interface link cards that support **TCP/UDP/IP** communications protocol.
- Configure the Net Transport communications software which uses the **TCP/UDP/IP** protocol.

The necessary software and at least one TCP/UDP/IP network interface card is delivered with each PA-RISC HP e3000 system. Internet Services runs on top of the Net Transport software and therefore runs over any type of link supported by Net Transport.

Verifying Installation of Internet Services Files

If you have installed or updated to version C.60.00 of MPE/iX, use the following steps to verify that the Internet Services files exist on your system:

1. If necessary, log on the system as MANAGER.SYS.
2. Enter a LISTFILE command for the NET group of the SYS account:

   ```
   :LISTFILE @.NET.SYS
   ```

3. Check the list displayed on your screen and make sure that you have the following files:

BOOTPD	BOOTPQRY
BPTABSMP	INETD
INSECSMP	INSVXL
JINETD	PROTSAMP
REMSH	SERVSAMP
TFTPD	

4. Run the Node Manager Maintenance utility to verify that you have successfully installed the set of Internet Services files (except for Telnet files, which you will check in Chapter 3, “Telnet Service.”)

   ```
   :NMMAINT,73
   ```

   You will see information similar to the following:

   ```
   : nmmaint,73
   NMS Maintenance Utility 32098-20014 B.00.09 (C) Hewlett Packard Co. 1984

   WED, JUL 23, 1997,  11:08 AM Data comm products build version: N.55.15

   Subsystem version ID’s:


   Internet Services for the HP e3000 module versions:

   NM program file: INETD.NET.SYS              Version:  B0001003
   NM program file: BOOTPD.NET.SYS             Version:  B0001003
   NM program file: BOOTPQRY.NET.SYS           Version:  B0001002
   NM program file: TFTPD.NET.SYS              Version:  B0001002
   NM program file: REMSH.NET.SYS              Version:  B0001003
   XL procedure:    INSVXL_SECURE_VERS         Version:  B0001004
   XL procedure:    INSVXL_IPCSEC_VERS         Version:  B0001002
   XL procedure:    INSVXL_NSRW_VERS           Version:  B0001003
   XL procedure:    INSVXL_NETOF_VERS          Version:  B0001002
   XL procedure:    INSVXL_SYSLOG_VERS         Version:  B0001003
   XL procedure:    INSVXL_SIGNAL_VERS         Version:  B0001002
   XL procedure:    INSVXL_GETTIME_VERS        Version:  B0001003

   Internet Services for the HP e3000 overall version = B.00.01
   ```

   The final line of information, which displays the current overall version of these software files, is useful when you need to call the Hewlett-Packard support staff.

5. Check for any error messages, such as a module is missing, or a message telling you of a version mismatch, for example:

```
Version levels differ in one or more modules.  (NMERR 103)
Internet Services for the HP e3000 overall version =  ?.??.??
```

Using Domain Name Resolver

To use the domain name resolver to resolve domain names to their IP addresses, you will need to configure a set of ASCII files on each node that contain the necessary information. Refer to the “Configuring the DNS Resolver” section of this chapter, or the *HP e3000/iX Network Planning and Configuration Guide*.

Sample Configuration Files

When you install or update to version C.60.00 of MPE/iX, a set of *sample* configuration files is automatically copied to the NET group of the SYS account for you. For example, INCNFSMP is the name of the sample inetd configuration file. These files were named and installed in this form to prevent overwriting any genuine configuration files already in use.

To view the group of files installed in NET.SYS, enter:

```
:LISTFILE @.NET.SYS
```

To configure Internet Services, you will do one of two things:

- If there are configuration files already in use, you will add the information needed to use each of the Internet Services to those files.
- If you are not already using Internet Services configuration files, you will use the sample configuration files that were installed with the FOS as templates for your own set. In this case, you will use the COPY command to create each of the configuration files, then create a symbolic link from a file name in the POSIX name space to the actual file, which exists in the MPE name space. (Linking the files is explained next.) Finally, you will edit the new configuration files to suit your needs.

Linking Configuration Files

The Internet Services software looks for some of its configuration files in the POSIX name space and not in the MPE name space. For example, it accesses the /etc directory and looks for the file named inetd.conf to read inetd configuration data. It does not look for the file INETDCNF.NET.SYS.

Rather than create two copies of the configuration file, one for each name space, Hewlett-Packard recommends that you create a symbolic link from a POSIX-named file to the MPE-named file. The instructions in the remainder of this manual describe this process. Linking the files, as opposed to making another copy of each one, offers three important advantages.

- Linking the file ensures consistency of content because regardless of which name you use to access the file, you will be reading or updating the same file.
- Giving the file a name in each name space allows you to view the file from either the POSIX or the MPE name space, but it is recommended that you use an MPE text editor to make changes. This is due to potential conflicts with the MPE/iX EOF marker if any lines are added using a POSIX editor program.
- Making the POSIX name point to the MPE name ensures that the file will be backed up with standard MPE STORE procedures in case you haven’t modified your STORE command to back up new or changed files in the POSIX name space.

Installed Configuration Files

If you install and configure all of the Internet Services according to the instructions in this manual, you will have the set of files described in Table 1-2.

Table 1-2 Configuration Files

Sample name	MPE name space	HFS name space	Description
SERVSAMP. NET.SYS	SERVICES.NET.SYS	/etc/services	The services name file, which associates an official service name and **alias** with the port number and protocol that a service uses. You will edit the services file for each new service you are adding to your system. The executing program uses the file named SERVICES.NET.SYS.
PROTSAMP.NET .SYS	PROTOCOL.NET.SYS	/etc/protocols	The file containing a list of protocols known to the system and the identification number and one or more aliases for each. You will rarely, if ever, need to edit this file. The executing program uses the file named PROTOCOL.NET.SYS.
INCNFSMP.NET .SYS	INETDCNF.NET.SYS	/etc/inetd. conf	The configuration file for the Internet daemon inetd, which determines which installed Internet Services are available to users. The executing program uses the file named /etc/inetd.conf.
INSECSMP. NET.SYS	INETDSEC.NET.SYS	/usr/adm/inetd .sec	The optional security file for inetd, which lets you control access to individual services by specific nodes. The executing program uses the file named /usr/adm/inetd.sec.
BPTABSMP. NET.SYS	BOOTPTAB.NET.SYS	/etc/bootptab	The configuration file for the Bootstrap protocol daemon, bootpd. The executing program uses the file named /etc/bootptab.

For each individual service you install, you will always edit the **services** file and the inetd configuration file. It is unlikely that you will need to edit the protocols file. The remainder of this chapter explains the **services** and **protocols** file. Chapter 2, “Internet Daemon,” explains working with the inetd configuration files.

Services File

The services file associates an official service name and alias with the port number and protocol that a service uses. You will edit the services file for each new service that you want to add to your system. The remaining chapters in this book, which describe the configuration of individual services, will assume that you know the following information. And, of course, you can refer back to this section as needed.

Creating and Linking the Services File

You may already have a services file installed on your system. If you know that you have such a file, and it is accessible by the POSIX file name `/etc/services` you may skip these steps.

If you do not have a services file, follow these steps to create the file and link to it. If you have such a file, but are unsure whether or not it is linked, perform step 2 only.

1. Create your own services file by using the `COPY` command to rename the sample file. Enter:

   ```
   :COPY SERVSAMP.NET.SYS, SERVICES.NET.SYS
   ```

2. Create a symbolic link from a file named `/etc/services` in the POSIX name space to `SERVICES.NET.SYS`. Enter:

   ```
   :NEWLINK /etc/services, SERVICES.NET.SYS
   ```

Editing the Services File

Use an MPE text editor to edit the file.

1. Open the services file with an MPE text editor.

   The contents will resemble the following:

```
# This file contains the information about the services provided.
# Copy this file to SERVICES.NET.SYS if that file does not already exist.
#
# The form for each entry is:
# <official service name>    <port number/protocol name>    <aliases>
#
# See the Configuring and Managing MPE/iX Internet Services Manual
# for more information (HP Part No. 32650-90835).
#
# Note: The entries cannot be preceded by a blank space.
#
echo           7/tcp                 # Echo
echo           7/udp                 #
discard        9/tcp  sink null      # Discard
discard        9/udp  sink null      #
daytime       13/tcp                 # Daytime
daytime       13/udp                 #
chargen       19/tcp  ttytst source  # Character Generator
chargen       19/udp  ttytst source  #
ftp           21/tcp
telnet        23/tcp
time          37/tcp  timeserver     # Time
time          37/udp  timeserver     #
domain        53/tcp  nameserver     # Domain Name Service
domain        53/udp  nameserver     #
bootps        67/udp                 # Bootstrap Protocol Server
bootpc        68/udp                 # Bootstrap Protocol Client
tftp          69/udp                 # Trivial File Transfer Protocol
DAServer      987/tcp                # SQL distributed access
shell         514/tcp  cmd           # Remote command no password used
```

2. For the service that you are installing, check the file to see if it has the appropriate entry. (Each chapter in the remainder of this manual has this information.) If not, enter the line in the file using the "Editing Tips" section, next, as a guideline.

NOTE For more information on FTP, refer to *Installing and Managing HP ARPA File Transfer Protocol Network Manager's Guide* or *HP ARPA File Transfer Protocol User's Guide*.

3. Save the file and exit the editor program.

Editing Tips

When you are editing the services file, use the following information to enter the information correctly.

- If you find the line that describes the service you are configuring, but it has been "commented out" (that is, preceded by a pound sign, #), the service has not yet been enabled. To enable it, simply delete the pound sign *and* any spaces that precede the service name.
- If you need to type the line into the file:
  - — use only lower case characters
  - — enter the service name in the first column without any leading spaces
  - — separate the individual fields on the line with any number of blanks or tab characters to improve readability

Protocols File

The protocols file contains a list of **protocols** known to the system, plus the identification number and one or more aliases for each. It is unlikely that you will need to edit the protocols file, but you may need to install and link it.

Creating and Linking Protocols File

You may already have a protocols file installed on your system. If you know that you have such a file, and it is accessible by the POSIX file name `/etc/protocols` you may skip these steps.

If not, follow the steps below to create and link the protocols file, `PROTOCOL.NET.SYS`. If you have such a file, but are unsure whether or not it is linked, perform step 2 only.

1. Use the `COPY` command to create the protocols file. Enter:

   ```
   :COPY PROTSAMP.NET.SYS, PROTOCOL.NET.SYS
   ```

   Make sure that you enter the singular form of protocol in the new MPE file name. That is, “PROTOCOL” and not “PROTOCOLS” should appear on the right side of the `COPY` command.

2. Create a symbolic link from `/etc/protocols` in the POSIX name space to `PROTOCOL.NET.SYS`. Enter:

   ```
   :NEWLINK /etc/protocols, PROTOCOL.NET.SYS
   ```

   Again, make sure that you enter the singular form of protocol in the new MPE file name `PROTOCOL.NET.SYS`.

Viewing Protocols File

Use an MPE text editor to open the file. It is unlikely that you will need to edit the file, but you can look at it now to familiarize yourself with its contents.

```
# This file associates protocol numbers with official protocol names and
# aliases.  This allows the user to refer to a protocol by a symbolic
# name instead of a number.  For each protocol a single line should be
# present with the following information:
#
# The form for each entry is:
# <official protocol name>    <protocol number>    <aliases>
#
# See the Configuring and Managing MPE/iX Internet Services Manual
# for more information (HP Part No. 32650-90835).
#
# Note: The entries cannot be preceded by a blank space.
#
11     tcp     6       TCP     # transmission control protocol
12     udp     17      UDP     # user datagram protocol
```

Other Sources of Information

You may find the following books useful when you are working with Internet Services:

- *Unix Network Programming* written by W. Richard Stevens. New Jersey: Prentice Hall, 1990
- *Telnet/iX User's Guide*

2 Internet Daemon

The **Internet daemon** inetd is the master server (sometimes called a “superserver”) for the Internet Services. When it is running, inetd listens for connection requests for the services listed in its configuration file and, in response to such requests, starts the appropriate server. You, as system manager, determine which Internet Services are available to your users by editing the inetd configuration file.

This chapter explains:

- How inetd behaves with **stream services** and with **datagram services**.
- How to edit the inetd configuration file so that it listens for connection requests from the specific Internet Services you want to use on your system.
- How to edit the optional security file for inetd which lets you control access to the Internet Services.
- How to use inetd logging capabilities to monitor and troubleshoot Internet Services.
- How to start and stop inetd.
- How to troubleshoot common problems that can occur with inetd.
- The implementation differences between inetd for MPE/iX and HP-UX.

Overview of inetd

The Internet daemon, or inetd, is the master server that coordinates the use of individual network services on your system. It listens for connection requests from other **nodes** on the network who want access to a service such as tftpd or bootpd. The Internet daemon checks if the requesting node has permission to use the service, starts the appropriate server if it does and, optionally, records information about the connection request.

Stream Services

The Internet daemon starts servers for both **stream services** and **datagram services**. For stream services, which use the **TCP/IP** protocol, inetd listens for connection requests on **stream sockets**. When it detects such a request, inetd determines which service the **socket** corresponds to and invokes a server for it. The server then handles incoming data, providing a reliable, full-duplex bytestream service to the requesting node. Once inetd has invoked the server, it returns to listening for other connection requests.

Datagram Services

For datagram services, which use the **UDP/IP** protocol, inetd listens for requests on **datagram sockets**. You can think of a datagram as a connection request and the message all in one package. Unlike the TCP/IP protocol, UDP/IP does not provide any message acknowledgment, flow control or sequencing. It is the simplest possible service with the advantage of low communications overhead. When inetd detects an incoming datagram, it invokes a server for that message. Once a datagram has been delivered, the socket becomes available for another incoming datagram. That is, there is no “connection,” simply the delivery and receipt of the datagram. For this reason, datagram service is sometimes referred to as “connectionless” communication.

Internal Services Provided by inetd

The Internet daemon provides several internal trivial services which are described here.

Service	Description
echo	Returns a character to the socket that sent it
discard	Discards all input from socket
chargen	Generates characters and sends them to a socket
daytime	Returns the current time in a format readable by people.
time	Returns current time in a format useful to machines, for example, the number of seconds since Jan 1, 1970.

inetd Files

There are four files of importance as shown in Table 2-1, for configuring and using `inetd`. Once you have installed or updated to version C.60.00 or later, of MPE/iX, these files are located in the NET group of the SYS account.

Table 2-1 The Internet Daemon Files

File	Description
INETD.NET.SYS	The program file for `inetd` which is linked to the POSIX file `/etc/inetd`.
INCNFSMP.NET.SYS	The sample configuration file for `inetd`. You will copy the sample file to `INETDCNF.NET.SYS`, create a symbolic link from the POSIX file `/etc/inetd.conf` to `INETDCNF.NET.SYS`, and edit it as necessary.
INSECSMP.NET.SYS	The sample security file for `inetd`. You will copy this file to `INETDSEC.NET.SYS`, create a symbolic link from the POSIX file `/usr/adm/inetd.sec` to `INETDSEC.NET.SYS`, and edit it as necessary.
JINETD.NET.SYS	The job file that you will stream to start `inetd` and abort to stop `inetd`. You won't need to copy, link, or edit this file.

The remainder of this chapter explains how to copy, link and edit these files to create a working version of the Internet daemon on your system.

inetd Configuration File

The Internet daemon accesses the configuration data it needs by reading the file `/etc/inetd.conf` in the POSIX name space. When you install or update to version C.60.00 of MPE/iX, you receive a sample configuration file that you can use as a template for your own `inetd` configuration file if you don't already have one. This process involves two steps: creating the actual file in the MPE name space and creating a symbolic link that points from the POSIX file `/etc/inetd.conf` to the MPE file. The steps to create and link the file is explained later in this section. The reasons Hewlett-Packard recommends symbolic linking is explained in Chapter 1, “Introduction to Internet Services.”

The Internet daemon reads its configuration file on three occasions:

- When `inetd` is started during normal system startup
- When `inetd` is started following a network shutdown as opposed to a system shutdown
- When you instruct an executing `inetd` to reread the configuration file after you have made changes to it that you wish to put into effect

Creating and Linking inetd Configuration File

You may already have a configuration file for `inetd` installed on your system. If you know that you have such a file, and it is accessible by the POSIX file name `/etc/inetd.conf` you may skip these steps.

If not, follow these steps to create the file and link to it. If you have such a file, but are unsure whether or not it is linked, perform step 2 only.

1. Create your own configuration file by using the `COPY` command to rename the sample file. Enter:

   ```
   :COPY INCNFSMP.NET.SYS TO INETDCNF.NET.SYS
   ```

2. Create a symbolic link from `/etc/inetd.conf` in the POSIX name space to `INETDCNF.NET.SYS`. Enter:

   ```
   :NEWLINK /etc/inetd.conf, INETDCNF.NET.SYS
   ```

3. Check the security provisions of the file and change them, if necessary. Hewlett-Packard recommends that only `MANAGER.SYS` has write access to `INETDCNF.NET.SYS`, and write and purge access to `/etc/inetd.conf`.

Adding New Services to inetd Configuration

There are two steps required to add a new service to the suite of Internet Services offered on your system. First you enter a line of information for the specific service to the `inetd` configuration file. Then you have `inetd` reread its configuration file, which is sometimes called reconfiguring the Internet daemon. In the unlikely event that `inetd` is not running when you edit the configuration file, you will invoke the new configuration by starting `inetd`. Starting `inetd` is explained later in this chapter.

To edit the `inetd` configuration file, do the following:

1. Open the configuration file with an MPE text editor.

   The contents will resemble the following:

```
######################################################################
#
# sample inetd configuration file
#
# For information on how to configure this file refer to the Configuring
# and Managing Internet Services manual
#
# Note: The entries cannot be preceded by a blank space. Blank lines
# and lines beginning with a pound sign(#) are ignored.
#
######################################################################
#
# Internet server configuration database
#
echo         stream tcp nowait MANAGER.SYS internal
echo         dgram  udp nowait MANAGER.SYS internal
daytime      stream tcp nowait MANAGER.SYS internal
daytime      dgram  udp nowait MANAGER.SYS internal
time         stream tcp nowait MANAGER.SYS internal
time         dgram  udp nowait MANAGER.SYS internal
discard      stream tcp nowait MANAGER.SYS internal
discard      dgram  udp nowait MANAGER.SYS internal
chargen      stream tcp nowait MANAGER.SYS internal
chargen      dgram  udp nowait MANAGER.SYS internal
#telnet      stream tcp nowait MANAGER.SYS internal
#bootps      dgram  udp wait   MANAGER.SYS /SYS/NET/BOOTPD bootpd
#tftp        dgram  udp wait   USER.TFTP /SYS/NET/TFTPD tftpd
#
```

2. Each of the services that run under `inetd` must have an entry in the configuration file. For example, the entry for the `tftp` program in `INETDCNF.NET.SYS` looks like this:

```
tftp  dgram  udp  wait  USER.TFTP     /SYS/NET/TFTPTD     tftpd
```

   For the service that you are installing, check the file to see if it has the correct entry. (Each chapter in the remainder of this manual has this information. The meaning of the individual fields in an entry are explained later in this chapter.) If not, enter the line now using the “Editing Tips” section, as a guideline.

NOTE For more information on FTP, refer to *Installing and Managing HP ARPA File Transfer Protocol Network Manager’s Guide* or *HP ARPA File Transfer Protocol User’s Guide*.

3. Save the file and exit the editor program.

4. Signal `inetd` to reread the configuration file by entering the following command at the CI prompt:

```
INETD.NET.SYS -c
```

   Or you may enter this command from the POSIX shell:

```
$/etc/inetd -c
```

Editing Tips

When you are editing the `inetd` configuration file, keep in mind these points:

- If you find the line, but it has been “commented out” (that is, preceded by a pound sign,#), the service has not yet been enabled. To enable it, simply delete the pound sign *and* any spaces that precede the service name.
- If you need to type the line into the file:
  - — Use only lowercase characters
  - — Enter the service name in the first column without any leading spaces
  - — Separate the individual fields on the line with any number of blanks or tab characters to improve readability

Fields in an inetd Configuration File Entry

Each entry in the `inetd` configuration file conforms to a common format in which each of the fields has a specific purpose. For example, the entry for TFTP looks like this:

```
tftp  dgram  udp  wait  USER.TFTP     /SYS/NET/TFTPD     tftpd
```

Reading an entry from left to right, these fields are:

Field	**Purpose**
service name	The name of the service in the services file.
socket type	Either `stream` if the socket is a stream socket, or `dgram` if the socket is a datagram socket.
protocol	A valid protocol name, either `tcp` or `udp`, as entered in the protocols file.
wait state	One of two states, `wait` or `nowait`, that applies only to datagram sockets. The `wait` entry instructs `inetd` to execute only one datagram server for the specified socket at any one time. This is a single-threaded datagram server. The `nowait` entry instructs `inetd` to execute a datagram server for a specified socket whenever a datagram arrives, which frees the socket so that `inetd` can receive further datagrams. This is a multi-threaded datagram server.
`user`	The identification of the user when the server is running.
`server program`	The absolute path of the program that `inetd` executes when it receives a connection request.
`arguments`	Arguments to the server program, beginning with argument zero, which is the name of the program.

inetd Security File

There is an optional security file associated with `inetd` that allows you to control which nodes have access to the Internet Services available on your system. The `inetd` security file will prevent `inetd` from starting a service unless the node making the request has permission to do so. Individual entries in the `inetd` security file determine which nodes are allowed or disallowed for a particular service.

The `inetd` security file is not the only security provided for Internet Services. It constitutes an extra layer of security in addition to the normal checks done by the services themselves. If the `inetd` security file does not exist, if a remote service is not listed in the security file, or if it is listed but it is not followed by the `allow` or `deny` key word, all remote hosts can attempt to use it. Such an attempt will succeed if it passes the security checks imposed by the requested service.

If `inetd` refuses a connection for security reasons, and `inetd` connection logging is enabled, a message is sent to the console indicating that there was an unsuccessful connection attempt.

Creating and Linking inetd Security File

You may already have a security file for `inetd` installed on your system. If you know that you have such a file, and it is accessible by the POSIX file name `/usr/adm/inetd.sec` you may skip these steps.

If not, follow the steps below to create the file and link to it. If you have such a file, but are unsure whether or not it is linked, perform step 2 only.

1. Create your own `inetd` security file by using the `COPY` command to rename the sample file. Enter:

   ```
   :COPY INSECSMP.NET.SYS TO INETDSEC.NET.SYS
   ```

2. Create a symbolic link from `/usr/adm/inetd.sec` in the POSIX name space to `INETDSEC.NET.SYS`. Enter:

   ```
   :NEWLINK /usr/adm/inetd.sec, INETDSEC.NET.SYS
   ```

3. Check the security provisions of the file and change them, if necessary. Hewlett-Packard recommends that only `MANAGER.SYS` has write access to `INETDSEC.NET.SYS`, and write and purge access to `/usr/adm/inetd.sec`.

Updating inetd Security File

Each line in the inetd security file contains a service name, a permission field, and the **IP addresses** or **domain names** of the hosts and networks allowed to use that service on your host system. You can open the file to view the current security restraints or to change them. To do so:

1. Open the security file with an MPE text editor. The contents will resemble the following:

```
# The lines in the file contain a service name, permission field and
# the Internet addresses or names of the hosts and/or networks
# allowed to use that service in the local machine.
# The form for each entry in this file is:
#
# <service name> <allow/deny> <host/network addresses, host/network names>
#
# For example:
#
# telnet         allow   10.3-5 192.34.56.5 ahost anetwork
#
# The above entry allows the following hosts to attempt to access your system
# using telnet:
#              hosts in subnets 3 through 5 in network 10,
#              the host with Internet Address of 192.34.56.5,
#              the host by the name of "ahost",
#              all the hosts in the network "anetwork"
#
# tftp      deny    192.23.4.3
#
# The tftp entry denies host 192.23.4.3 to access your system using tftp
#
# Hosts and network names must be official names, not aliases.
# See the Configuring and Installing Internet Services Manual for more
# information.
```

   The word allow or deny in the second column determines whether the list of remote hosts in the next field to the right has access to the specified service. If there is more than one line for a service, regardless of whether a statement indicates allow or deny, the inetd server ignores all but the last line.

2. Make any necessary editing changes. Refer to the following three sections, "Editing Tips", "Using Wildcard Characters" and "Using Range Character" for more information.

3. Save your file and exit the editor.

Editing Tips

When you edit the inetd security file, remember the following points:

- To "comment out" a line, begin column 1 with a pound symbol (#). To enable a security provision that has been commented out, delete the pound symbol *and* any blank spaces preceding the service name.

- Enter the real service name, not the alias, of a valid service in the inetd configuration file.

- Separate the IP addresses and domain names by a white space. You may enter any mix of addresses and names. For example, the following entry denies Telnet access to host hp22.cup.hp.com, any hosts on the network named "testlan," and the host with IP address 192.54.24.5:

  ```
  telnet deny hp22.cup.hp.com testlan 192.54.24.5
  ```

- To continue an entry on the next line, place a slash (/) *at the end of the line* to be continued. The Internet daemon will ignore a slash that appears in the middle of the line, continue reading to the end, and ignore the next line. In this case, it will probably misinterpret the entry and you will see an error message.

Using Wildcard Characters

You may use wildcard characters (*) in any of the fields of the address to specify permissions for a group of hosts or networks. This makes it more convenient to specify an entire network, since you will not need to specify each host in that network. The following sample entry, for example, allows all hosts with network addresses starting with a 10, as well as the single host whose address is `192.54.24.5` to use `Telnet`:

```
telnet allow 10.* 192.54.24.5
```

You cannot use the wildcard character in combination with other integers in one part of an address field. For example, this entry in the `inetd` security file will generate an error message because the second field includes a 5 followed by the * character:

```
tftp deny 10.5*
```

Either integers *or* the wildcard character is allowed in one part of an address field.

Using Range Character

You may use the range indicator (-) in any of the fields of the address to specify which hosts or networks in a group are exempted from the permission assignment. This makes it more convenient to allow or deny a service for a subnet within the network you specify. The following sample entry, for example, denies hosts in subnets 3 through 5 of network 10 access to `Telnet`. Note that the wildcard character * at the end of the address lets you avoid specifying the individual hosts within the subnet.

```
telnetd deny 10.3-5.*
```

Starting and Stopping inetd

On the HP e3000, the instructions for starting the Internet daemon are contained in the job file `JINETD.NET.SYS`. When you stream `JINETD`, it invokes the daemon and reads the `inetd` configuration file to determine what services have been configured, and listens for connection requests for those services. Any messages relating to `inetd` are sent either to the console or to `$STDLIST` for `JINETD`, which is a spool file. The Internet daemon will continue to run, responding to requests for any of the configured services, until you stop it. The Internet daemon only terminates in an error state if there are no valid services listed in the configuration file.

Starting inetd From a Job

To start `inetd`, you stream the `JINETD` job. You may do this manually, by entering the `STREAM` command when the system is running, or you may include the `STREAM JINETD` command in the `SYSSTART` file to have `inetd` automatically started at system startup.

To start `inetd` manually:

1. Log onto your system as `MANAGER.SYS,NET`.
2. Check to make sure that `inetd` has not already been started by entering at the CI prompt:

   ```
   :SHOWJOB JOB=@J
   ```

   Look for the job logged on as `JINETD.NET.SYS` and, if it is not listed, continue with the next step.
3. At the CI prompt, enter `STREAM JINETD.NET.SYS`.

If you attempt to start `inetd` when it is already running, you'll see the following error message and the job will not be started:

```
An inetd is already running.
```

Starting JINETD Automatically

If you want to have the Internet daemon started automatically when your system starts up, add the `STREAM JINETD` command to the `SYSSTART` file. When you do, be sure that the stream command follows the network startup command `NETCONTROL START`.

Passwords on JINETD

When you stream the job file `JINETD.NET.SYS`, it logs on as `MANAGER.SYS`. As part of the installation of `inetd`, you must take care of any password requirements for this job. Two of the ways that you can do this include:

- Add the `MANAGER.SYS` passwords directly to the job file, then alter the file security afterwards so that only `MANAGER.SYS` can read it. For example:

  ```
  :ALTSEC JINETD.NET.SYS; (R,W:CR;X,L:AC)
  ```

- Use the `PASSEXEMPT` parameter of the `JOBSECURITY` command (version C.60.00 and later) to control password exemption.

Starting inetd Interactively

You may also start `inetd` interactively, though this is not recommended for normal use. To do so, enter the following command at the CI prompt:

```
:INETD.NET.SYS
```

Or, from the POSIX shell enter this command:

```
$/etc/inetd
```

When you start `inetd` interactively, `$STDLIST` for the Internet daemon is your terminal. This means that all error and warning messages that normally go to `JINETD's` spool file will appear on the screen.

Error and Status Reporting for inetd

While `inetd` is running, any errors and other status messages that it generates are recorded so that you can monitor its condition. All errors, regardless of their degree of seriousness, are sent to the `$STDLIST` device assigned to `inetd`. For example, if you streamed `JINETD`, error messages will appear in the spool file associated with that job. More critical errors are displayed on the system console in addition to being sent to `$STDLIST`. For more information, read “Using inetd Message Logging” later in this chapter.

Stopping inetd

To stop `inetd`, you abort the `JINETD` job. Stopping the `inetd` server (aborting `JINETD`) will cause subsequent incoming connection requests to be refused.

1. First find the number assigned to `JINETD` by entering:

   ```
   :SHOWJOB JOB=@J
   ```

   You will see a display of job information similar to the following:

   ```
   JOBNUM  STATE IPRI JIN  JLIST    INTRODUCED  JOB NAME

   #J6546  EXEC        10S LP       THU 12:42A  TRNSPOOL,MGR.NSD
   #J6539  EXEC        10S PP       THU 12:32A  SPOOLJ,UNISPOOL.SYS
   #J6540  EXEC        10S LP       THU 12:41A  JINETD.NET.SYS

   3 JOBS (DISPLAYED):
       0 INTRO
       0 WAIT; INCL 0 DEFERRED
       3 EXEC; INCL 0 SESSIONS
       0 SUSP
   JOBFENCE= 6; JLIMIT= 10; SLIMIT= 60

   CURRENT:  1/15/96 16:12
   ```

```
JOBNUM  STATE IPRI JIN  JLIST    SCHEDULED-INTRO   JOB NAME

#J6667  SCHED   15  10S PP        1/15/96 16:50    CHECKJOB,MANAGER.SYS

1 SCHEDULED JOB(S)
```

2. Issue the `ABORTJOB` command, specifying `JINETD's` job number on the command line. For example, if `JINETD` were logged on as job number “6540”, you would enter:

   ```
   :ABORTJOB #J6540
   ```

NOTE If you have started `inetd` interactively, you use the `-k` option to kill (stop) it. To do so, enter `INETD.NET.SYS -k` at the CI prompt or enter `/etc/inetd -k` from the POSIX shell.

Summary of inetd Command Line Options

There are three options that you may add to the command line when you enter `INETD.NET.SYS` at the MPE CI prompt or enter `/etc/inetd` from the POSIX shell.

`-c`	Instructs `inetd` to reread the configuration file. Use this after you have made changes to the configuration (such as adding a new service) that you want to put into effect now, for an executing `inetd`.
`-k`	Kills, or stops, the currently executing `inetd`.
`-l`	A toggle command that starts or stops connection logging for `inetd`.

Using inetd Message Logging

There are two kinds of message logging that you, as System Manager, can use to monitor and manage Internet Services on your system. The first type is event logging, which is always enabled. It records informational messages, error messages and warnings about the Internet Services. The second type is connection logging, which you can enable and disable. It records successful and failed connection attempts and its own status (on or off). Both event logging and connection logging write messages to the `$STDLIST` device for `inetd` and, in some cases, to the system console.

The kinds of informational, error, and warning messages that are always reported for `inetd`, and what they mean, are listed in the “Troubleshooting” section, later in this chapter. Connection logging is explained next.

Connection Logging

When connection logging is enabled, the Internet daemon records both successful and failed attempts to establish a connection with the host system you are managing. Reviewing the log file can give you important information for managing the Internet Services on your system including:

- Which services are heavily used and which are not.
- Identity of the clients using the Internet Services on your system.
- Pattern of usage, daily, weekly or monthly, for example, for a particular service or set of services.
- Which host(s) are being used for unsuccessful connection attempts, which can indicate who may be attempting to access to your system without authorization.

The syntax of the messages you will see appears here:

```
<<server>><<protocol>><<user>><<program>>
<<status>>:<<error-msg>>
```

Enable and Disable Connection Logging

The same command turns connection logging on or off, depending upon its current state. So, for example, if message logging is currently disabled, enter the following command at the CI prompt to turn it on:

```
:INETD.NET.SYS -1’’
```

Or, from the POSIX shell, enter the following command:

```
$/etc/inetd -1
```

If message logging is enabled, use either the CI or POSIX command shown above to turn it off.

Troubleshooting inetd

This section explains the kinds of error messages you may see regarding the operation of `inetd`. The messages will appear either on the console or they will be sent to the `$STDLIST` for `inetd` or both, depending upon the message’s level of importance.

Message	Explanation
`An inetd is already running`	You attempted to start `inetd` when one is already running. You may invoke `inetd` a second time if you use the `-c`, `-k`, or `-l` option, but you cannot run multiple copies of `inetd`.
`There is no inetd running`	You attempted to reconfigure `inetd` when none was running. The first time you run `inetd`, you must stream it as a job or run it interactively without specifying the `-c` (reconfiguration) option.
`Inetd not found`	This message occurs if you invoke `inetd` with the `-c` option and `inetd` cannot reread its configuration file (which is the purpose of `-c`). This occurs when the original Internet daemon dies or is killed without releasing its semaphore. (The Internet daemon locks a global semaphore to indicate when it is running to prevent users from running more than one `inetd` at a time.) To fix the problem, enter the `inetd -k` command to remove the semaphore left by the previous Internet daemon, then restart `inetd`.

The following diagnostic messages are generated by successful and failed attempts to establish a connection to the Internet Services.

Message	Explanation
`/etc/inetd.cnf: Unusable configuration file`	The Internet daemon cannot access its configuration. The error message preceding this one specifies the reason for the failure.

Message	Explanation
`/etc/inetd.conf: line number:` *nnn* `error`	There is an error on the line specified by *nnn* in the `inetd` configuration file. The Internet daemon skips this line, continues reading the rest of the file, and configures itself accordingly. To solve the problem, open the configuration file, edit the erroneous line, and save the corrected version. Then, tell `inetd` to reread the new version of `INTEDCNF` by issuing the `inetd.net.sys -c` command at the CI prompt.
system call:...	The system call noted in the error message failed. See the corresponding entry in the *Berkeley Sockets/iX Reference Manual* for a description of the system call. The reason for the failure is explained in the error message appended to the system call name.
Cannot configure inetd	Due to errors in the `inetd` configuration file, none of the services it lists could be set up properly.
`Too many services running`	The maximum number of services allowed to access `inetd` simultaneously has been exceeded.
`file: found before end of the line`	An entry in a configuration file may need to exceed one line. If so, you indicate that the line continues by inserting a backslash at the end, then continue typing data on the next line. If, however, you place a backslash in the middle of the line, `inetd` will ignore it and continue reading to the end of the current line, but will not continue to the next line. In this case, it is likely that the configuration information will be misread.
`service/protocol; Unknown service`	The system call `getservbyname` failed because the service is not listed in the services file. To solve the problem, you may either add an entry for the service to the services file or delete the entry for the service from the `inetd` configuration file.
`service/protocol`: Server failing (looping), service terminated.	When `inetd` tries to start 40 servers within 60 seconds for a datagram service, it assumes that the server is failing to handle the connection. To avoid entering a potentially infinite loop, `inetd` issues this message, discards the packet requesting the socket connection, and refuses further connections for this service. After 10 minutes, `inetd` tries to reinstate the service and accept connection requests.
`service/protocol: socket` `service/protocol: listen` `service/protocol: getsockname`	Any of these three errors renders the service unusable. To make the service available again, you must issue the `inetd -c` command to have `inetd` reread the configuration file.
`service/protocol: bind:...`	Indicates that the service is temporarily unusable because `inetd` cannot bind the service to the socket. After 10 minutes, `inetd` tries to bind the socket again. If it is successful, then it will listen for a connection request and provide the appropriate service. If it fails, it will wait another 10 minutes and try again.

Message	Explanation
`service/protocol: Access denied to remote host (address)`	The remote host failed to pass the security test for the service indicated in the message. If this message appears frequently, it can indicate that someone is trying to repeatedly access your system, and failing.
`service/protocol: Connection from remote host (address)`	When connection logging is enabled, this message indicates a successful connection attempt to the specified service.
`service/protocol: Added service, server executable`	Records the services that are added when you reconfigure `inetd`.
`service/protocol: New…`	Lists the new user identifications, new servers, or executable programs used for the service when reconfiguring `inetd`.
`service/protocol: Deleted service`	Records the services that are deleted when you reconfigure `inetd`.

The following diagnostic and error messages are generated by problems in the `inetd` security file.

Message	Explanation
`/usr/adm/inetd.sec: Field contains other characters in addition to * for service`	The wildcard character (`*`) is used in combination with additional integer(s) in one part of an address field, which is not allowed. For example, the Internet address `10.5*.8.7` entered in the `inetd` security file will generate an error message because the second field includes a `5` followed by the `*` character. Either integers or the wildcard character is allowed in one part of an address field.
`/usr/adm/inetd.sec: Missing low value in range for service`	You have used the range indicator (`-`) in the wrong way in an entry in the `inetd` security file. For example, the second field of the Internet address `10.-5.8.7` is incorrect because it does not include both a starting range number ("high value") and the ending range number ("low value"). A correct use of the range indicator in an Internet address would be `10.8-5.8.7`.
`/usr/adm/inetd.sec: Missing high value in range for service`	You have used the range indicator (`-`) in the wrong way in an entry in the `inetd` security file. For example, the second field of the Internet address `10.5-.8.7` is incorrect because it does not include both a starting range number ("high value") and the ending range number ("low value"). A correct use of the range indicator in an Internet address would be `10.8-5.8.7`.
`/usr/adm/inetd.sec: High value in range is lower than low value for service`	You expressed a range of numbers incorrectly in an entry in the `inetd` security file. For example, the second field of the Internet address `10.5-8.8.7` is incorrect because the starting range number ("high value") is lower than the ending range number ("low value"). A correct use of the range indicator in an Internet address would be `10.8-5.8.7`.

Message	Explanation
`/usr/adm/inetd.sec: allow/deny field does not have a valid entry for service.`	The entry in the second column is not one of the keywords `allow` or `deny`. The `inetd` server ignores the entry and does not implement security for this service unless there is a subsequent entry in the `inetd` security file for this service that is correct.

Implementation Differences

The implementation of `inetd` on the HP e3000 differs from `inetd` on the HP 9000 in the following ways:

- On the HP e3000, you normally run `inetd` as a job.
- On the HP e3000, there is no `syslogd` server. Instead, all error and informational messages about `inetd` are automatically written to `$STDLIST` for `inetd`. When you run `inetd` as a job, messages are sent to the job's output spool file. Messages which would be logged at the `syslogd` warning log level on HP-UX are, on MPE/iX, additionally sent to the console.

3 Telnet Service

With the release of version C.55.00 of MPE/iX, Telnet server functionality is available to HP e3000 customers. The Telnet server allows users on a remote system that supports the **TCP/IP** and Telnet protocols to log on and run applications on the HP e3000. The Telnet client, which was first made available on version C.50.00 of MPE/iX, gives users on an HP e3000 direct access to other systems that support Telnet and TCP/IP.

This chapter describes:

- How to verify the installation of the Telnet files
- How to edit the `inetd` configuration file and the services file to configure the Telnet server.
- How to start the Telnet server once the product has been configured.
- How to troubleshoot problems that arise with Telnet
- Implementation differences between `Telnet` for MPE/iX and `Telnet` for HP-UX.

Before release C.55.00, the capability to receive incoming Telnet connections on the HP e3000 was only available with DTC Telnet access. The HP e3000 processed such connections via a DTC configured with a Telnet Access Card (TAC) using PC-based management software. HP e3000 customers can continue to use DTC Telnet access, particularly if the level of Telnet traffic places a heavy load on the processing capacity of the host HP e3000's CPU.

NOTE Online information about the Telnet client and server is available in the ASCII file `TELNTDOC.ARPA.SYS`.

Overview of Telnet Service

Telnet service consists of a Telnet client and a Telnet server.

The Telnet server uses the standard virtual terminal protocol, originally developed by the Advanced Research Projects Agency (ARPA) to allow users on a remote node that supports the Telnet and TCP/IP protocols to log on and run applications on the host HP e3000. When you configure and enable Telnet on your system, `inetd`, the master server for the Internet Services, will listen for connection requests from Telnet clients. If the request comes from an authorized client node (for example, one that is allowed Telnet access to the host via the `allow` entry in the `inetd` security file), `inetd` will accept the request and start a Telnet session for the requesting client.

The Telnet client allows users on your system to log onto and run applications on a remote host system that supports Telnet access. On MPE/iX, the Telnet client is the program file `TELNET.ARPA.SYS`.

Read “Implementation Differences” for a discussion of the differences between the implementation of the Telnet server on the HP e3000 and the Telnet server as it is implemented on HP-UX systems.

Verifying Installation of Telnet Files

If you have installed or updated to version C.60.00 of MPE/iX, use the following steps to verify that the Telnet software exists on your system:

1. If necessary, log on the system as `MANAGER.SYS`.
2. Run `NMMAINT` to verify that you have successfully installed the Telnet files.

   ```
   :NMMAINT,72
   ```

   You will see information similar to the following.

   ```
   NMS Maintenance Utility 32098-20014 B.00.09 (C) Hewlett Packard Co. 1984

   THU, JAN 18, 1996,  1:39 PM
   Data comm products build version: N.55.08

   Subsystem version ID's:


   HP TELNET/iX Subsystem HP32040A module versions:

   NM program file: TELNET.ARPA.SYS     Version:  A5500000
   NL procedure:    PTD_SM_VER          Version:  A5500000
   NL procedure:    PTD_HANDLER_VER     Version:  A5500002
   NL procedure:    PTD_PTID_VER        Version:  A5500001
   NL procedure:    PTD_PTOD_VER        Version:  A5500001
   NL procedure:    PTD_COMMON_VER      Version:  A5500000

   HP TELNET/iX Subsystem HP32040A overall version = A.55.00
   ```

3. Check the final line of the display to make sure there are no error messages such as a module is missing or there is a version mismatch. For example:

   ```
   Version levels differ in one or more modules.  (NMERR 103)
   HP TELNET/iX Subsystem HP32040A overall version = ?.??.??
   ```

4. Issue a `LISTGROUP` command for `ARPA.SYS` to verify that its capabilities are PM, PH, IA, and BA.
5. Issue a `LISTF` command for the Telnet files in `ARPA.SYS` to verify that ANY (anyone) can read `TELNTDOC.ARPA.SYS` and that ANY (anyone) can read and execute `TELNET.ARPA.SYS`. Enter:

   ```
   :LISTF TEL@.ARPA.SYS,3
   ```

Configuring Telnet Server

To configure Telnet, you will edit two files: the services file, which lists the individual services that comprise the suite of Internet Services, and the `inetd` configuration file, which informs the Internet daemon about running Telnet on this system.

Editing the Services File

The services file associates official service names and aliases with the port number and protocol the services use. To enable Telnet, you must edit the services file. Perform the following:

1. Open the services file with an MPE text editor. You may edit the `/etc/services` file from the POSIX shell or the `SERVICES.NET.SYS` file from MPE/iX, whichever you prefer. Both file names should point to the same file.
2. Verify that the following line exists in the file or add it if it does not:

   ```
   telnet 23/tcp
   ```
3. If the line already exists in the file and it is preceded by a pound symbol (#), delete the symbol and any spaces before the service name to enable the service.
4. Save the file and exit the editor program.

For more detailed information about editing this file, read Chapter 1, “Introduction to Internet Services.”

Adding Telnet Service to inetd Configuration

The configuration file for `inetd` determines which installed Internet Services are available to users. To add Telnet service to your system, you need to edit the configuration file for `inetd`, then have `inetd` re-read the configuration. Perform the following:

1. Open the configuration file with a text editor. You may edit the `/etc/inetd.conf` file from the POSIX shell or the `INETDCNF.NET.SYS` file from MPE/iX, whichever you prefer. Both file names should point to the same file.
2. Verify that the following line exists in the file or add it if it does not:

   ```
   telnet stream tcp nowait MANAGER.SYS internal
   ```
3. If the line already exists in the file and it is preceded by a pound symbol (#), delete the symbol and any spaces before the service name to enable the service.
4. Save the file and exit the editor program.
5. Signal `inetd` to reread the configuration file by entering the following command at the CI prompt:

   ```
   :INETD.NET.SYS -c
   ```

   Or you may enter this command from the POSIX shell:

   ```
   $/etc/inetd -c
   ```
6. If you have added the Telnet server to the `inetd` configuration file while the Internet daemon is not running, you must start `inetd` to start the Telnet server. To do so, stream the job `JINETD.NET.SYS` from the CI prompt.

   ```
   :STREAM JINETD.NET.SYS
   ```

For more detailed information about editing this file, read Chapter 2, “Internet Daemon.”

Troubleshooting Telnet

This section explains the kinds of errors that may arise regarding the operation of Telnet. The Telnet client user will, in all but one case, be alerted about the problem directly; an error message will appear on the client's terminal. You, as system manager of the host system may receive phone calls from client asking you to investigate the problem.

Problem	Explanation
Unknown service	This message will be written to `$STDLIST` for `JINETD.NET.SYS` when a Telnet client is unable to find the Telnet entry in the services file. Telnet client users may see a similar message on their terminal, and call you, the system manager of the host, to resolve the problem. Open the services file and make sure that the line `telnet 23/tcp` exists. If necessary add the line and then reconfigure the Internet daemon. For more information, read "Editing the Services File" earlier in this chapter.
The Telnet client cannot run Telnet	The Telnet client user may not have entered the correct program name at the prompt, which is `TELNET.ARPA.SYS`. Or, there may be problems with the network.
The Telnet client cannot connect to the host	The Telnet client user can encounter this problem for one of several reasons: • The user entered the domain name, IP address, or NS node name incorrectly. • The system the client attempted to access does not support Telnet. • The network of the system the client attempted to access is not working. • The Internet daemon is not running on the system the client tried to access.
There is a host name lookup failure	The Telnet user tried to log on when the network was not running. Or the host system the client tried to access is not configured on the network.
The Telnet client cannot logon to a host	The Telnet client successfully established a connection to the host, but could not logon. The user may call you, as host system manager, to verify that the logon account and passwords are correct and to see if the system limits are set such that new Telnet sessions are prohibited.

Problem	Explanation
The Telnet server cannot run an application	The Telnet client successfully established a Telnet connection and logs on to the host system. But, when the user runs the application, the software behaves oddly or it produces error messages. If you receive a call about this problem, you or the user can consult the *Asynchronous Serial Communications Programmer's Reference Manual* to see if the application is attempting to use file system instrinsics that the Telnet server doesn't support. Or have the user and his or her system manager check the set and toggle values on their system to make sure they are the values required by the application.
Invalid command	The Telnet client user entered an invalid command at the Telnet prompt. Type a question mark (?) to display a list of valid commands.

Implementation Differences

The implementation of Telnet on the HP e3000 does not use a separate `telnetd` server file similar to the `tftpd` or `bootpd` server. Instead, Telnet server functionality is provided by code that resides in `NL.PUB.SYS` on version C.60.00 of MPE/iX. As a result, the last column of the Telnet entry in the `inetd` configuration file is the word “internal.” For example:

```
telnet stream tcp nowait MANAGER.SYS internal
```

By contrast, the entry for the `BOOTP` server in the `inetd` configuration file shows “bootpd” in the last column because the `BOOTP` server is not implemented internally. For example:

```
bootps dgram udp wait MANAGER.SYS /SYS/NET/BOOTPD bootpd
```

The implementation of the Telnet server as an internal program concerns you as system manager, in the following two ways:

- When you issue a `LISTFILE` command for `NET.SYS`, you will not see a `telnetd` server file. You do, however, edit the services file and the `inetd` configuration file to enable Telnet on your system as you do for the other Internet Services.
- Any security checking the host does before it initiates a Telnet session for the requesting client must be handled by the Internet daemon’s internal security. Specifically, this means that system programmers cannot write “wrappers,” programs that wrap around the Telnet entry in the configuration file to force a separate security-checking program to run on that socket to determine if the connection can or should be established. Instead, you use the `inetd` security file to allow or deny specific nodes Telnet access to your system. For information, read Chapter 2, “Internet Daemon.”

4 BOOTP Service

The Internet Boot Protocol daemon, or `bootpd`, is used to boot LAN devices such as routers, printers, X-terminals, and diskless workstations. Nodes on the network use `bootpd` to get configuration information such as an **IP address** and a **subnet mask** and automatically boot the device. This chapter describes:

- How to configure `bootpd`.
- How to start `bootpd` once it has been configured.
- Implementation differences between `bootpd` for MPE/iX and `bootpd` for HP-UX.

Overview of bootpd

The Bootstrap Protocol BOOTP allows a client system to get boot information such as its own IP address, the address of a BOOTP server, and the name of the file it needs to load into its memory and execute to boot the printer. The bootstrap operation happens in two phases. In the first phase, the BOOTP daemon bootpd determines the address of a BOOTP server and selects a boot file. In the second phase, the Trivial File Transfer Protocol daemon tftpd transfers the boot file to the node that requests it.

bootpd Files

There are three files that you will need to configure and use bootpd on your system. These files were copied to the NET group of the SYS account when you installed or updated to version C.55.00 or later, of MPE/iX. Table 4-1 briefly describes each one.

Table 4-1 Files for bootpd

File	Description
BOOTPD.NET.SYS	The program file for bootpd which is linked to the POSIX file /etc/bootpd.
BPTABSMP.NET.SYS	The sample configuration file for bootpd that contains information about all of the network devices this system can boot. You will copy this file to BOOTPTAB.NET.SYS, create a symbolic link from the POSIX file /etc/bootptab to this file, and edit it as necessary.
BOOTPQRY.NET.SYS	A program for testing bootpd. You will not need to copy or edit this file, but you will create a symbolic link from the POSIX file /etc/bootpquery to BOOTPQRY.NET.SYS.

Configuring bootpd

To configure bootpd, you will edit three files: the services file, which lists the individual services that comprise the suite of Internet Services, the inetd configuration file, which informs the Internet daemon about running bootpd on this host, and the bootpd configuration file, which contains client and **relay** information. These tasks are explained in the following sections.

Editing the Services File

The services file associates official service names and aliases with the port number and protocol the services use. To enable bootpd, you must edit the services file. Perform the following:

1. Open the services file with an MPE text editor. You may edit the /etc/services file from the POSIX shell or the SERVICES.NET.SYS file from MPE/iX, whichever you prefer. Both names should point to the same file.
2. Verify that the following lines exist in the file or add them if they do not:

```
bootps 67/udp # Bootstrap protocol server
```

```
bootpc 68/udp # Bootstrap protocol client
```

3. If the lines already exist in the file and they are preceded by a pound symbol (#), delete the symbol and any spaces before the service name to enable the service.
4. Save the file and exit the editor program.

Adding BOOTP Server to inetd Configuration

The configuration file for `inetd` determines which installed Internet Services are available to users. To add `bootpd` to your system, you need to edit the configuration file for `inetd`, then have `inetd` re-read the configuration. Perform the following:

1. Open the `inetd` configuration file with a text editor. You may edit the `/etc/inetd.conf` file from the POSIX shell or the `INETDCNF.NET.SYS` file from MPE/iX, whichever you prefer. Both names should point to the same file.
2. Verify that the following line exists in the file or add it if it does not:

   ```
   bootps dgram udp wait MANAGER.SYS /SYS/NET/BOOTPD bootpd
   ```

3. If the line already exists in the file and it is preceded by a pound symbol (#), delete the symbol and any spaces before the service name to enable the service.
4. Save the file and exit the editor program.
5. Signal `inetd` to reread the configuration file by entering the following command at the CI prompt:

   ```
   :INETD.NET.SYS -c
   ```

   Or you may enter this command from the POSIX shell:

   ```
   $/etc/inetd -c
   ```

6. If you have added `bootpd` to the `inetd` configuration file while the Internet daemon is not running, you must start `inetd` to start the `BOOTP` server. To do so, stream the job `JINETD.NET.SYS` from the CI prompt.

   ```
   :STREAM JINETD.NET.SYS
   ```

For more detailed information about editing this file, read Chapter 2, “Internet Daemon.”

The bootpd Configuration File

When bootpd is started, it reads a configuration file to find out information about clients and relays, then listens for boot request **packets**. By default, bootpd uses the configuration file /etc/bootptab, but you may specify another configuration file.

The BOOTP server will reread its configuration file and update its information about new, deleted or modified hosts on two occasions other than startup: when you send it a **SIGHUP signal**, or when it receives a boot request packet and detects that the configuration file has been edited.

Creating and Linking bootpd Configuration File

You may already have a configuration file for bootpd installed on your system. If you know that you have such a file, and it is accessible by the POSIX file name /etc/bootptab you may skip these steps.

If not, follow the steps below to create the file and link to it. If you have such a file, but are unsure whether or not it is linked, perform step 2 only.

1. Create your own configuration file by using the COPY command to rename the sample file. Enter:

   ```
   :COPY BPTABSMP.NET.SYS TO BOOTPTAB.NET.SYS
   ```

2. Create a symbolic link from /etc/bootptab in the POSIX name space to BOOTPTAB.NET.SYS. Enter:

   ```
   :NEWLINK /etc/bootptab, BOOTPTAB.NET.SYS
   ```

3. Check the security provisions of the file and change them, if necessary. Hewlett-Packard recommends that only MANAGER.SYS has write access to BOOTPTAB.NET.SYS, and write and purge access to /etc/bootptab.

Editing the bootpd Configuration File

Use the following steps to edit the bootpd configuration file:

1. Open the file with an MPE text editor. You may edit the /etc/bootptab file from the POSIX shell or the BOOTPTAB.NET.SYS file from MPE/iX, whichever you prefer. Both file names should point to the same file.
2. Add, delete, or change any of the entries in the file. The following sections give you more information about the contents of the bootpd configuration file.
3. Save the file and exit the editor program.

Adding Client and Relay Data to bootpd Configuration File

To allow a client to boot from your local system or to allow a boot request to be relayed to the appropriate boot server, you must add information about the client to the bootpd configuration file. This file contains client entries and relay entries. Client entries provide the information necessary to allow clients to boot from your system. Relay entries provide the information necessary to relay a boot request to one or more bootpd servers.

The information that you need to collect for these types of entries is explained in the next two sections.

Collecting Client Information

To make an entry for the client in the bootpd configuration file, you need to collect information about the client such as the following:

- Name of the client's system.
- Type of network interface hardware (IEEE 802.3 or Ethernet).
- Client's hardware address.
- Client's assigned IP address.
- IP address mask that identifies the network where the client resides.
- Address of the gateway for the client's local subnet.
- Name of the boot file that the client will retrieve using TFTP.

Collecting Relay Information

To make a relay entry for the client in the `bootpd` configuration file, you need to collect information such as the following:

- Name of the client's system.
- Type of network interface hardware (IEEE 802.3 or Ethernet).
- Client's hardware address.
- Subnet mask used to identify the network address where the client resides.
- Address of the gateway that connects the client's local subnet to the intended `BOOTP` server's subnet.
- IP addresses of the `BOOTP` servers to which the local system will relay the client's boot request.
- Threshold value, which is the number of elapsed seconds since the client's first request.
- Maximum number of hops that the client's boot request can be forwarded.

Syntax of bootpd Configuration Entries

An entry in the `bootpd` configuration file consists of a single line with the following format:

```
hostname:tag=value tag=value tag=value
```

The `hostname` is the actual name of a `BOOTP` client and the tag is a two-character case-sensitive symbol. Most tags are followed by an equal sign and a value, as shown above, though some tags do not require a value. The `BOOTP` daemon uses these tags and values to recognize a client's boot request, supply parameters in the bootreply to the client, or relay the boot request.

For example, here is an entry for client printer01:

```
printer01: ht=ether: ha=080009030166: ip=15.19.8.2:\\ sm=255.255.248.0: gw=15.19.8.1: bf=/printer01
```

This entry tells bootpd that the host `printer01` uses an Ethernet network interface (`ht=ether`) whose hardware address (`ha`) is `080009030166`. The IP address (`ip`) is `15.19.8.2`, the Subnet mask (`sm`) is `255.255.248.0`, and the address of the gateway (`gw`) is `15.19.8.1`. The bootfile that `tftpd` will transmit to boot this printer (`bf`) is `/printer01`.

Tags Used in bootpd Configuration File

You can use any of the following tags to enter client or relay data into the bootpd configuration file.

Tag	Description
ba or ba=address	Tells bootpd to broadcast the boot reply to the client. If you specify no value for ba, bootpd sends the boot reply on the configured broadcast address of each network interface on the server's system. If you specify an IP-address for its value, bootpd sends the boot reply to a specific IP or broadcast address. Use the ba tag only for diagnostic purposes, for example when debugging boot replies with BOOTPQRY.
bf=filename	Specifies the filename, in Hierarchical File Structure (HFS) syntax, of the bootfile that the client should download. The client's boot request, and the values of the hd and bf tags, determine the contents of the bootfile field in the boot reply packet.
bs=size or bs	Specifies the size of the bootfile in 512-octet blocks, expressed as a decimal, octal, or hexadecimal integer. Or, if you omit the value, bootpd will automatically calculate the bootfile size at each request.
ds=ip address list	Specifies the IP address of one or more RFC1034 Domain Name servers.
gw=ip address list	Specifies the IP address of one or more gateways for the client's subnet. If you prefer one of multiple gateways, list it first.
ha=hardware-address	Specifies the hardware address of the client in hexadecimal. You may include periods and/or a leading 0x for readability. The ha tag must be preceded by the ht tag either explicitly or implicitly; see tc below.
hd=home-directory	Specifies an HFS directory name to which the bootfile is appended (see bf tag above). The default value is (/).
hn	Directs bootpd to send the client's hostname in the boot reply. The BOOTP daemon attempts to send the entire hostname as it is specified in the configuration file. If this cannot fit into the reply packet, it attempts to shorten the name to just the host field (up to the first period, if present) and send that. In no case will bootpd send an arbitrarily truncated hostname. If nothing reasonable can fit, it sends nothing.
ht=hardware-type	Specifies the hardware type code. The hardware-type can be an unsigned decimal, octal, or hexadecimal integer corresponding to one of the ARP Hardware Type codes specified in RFA1010. The HP e3000 implementation will support ether for ethernet networks and ieee802 for IEEE 802.3 networks.
ip=ip address	Specifies the IP address of the BOOTP client.
sm=subnet-mask	Specifies the client's subnet mask as a single IP address.

Tag	Description
`T`*nnn*`=generic-data`	A generic tag where *nnn* is an RFC1048 vendor field tag number. This allows `bootpd` to immediately take advantage of future extensions to RFC1048. The generic-data data can be represented as either a stream of hexadecimal numbers or as a quoted string of ASCII characters. The length of the generic data is automatically determined and inserted into the proper fields of the RFC1048-style boot reply.
`tc=template-host`	Indicates a table continuation. Often many host entries share common values for certain tags (such as domain servers) and, rather than repeatedly specifying these tags, a full specification can be listed for one host entry and shared by others. The template-host is a dummy host (configuration file entry) for a host that does not actually exist and never sends boot requests. Information explicitly specified for a host always overrides information implied by a `tc` tag symbol, regardless of its location within the entry. The value of `template-host` can be the hostname or IP address of any host entry previously listed in the configuration file. If it is necessary to delete a specific tag after it has been inferred via `tc`, enter `tag@`. For example, to undo an RFC1034 domain name server specification, use `:ds@:` at an appropriate place in the configuration entry. After canceling the tag this way, you may set it again.
`to=offset`	Specifies the client’s time zone offset in seconds from UTC. The time offset can be either a signed decimal integer or the keyword auto which uses the server’s time zone offset.
ts=`ip_address_list`	Specifies the IP address of one or more RFC868 Time Protocol servers.
`vm=magic-cookie`	Specifies the RFC1048 vendor information magic cookie, magic-cookie can be one of the following keywords: `auto`, indicating that vendor information is determined by the client’s request, `rfc1048`, which always forces an RFC1048-style reply, or `cmu`, which always forces a CMU-style reply.

Editing Tips

When you are updating the `bootpd` configuration file, keep the following points in mind:

- Client’s hostname must be the first field of an entry.
- If you specify an `ht` tag, it must precede the `ha` and `hm` tags.
- If you specify the `gw` tag, you must also specify the `sm` tag.
- IP addresses listed for a single tag must be separated by a space.
- A single client entry can be extended over multiple lines if you use a backslash (\) at the end of each line.
- Blank lines and lines that begin with the pound sign (#) are ignored.

A relay entry can contain relay parameters for an individual system or for a group of systems. If a BOOTP client does not have an individual entry in the bootpd configuration file, bootpd searches the group relay entries and uses the first group relay entry that matches the BOOTP client.

Sample bootpd Configuration Files

The two following examples show sample bootpd configuration files.

The first examle shows the configuration for a simple network without gateways or subnets.

```
#
#
# The first entry is the template for options common to all of the printers.
#
#global.defaults:\\
#       hn:\\
#       ht=ether:\\
#       vm=rfc1048:\\
#
# Now the actual entries for the individual printers are listed.
#
#printer1:\\
#       tc=global.defaults:\\
#       ha=08000903212F:\\
#       ip=10.13.193.72
#
#printer2:\\
#       tc=global.defaults:\\
#       ha=0800090324AC:\\
#       ip=10.13.193.73
#
#
```

The second example shows the configuration for a network with gateways and subnets.

```
#
#
#printer1:\\
#       tc=global.defaults:\\
#       ha=08000903212F:\\
#       gw=10.13.192.2:\\
#       sm=255.255.248.0:\\
#       ip=10.13.193.72
#
#printer2:\\
#       tc=global.defaults:\\
#       ha=0800090324AC:\\
#       gw=10.13.192.2:\\
#       sm=255.255.248.0:\\
#       ip=10.13.193.73
#
```

Starting bootpd

To successfully start bootpd, you must have a current and correct configuration file for it. The default file is /etc/bootptab but you may use an alternate configuration file by specifying its POSIX file name on the command line. Without this configuration file, bootpd will not be able to service BOOTP requests.

You can run bootpd under the Internet daemon only. You may not run it as a standalone server.

Starting bootpd Under inetd

If you are running `bootpd` with `inetd`, make certain that you have edited the `inetd` configuration file as explained earlier in this chapter. There is no special step required of you to start `bootpd`: When the Internet daemon is running, it will automatically invoke `bootpd` when it gets a connection request for that service. To find out how to start `inetd`, refer to Chapter 2, “Internet Daemon.”

Command Line Options for bootpd

You can change the way that `bootpd` operates by entering the `bootpd` command followed by one of the command line options. For example:

```
:BOOTPD.NET.SYS -d
```

The options available to you are explained below.

Option	Purpose
`-t`	Changes the timeout value for `bootpd`. The `BOOTP` daemon starts when the first `BOOTP` request arrives. If no other boot request arrives within the default period of 15 minutes, `bootpd` ends. If you specify a timeout of 0 minutes, the server will not die until you abort `JINETD` or `JINETD` ends in an error state.
`-d`	Sets the verbosity level for the logging messages generated by `bootpd`.
`configfile`	The configuration file `bootpd` reads to get configuration information, expressed in HFS syntax. By default, `bootpd` uses `/etc/bootptab`.

Troubleshooting bootpd

The BOOTPQRY program is a diagnostic tool used to check the configuration of bootpd. It uses the supplied parameters to construct a boot request to send to a BOOTP server. It prints the contents of the boot reply, including the client's Internet address, the name of a boot file, and the name and address of the server that sent the reply. BOOTPQRY formats and prints RFC1048 or CMU-style vendor information included in the reply.

The boot request packet is broadcast on the BOOTP server port. Responding servers return a bootreply packet on the BOOTP client port. BOOTPQRY can only display bootreply packets when the BOOTP server broadcasts the reply on the client port or when the hardware address and IP address supplied in the boot request are those of the host on which BOOTPQRY is run.

To use the BOOTPQRY program to troubleshoot bootpd, do the following:

1. Open the bootpd configuration file and look for the entry describing the network device you want to test.
2. When you find the entry, add the ba tag to it. This will force bootpd to broadcast the reply so that BOOTPQRY can display it.
3. Run the BOOTPQRY program by entering the BOOTPQRY command followed by the hardware address of the network you are testing, expressed in hexadecimal notation. For example, at the CI prompt you would enter:

   ```
   :BOOTPQRY.NET.SYS 08000902CA00
   ```

   Or, from the POSIX shell, you would enter:

   ```
   $/etc/bootpquery 08000902CA00
   ```

Diagnostic Options

The following options provide the information for the boot request:

Option	Purpose
haddr	The hardware address of the BOOTP client to use in the boot request. A BOOTP server responds if it has configuration information for a host with this link level address.
htype	The type of address specified as haddr, which may be ether or ieee802. The default address type is ether.
-i<ipaddr>	The Internet address of the BOOTP client <ipaddr> to use in the boot request. If the BOOTP client doesn't know its IP address, the BOOTP server supplies it in the bootreply. Otherwise, the server returns the bootreply directly to ipaddr.
-s<server>	The name of the BOOTP server <server> to which the boot request should be sent directly. When the BOOTP server is known, the boot request is not broadcast.
-v<vendor>	Request vendor information for <vendor>. The vendor can be specified as rfc1048 or CMU. For any other vendor specification, the first four characters of the parameter are used as the vendor magic cookie.
-f<bootfile>	Specify a boot file needed by the BOOTP client. If a boot file is specified in the boot request, the BOOTP server responds only if the server host can make the file available via TFTP.

Sample Diagnostic Results

Here is an example of BOOTPQRY output:

```
# bootpquery 0800092175ff

Received BOOTREPLAY from hpmpe992.cup.hp.com (15.19.134.20)
 hardware Address: 08:00:09:21:75:ff
 Hardware Type ethernet
 IP Address:  15.19.123.53
 Boot file:  (None)

RFC1048 Vendor Information:
 Subnet Mask: 255.255.248.0
 Log Server  15.19.134.20
 Host Name;  hpljnet2
 Tag #144  [104, 112, 110, 112, 108, 106,
      110, 101, 116, 46, 99, 102, 103]
```

Implementation Differences

The implementation of `bootpd` on the HP e3000 differs from `bootpd` on the HP 9000 in following ways:

- The `BOOTP` entry in the `inetd` configuration file must have an MPE/iX compatible user name. Hewlett-Packard recommends that you use `MANAGER.SYS`.
- You cannot run `bootpd` as a standalone server. It can only be run by the Internet daemon.

5 TFTP Service

The Trivial File Transfer Protocol (TFTP) is a basic communications protocol used to transmit files between nodes on a network. It is implemented on top of the Internet User Datagram Protocol (UDP), so it can be used across networks that support UDP. On the HP e3000, the TFTP daemon `tftpd` transfers boot files to or from the host HP e3000 to remote nodes on the network. This permits a network device to get the information it needs to start itself.

This chapter describes:

- How to configure `tftpd`
- How to start `tftpd` once the server has been configured.
- Implementation differences between `tftpd` for MPE/iX and `tftpd` for HP-UX.

Overview of tftpd

TFTP is a simplified version of the File Transfer Protocol (FTP). The primary function of the TFTP daemon `tftpd` is to support the Bootstrap Protocol BOOTP, which allows network devices to get the information they need to boot, or start, themselves. Network devices commonly use TFTP to transmit boot files because TFTP is simple enough to be implemented in ROM.

On the HP e3000, the TFTP daemon `tftpd` transfers files to or from the host HP e3000 to remote systems or printers. Configuring `tftpd` on your system allows you to make boot files (and other kinds of files) available to remote clients that support TFTP.

Configuring tftpd

To configure `tftpd`, you will edit two files: the services file, which lists the individual services that comprise the suite of Internet Services, and the `inetd` configuration file, which informs the Internet daemon about running `tftpd` on this system. These tasks are explained in the next sections.

Editing the Services File

The services file associates official service names and aliases with the port number and protocol the services use. To enable `tftpd`, you must update the services file. Perform the following:

1. Open the services file with an MPE text editor. You may edit the `/etc/services` file from the POSIX shell or the `SERVICES.NET.SYS` file from MPE/iX, whichever you prefer. Both names should point to the same file.
2. Verify that the following line exists in the file or add it if it does not:

   ```
   tftp 69/udp # Trivial File Transfer Protocol
   ```

3. If the line already exists in the file and it is preceded by a pound symbol (#), delete the symbol and any spaces before the service name to enable the service.
4. Save the file and exit the editor program.

Adding TFTP Service to inetd Configuration

The configuration file for `inetd` determines which installed Internet Services are available to users. To add `tftpd` to your system, you will need to edit this configuration file, then have `inetd` re-read the configuration. To do so:

1. Open the `inetd` configuration file with a text editor. You may edit the `/etc/inetd.conf` file from the POSIX shell or the `INETDCNF.NET.SYS` file from MPE/iX, whichever you prefer. Both names point to the same file.
2. Verify that the following line exists in the file or add it if it does not:

   ```
   tftp dgram udp wait USER.TFTP /SYS/NET/TFTPD tftpd
   ```

3. If the line already exists in the file and it is preceded by a pound symbol (#), delete the symbol and any spaces before the service name to enable the service.

4. Save the file and exit the editor program.

There are two options in the `tftpd` entry, `[user]` and `[path]`, which are explained in the next two sections. For more detailed information about editing the configuration file, read Chapter 2, "Internet Daemon."

Specifying the TFTP User

The Internet daemon runs `tftpd` as the user specified in the `[user]` parameter of its entry in the `inetd` configuration file. For example, this entry instructs `inetd` to run the `TFTP` server as `USER.TFTP`:

```
tftp dgram udp wait USER.TFTP /SYS/NET/TFTPD tftpd
```

Hewlett-Packard recommends that you run `tftpd` this way, and that you use the following steps to create the `TFTP` account and two user identifications, `USER.TFTP` and `MGR.TFTP`, with the appropriate capabilities:

1. If necessary, log onto the system as `MANAGER.SYS` or to another user identity that has been assigned SM capability.
2. Create the `TFTP` account by entering the following command at the CI prompt:

   ```
   :NEWACCT TFTP,MGR;CAP=AM,PH,DS,ND,SF,IA,BA
   ```

3. Create the new user of the `TFTP` account with a home directory of `TFTPDIR` by entering the following command at the CI prompt:

   ```
   :NEWUSER USER.TFTP;cap=BA,PH,DS;home=TFTPDIR
   ```

   When a client accesses `tftpd` it will first look for the file in the home group `TFTPDIR`.
4. Create the home directory `TFTPDIR` by entering the following command at the CI prompt:

   ```
   :NEWGROUP TFTPDIR.TFTP
   ```

5. Modify the new manager of the `TFTP` account by entering the following command at the CI prompt:

   ```
   :ALTUSER MGR.TFTP;cap= PH,DS,ND,SF,IA,BA
   ```

For security reasons, `USER.TFTP` is not assigned ND, SF, PM or SM capabilities. This way `USER.TFTP` can be used to run `tftpd` while `MGR.TFTP`, who is assigned some of these capabilities, can control which files are placed in the `TFTPDIR` group.

Specifying a Search Path

As an option, you can use the `[path...]` parameter in the `inetd` configuration file entry to specify the list of files or directories that are available to TFTP clients. For example, if you would like to have the `/tmp` and `/bin` directories available to TFTP clients in addition to the home group of the TFTP user, edit the line to look like this:

```
tftp dgram udp wait USER.TFTP /SYS/NET/TFTPD tftpd /tmp /bin
```

When a file is requested by a TFTP client, `tftpd` first looks for a file relative to the home directory of the user specified in the `inetd` configuration file. If it does not find the file there, it then checks to see if the following two conditions are met:

- File requested is at or below `[path]`.
- User specified in the `inetd` configuration file (in the previous examples, `USER.TFTP`) has access to the file.

When invoked with no path arguments, `tftpd` cannot follow symbolic links that refer to paths outside of the home directory of the user specified in the `inetd` configuration file.

Permission to Retrieve Files

If permission is given to remote systems to retrieve a file through TFTP, then the file must be readable by the user specified in the `inetd` configuration file. If permission is given to remote systems to transmit a file through TFTP, then the file must already exist and be writable by the user specified in the `inetd` configuration file.

Starting tftpd

The TFTP daemon runs under the Internet daemon. If you have just added `tftpd` to the `inetd` configuration, you must reconfigure `inetd` to begin using TFTP. To reconfigure `inetd`, enter the following command at the CI prompt:

```
:INETD.NET.SYS -c
```

Or, from the POSIX shell, enter this command:

```
$/etc/inetd -c
```

If you have added `tftpd` to the `inetd` configuration file while the Internet daemon is not running, you must start `inetd` to start the TFTP server. To do so, stream the job `JINETD.NET.SYS` from the CI prompt.

```
:STREAM JINETD.NET.SYS
```

Troubleshooting tftpd

The following error messages may be generated by TFTP and logged with the syslog facility, if it is enabled.

Message	Explanation
`Unknown option ignored`	An invalid option was specified in the `tftpd` arguments. Remove or correct the arguments and restart `tftpd`.
`Invalid total time-out`	The value given for the `-T` option was either not a number or was a negative number. Correct the value and restart `tftpd`.
`Invalid retransmission time-out`	The value for the `-R` option was either not a number or was a negative number. Correct the value and restart `tftpd`.
`system call<$Isystem call>:…`	The system call specified in the message failed. The reason for failure is explained in the error message appended to the system call name in its documentation.

Implementation Differences

The implementation of `tftpd` on the HP e3000 differs from `tftpd` on the HP 9000 in three ways:

- On HP-UX, `tftpd` is usually run as root. On MPE/iX, it is usually run as `USER.TFTP`.
- On HP-UX, `tftpd` checks if the user `tftp` can write to or read the file. On MPE, `tftpd` checks if the user specified in its configuration file can write to or read the file. If you configure `tftpd` as recommended in this chapter, `USER.TFTP` will be specified in the configuration file and `tftpd` will check the same user.
- On MPE/iX, the `tftp` user is configurable and it is not on HP-UX. As a result, on MPE/iX `tftpd` looks at the file relative to the home directory of whichever user is specified in the `inetd` configuration file. On HP-UX, `inetd` always looks at the file relative to the home directory of the `tftp` user.

6 REMSH Service

The remote shell, or `remsh`, service is used to connect to a specified host and execute a command on that remote host. The remote shell or `remsh` is available with version C.60.00 of the MPE/iX operating system.

This chapter describes:

- How to configure the services file to allow `remsh` to run.
- How to verify that `remsh` is available on the system.
- How to run `remsh`
- Implementation differences between `remsh` on MPE/iX and `remsh` for HP-UX.

Overview of remsh Service

The remote shell `remsh`, is the same service as `rsh` on BSD UNIX systems. The name was changed due to a conflict with the existing command `rsh` (restricted shell) on System V UNIX systems.

Use `remsh` to connect to the remote system and execute a command on that remote system. Output from the remote command is sent to standard output for `remsh`, so the user can see the results of the command.

Verifying Installation of remsh Files

The `remsh` client is part of the Internet Services product with release C.60.00. To verify that `remsh` is available on your system you may use `NMMAINT` verify versions of the Internet services product.

```
hawaii(PUB); nmmaint,73
NMS Maintenance Utility 32098-20014 B.00.09 (C) Hewlett Packard Co. 1984

WED, JUL 23, 1997,  11:08 AM Data comm products build version: N.55.15

Subsystem version ID’s:


Internet Services for the HP e3000 module versions:

NM program file: INETD.NET.SYS               Version:  B0001003
NM program file: BOOTPD.NET.SYS              Version:  B0001003
NM program file: BOOTPQRY.NET.SYS            Version:  B0001002
NM program file: TFTPD.NET.SYS               Version:  B0001002
NM program file: REMSH.NET.SYS               Version:  B0001003
XL procedure:    INSVXL_SECURE_VERS          Version:  B0001004
XL procedure:    INSVXL_IPCSEC_VERS          Version:  B0001002
XL procedure:    INSVXL_NSRW_VERS            Version:  B0001003
XL procedure:    INSVXL_NETOF_VERS           Version:  B0001002
XL procedure:    INSVXL_SYSLOG_VERS          Version:  B0001003
XL procedure:    INSVXL_SIGNAL_VERS          Version:  B0001002
XL procedure:    INSVXL_GETTIME_VERS         Version:  B0001003

Internet Services for the HP e3000 overall version = B.00.01
```

Configuring remsh Client

There is only one file on the MPE/iX system that you will need to change in order to allow use of the `remsh` client. That is the file `SERVICES.NET.SYS`. However, there are some files that will need to be configured on the remote UNIX systems.

Editing the Services File

The services file associates official service names and aliases with the port number and protocol the services use. To enable `remsh`, you must edit the services file. Perform the following:

1. Open the services file with a text editor. You may edit the `/etc/services` file from the POSIX shell or the `SERVICES.NET.SYS` file from MPE/iX, whichever you prefer. Both names should point to the same file.
2. Verify that the following line exists in the file, or add it if it does not:

   ```
   shell   514/tcp cmd   # remote command, no passwd used
   ```

3. If the line already exists in the file and is preceded by a pound symbol (#), delete the # and any spaces before the service name to enable the service.
4. Save the file and exit the editor program.

UNIX Configuration

The `remsh` service does not prompt for user ID and passwords. That information is handled via the command line parameters and configuration on the UNIX host. See the “Using remsh” section for details on how the user id is determined and passed to the UNIX host.

Password information is bypassed by use of a `.rhosts` in the remote user’s home directory or by use of the file `/etc/hosts.equiv.` See the man pages of the UNIX system for details on how to set up a `/etc/hosts.equiv` file. A user’s `.rhosts` file entry will consist of the MPE/iX system name and user ID.

If you wish to access the HP-UX Host “taltos” as user **cawti** from the MPE/iX system jhereg while user `MANAGER.SYS`, you’ll need to set up a host equivalency via the `/etc/hosts.equiv` file, or you will create a `.rhosts` file in the home directory of user **cawti** on the “taltos” machine. The `.rhosts` file entry would look like:

```
jhereg MANAGER.SYS
```

This will cause the `remsh` daemon on the UNIX host to allow a connection from `MANAGER.SYS` on jhereg to the **cawti** user on the host “taltos.” The `.rhosts` file for user **cawti** would contain an entry for every host and userid that you desired to access the “taltos” host as if they were the user **cawti**.

NOTE The MPE/iX equivalent of the UNIX user id is the User.Account. An artifact of the MPE/iX implementation is that the MPE/iX information is usually reported in upper case. So be sure your `.rhosts` or `/etc/hosts.equiv` entries use the MPE/iX user ID information in uppercase.

Using remsh

The `remsh` service is accessed by running the `REMSH.NET.SYS` program. You may do so under the MPE/iX CI or under the POSIX shell. While the format of the commands will differ depending on how you run the program, the parameter list remains the same.

For the purposes of explaining the parameters, look at a sample invocation from the POSIX shell. Detailed examples of both the POSIX shell and MPE/iX invocations will follow later.

From the POSIX shell, invoke the `remsh` by typing:

```
/SYS/NET/REMSH remotehost -1 remoteuser remotecommand
```

In all cases you must provide a `remotehost` and a `remotecommand`. The `remsh` program will fail and generate an error message otherwise. Unless the remote system has MPE/iX type userids, you will also need to provide a `-l remoteuser` parameter as well. Otherwise the remote system will not allow the connection.

The name of the remote host you are attempting to connect to is remotehost. The host name can be either the official name or an alias as understood by gethostbyname().

The userid is `remoteuser` on the remote system.

NOTE The traditional UNIX implementation of `remsh` makes the *`-l remoteuser`* parameter optional. If you do not provide a *`-l remoteuser`* parameter, `remsh` takes your current userID and assumes that you wish to connect to the same userID on the remote system. Since the MPE version of the userID is `USER.ACCOUNT`, and the UNIX equivalent is user, it is unlikely that you will find a user on the remote system to match your id. We recommend that you always provide the *`-l remoteuser`* argument to `remsh`.

The `remotecommand` is the command the user wishes to execute on the remote machine. This command may be a CI command, a program (that meets certain criteria) or a shell script. If `remotecommand` is not specified, `remsh` will terminate and provide a usage message.

NOTE `remsh` cannot be used to run commands that require a terminal interface (such as vi) or commands that read their standard error (such as more).

MPE/iX Examples

To run `remsh` from MPE/iX prompt, type:

```
run remsh.net.sys;info="remotehost -l remoteuser remotecommand"
```

```
jhereg(PUB): run remsh.net.sys;info="taltos -l cawti pwd " /u2/home/cawti
END OF PROGRAM
jhereg(PUB):
```

POSIX Examples

From the POSIX Shell prompt, type:

```
/SYS/NET/REMSH remotehost -l remoteuser remotecommand
```

```
shell/iX> /SYS/NET/REMSH taltos -l cawti pwd
/u2/home/cawti
shell/iX>
```

There are a number of shell features that can be taken advantage of, while running under the POSIX shell.

Shell metacharacters that are not quoted are interpreted on the local host; quoted metacharacters are interpreted on the remote host. Thus the command line:

```
/SYS/NET/REMSH taltos -l cawti cat remotefile >> localfile
```

appends the remote file `remotefile` to the local file `localfile`, while the command line:

```
/SYS/NET/REMSH taltos -l cawti cat remotefile ">>" otherremotefile
```

appends `remotefile` to the remote file `otherremotefile`.

The following command line runs `remsh` in the background on the local system, and the output of the remote command comes to your terminal asynchronously:

```
/SYS/NET/REMSH otherhost -l remoteuser  -n remotecommand &
```

The following command line causes `remsh` to return immediately without waiting for the remote command to complete:

```
/SYS/NET/REMSH otherhost -l remoteuser "remotecommand 1>&- 2>&- &"
```

`remsh` was written so that if the first parameter in its argument vector is not `remsh`, it will use the value as a host name. So you may symbolically link the host name to the `remsh` program. A typical BSD UNIX implementation will have these links under the `/usr/hosts` directory.

If you have made a symbolic link to the `remsh` program that is the host name, for example you have already entered, (ln `-s /SYS/NET/REMSH` taltos in our examples), you could simply generate the same result as the first example with the following:

```
shell/iX>taltos -l cawti pwd /u2/home/cawti shell/iX>
```

Troubleshooting remsh

`remsh` MPE/iX/X version won't support rlogin or rexec functionality usage: `remsh` host `-l` login `-n` command	Be sure to provide a command to execute.
`remshd` Login incorrect.	Probably invalid entry in remote `.rhosts` file. Be sure host name and user id are correct. User ID must be in uppercase. Be sure you provided a `-l` userid parameter or that the remote system has a userid that matches your MPE/iX logon.
Program requires more capabilities than allowed for the group, the user of a temporary file, or the hierarchical directory user. (LDRERR 505) Native mode loader message 505 Unable to load program to be run. (CIERR 625)	The first message is from running `remsh` from MPE/iX name space and the second from running under the POSIX Shell. The cause is typically lack of PM capability on the group where `remsh` resides. Since `remsh` is in `NET.SYS`, this problem is unlikely to be seen unless, someone changes the capability of the `NET.SYS` group.

```
**** EXEC FUNCTION FAILED; subsys =517; info = 48
ABORT: REMSH.NET.SYS
NM SYS a.00aa0270 dbg_abort_trace+$24 NM UNKN 150.00366f6c NM UNKN 2dd.0004bbd8 [1] +
Done (134) REMSH hpcsyn24 -l casc -n pwd 262204 Abort REMSH
```

`shell/tcp` Unknown service.	The "shell" service specification is not present in the services file. Edit `/etc/services` or `SERVICES.NET.SYS` to fix.
Can't establish `stderr`	`remsh` cannot establish secondary socket connection for `stderr`.
Couldn't reopen `stderr`	The remote command tried to reopen `stderror`. This is not allowed under `remsh`.
`<system call>: ...`	Error in executing system call. Appended to this error is a message specifying the cause of the failure.

Implementation Differences

The full remote shell service typically consists of two parts (the `remsh` client which allows a user on this machine to access remote hosts and the `remshd` server which allows `remsh` clients on other hosts to access the local host). Only the `remsh` client functionality has been implemented on the MPE/iX system.

The UNIX version of the `remsh` client has an optional `-n` parameter that tells the client to not read from `STDIN`. Due to differences between MPE I/O and UNIX I/O the `-n` parameter has been hard coded into the MPE/iX client.

The HP-UX `remsh` client also allows rlogin and rexec functionality. Since the MPE/iX implementation was designed to address the needs of users attempting to access UNIX commands/scripts from stream jobs, we chose not to implement any feature needing interactive input with the remote system.

7 Samba for MPE/iX Services

Samba for MPE/iX is a suite of programs which work together to allow clients to access a server's file space and printers via the Server Message Block (SMB) file server. Samba for MPE/iX runs on MPE/iX shell operating system starting with the MPE/iX 6.0 release. It allows the MPE/iX shell operating system to act as a file and printer server for SMB clients which are, primarily, Windows for Workgroups, Windows 95, Windows NT, and other clients.

Overview of Samba for MPE/iX

Samba for MPE/iX is a suite of programs which allow an HP e3000 running MPE/iX operating system to provide service using a Microsoft networking protocol called Server Message Block (SMB). This product allows implementation of interoperability features allowing the system to act as a file and print server to PC clients running the following operation systems:

- Microsoft Windows NT
- Microsoft Windows 95
- Microsoft Windows for Workgroups

Introduction to Samba

Samba is an application of choice allowing interoperability between Windows and UNIX-like systems. It is a group of programs that allows a UNIX host to act as a fileserver for DOS and Windows platforms and also provides print services for them. It is freely available under the GNU Public License. Samba allows UNIX-like machines to be integrated into a Windows network without installing any additional software on the Windows machines. Many different platforms run Samba successfully; and there are nearly forty different operating systems which support Samba.

Features of Samba for MPE/iX

As more of our customers implement and configure networking services in a heterogeneous environment of MPE/iX, UNIX, and Windows NT servers, along with Netware, Windows, and NT workstation clients, the need for knowledge in the area of interoperability becomes a must for our customers. Beginning with MPE/iX release 6.0, Samba for MPE/iX is available on MPE/iX shell operating system. It allows clients to access a server's filespace and printers via the SMB protocol.

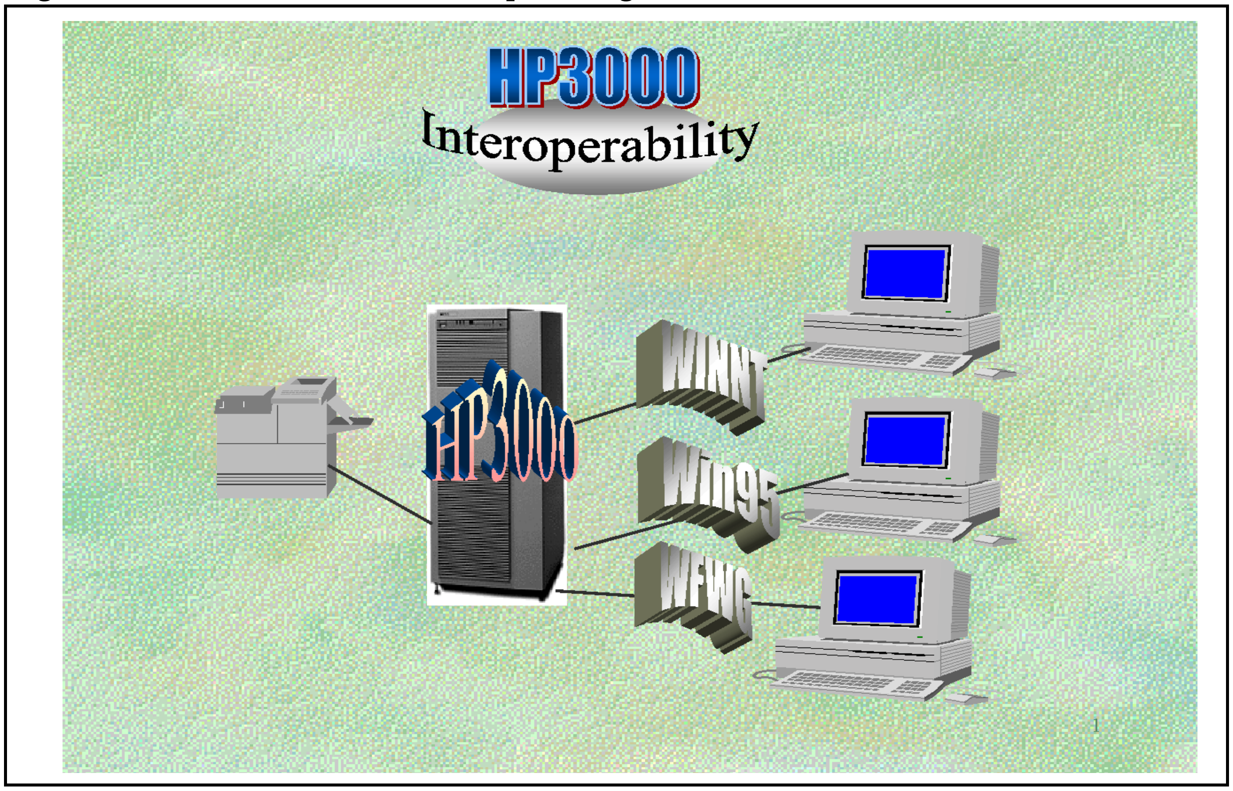
Samba for MPE/iX is the result of porting Samba to MPE/iX under POSIX environment. It is a solution for those wishing to access HP e3000 disk storage and printers (both networked and spooled from MPE/iX) from common PC client operating systems like Windows 95 and NT Workstation.

Samba for MPE/iX allows access to these disk and printer resources of MPE/iX, by providing standard SMB file and printer services that are accessible from PC clients and their applications. It is available to the HP e3000 users starting with the MPE/iX 6.0 release.

Samba for MPE/iX can now be configured remotely from the convenience of a browser. Various parameters share security, and other features can be configured from a browser interface, in effect giving added flexibility.

A general UNIX program that is part of the Samba suite has also been ported to MPE/iX shell operating system. This program allows MPE users to use an FTP-like interface to access filespace and printers on any other SMB servers. This capability enables these operating systems to act like a LAN server or Windows NT server. See Figure 7-1 for HP e3000 interoperating with the Microsoft platforms.

Figure 7-1 HP e3000 Interoperating With Microsoft Platforms



Benefits of Using Samba for MPE/iX

There are many benefits in having an MPE/iX and Samba for MPE/iX environment, some of which are listed here:

- The remote MPE/iX based POSIX filesystem can be browsed as shared/services from PC clients.
- Remote files can be operated on as if they are stored locally.
- Samba for MPE/iX acts as translator between the different file systems for file names and attributes and provides security based on user authentication.
- Samba for MPE/iX can support the use of long file names by Windows 95 and Windows NT workstation PC clients.
- Samba for MPE/iX provides seamless interoperability between common desktop operating systems, popular PC applications, and HP e3000 through Microsoft network.

Major Components of Samba for MPE/iX

Table 7-1 shows the major components of the Samba for MPE/iX suite.

Table 7-1 Major Components

SMBD	The SMB server handles connections from clients, performing all the file, permission, and username authentication.
NMBD	The NetBIOS name server advertises Samba for MPE/iX on the network, and helps clients locate servers.
SMBCLIENT	Client program on MPE/iX host.
SMB.CONF	Samba for MPE/iX runtime configuration file.
TESTPARM	A program to test the Samba for MPE/iX configuration file.
TESTPRNS	A program to test server access to printers.
SWAT	A program to remotely configure the Samba for MPE/iX runtime configuration file (smb.conf) via the web (with a Web browser).

The Samba for MPE/iX product contains:

- **SMBD:** This is the server that can provide most SMB services.

  The SMB protocol section in the Samba for MPE/iX configuration file `“SMB.CONF”`, describes the role of SMB. The HP e3000 running SMBD will act as a File and Print server for the clients using the SMB protocol. This is compatible with the LanManager protocol, and can service LanManager clients.

  These clients include Windows for Workgroups, Windows 95 and Windows NT.

  A session is created whenever a client requests one. Each client gets a child process for each session. This copy then services all connections made by the client during that session. When all connections from its client are closed, the copy of the server for that client terminates.

- **NMBD:** This is a server that understands and can reply to NetBIOS Name Service Requests on TCP port 137, like those sent by LanManager clients.

  NMBD also controls browsing (viewing the resources available on a Windows network is called browsing). When they start up, LanManager compatible clients such as Windows 95/Windows NT, may wish to locate a LanManager server. That is, they wish to know what IP address a specified host is using.

  This program simply listens for such requests, and if its own name is specified, it will respond with the IP address of the host on which it is running. Its “own name” is, by default, the name of the host on which it is running.

- **SMBCLIENT:** The SMBCLIENT is a client that can “talk” to an SMB server.

  When this program is run on the HP e3000, it will be acting as a client. It is a command-line program and offers an interface similar to that of the FTP program. Operations include things like “getting” files from the server to the local machine, “putting” files from the local machine to the server, retrieving directory information from the server, etc.

- **SMB.CONF:** The `SMB.CONF` file is a configuration file of the Samba for MPE/iX suite which contains runtime configuration information for both SMBD and NMBD.

This file consists of sections and parameters. Each section in the configuration file corresponds to a service. The special sections are **[global]**, **[homes]** and **[printers]**. The **[global]** section is used to set global configuration options that apply to the server as a whole. The **[homes]** section is designed to grant access to all users home directories and the entries in **[printers]** section correspond to the print services of the Samba for MPE/iX server.

- **TESTPARM:** This is a test program to validate the contents of the `SMB.CONF` configuration file.

  If this program reports no problems, you can use the configuration file with confidence that SMBD will successfully load the configuration file.

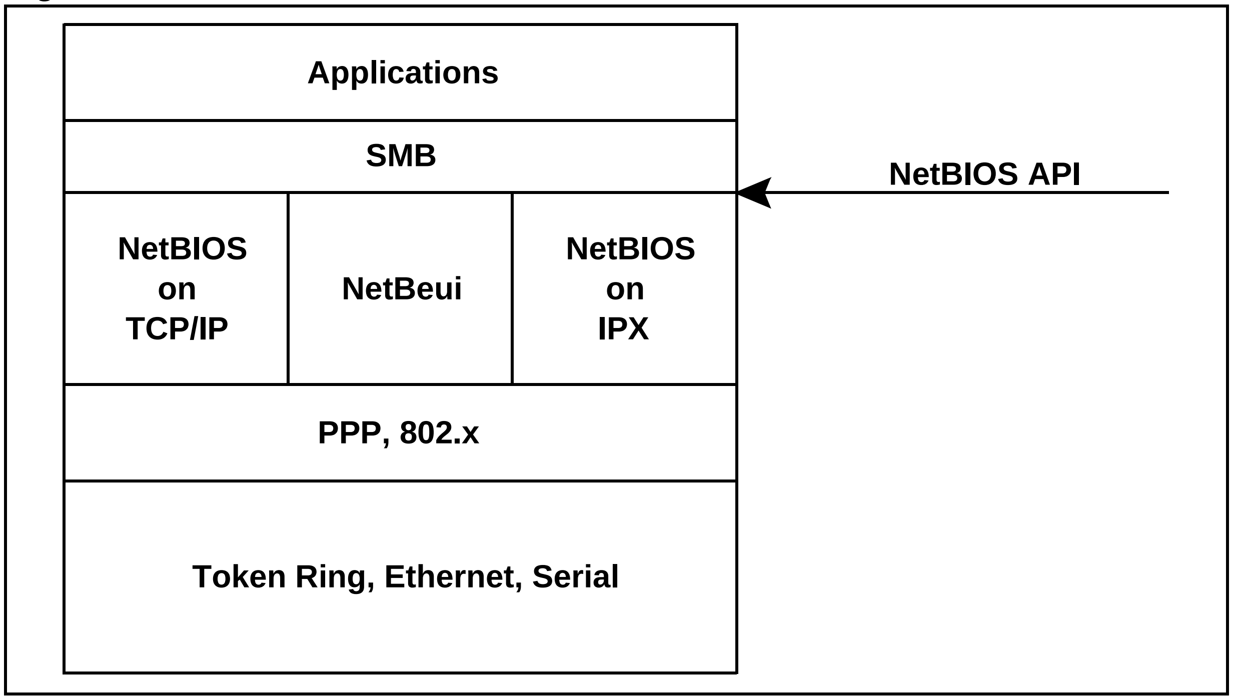
- **TESTPRNS:** This tool checks whether the printer name is valid for the services provided by SMBD.
- **SWAT:** The acronym SWAT stands for Samba Web Administration Tool. It is used to provide a web interface to configuring **smb.conf**. It gives the flexibility of dynamically altering the configuration file to reflect changes in needs with respect to shares and printers. This is done from a remote location with the aid of a web browser.

SMB Protocol

SMB, which stands for Server Message Block, is a protocol for sharing files, printers, serial ports, and communication abstractions, such as named pipes and mail slots, between computers.

SMB is a request/response protocol and it is implemented on top of the NetBIOS API, see Figure 7-2. It plays the role of session, presentation, and a part of application layer of the OSI stack. SMB can be used over TCP/IP, NetBEUI, and IPX/SPX. In the case of TCP/IP or NetBEUI, the NetBIOS API is being used. Samba for MPE/iX uses SMB over TCP/IP.

Figure 7-2 SMB Protocol

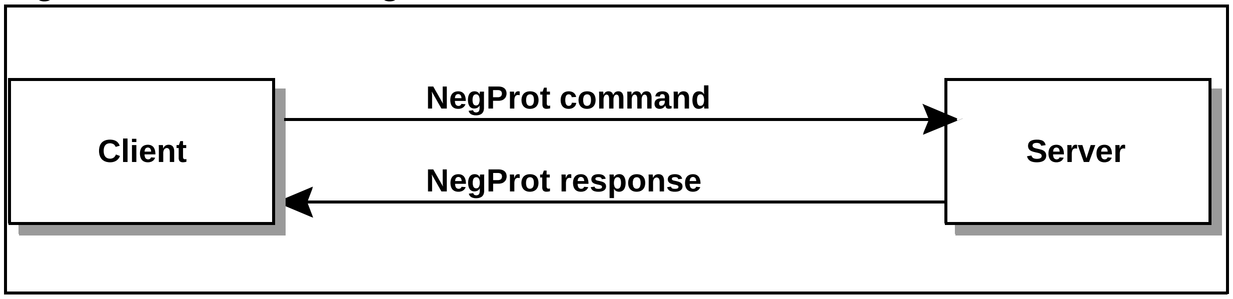


The SMB messages can be categorized into four types of messages: session control, file, printer, and message. Session control messages start, authenticate, and terminate sessions. File command controls file access and printer command controls printer access. Message commands allow an application to send messages to or receive messages from another host. (For example, WinPopup messages). NetBIOS names are up to 15 characters long, and are usually the name of the computer that is running NetBIOS.

Example of SMB Conversation

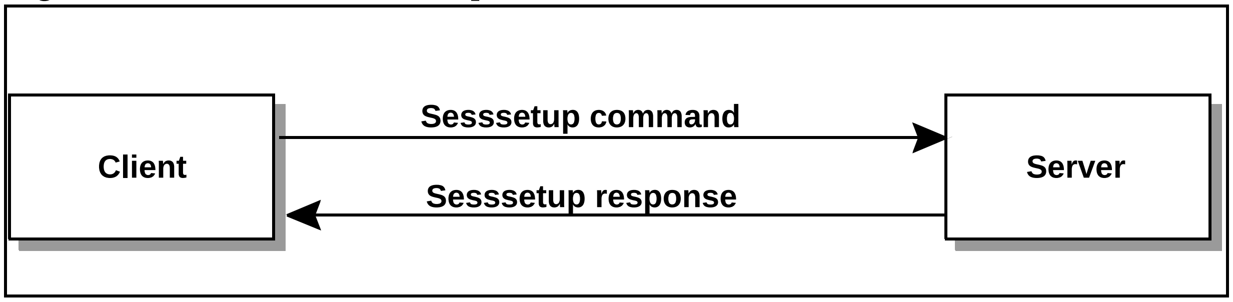
Figure 7-3 demonstrates the process of connecting to a file space service. The SMB Negotiate Protocol command (`NegProt`) is used to decide on a protocol extension to be used with the server. The client sends a SMB `NegProt` to the server. This will list the protocol dialects/protocol extensions that it understands. The server responds with the index of the dialect that it wants to use, or 0xFFFF if none of the dialects were acceptable.Dialects newer than the Core and CorePlus protocols supply information in the `NegProt` response to indicate their capabilities such as max buffer size. The six important protocol extensions of SMB are Core, CorePlus, LAN Manager 1.0, LM 2.0, and NT LM 0.12 and CIFS 1.0.

Figure 7-3 SMB NegProt Connection



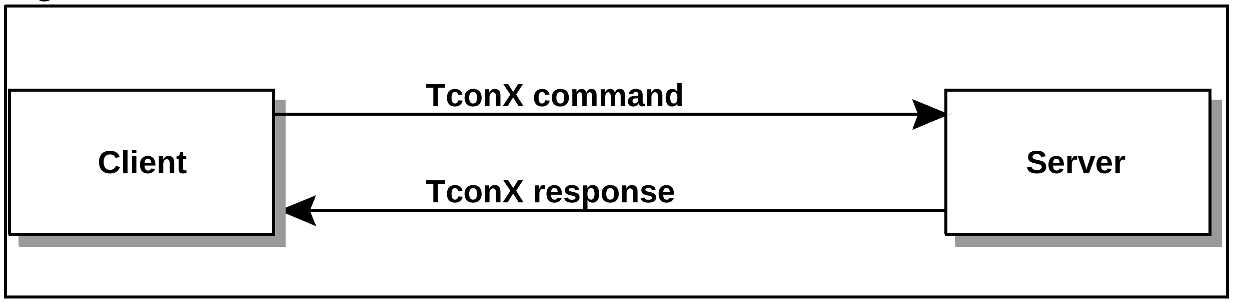
Once a protocol has been established, the client can proceed to logon to the server. Client now sends a SMB Session Setup command (`SesssetupX`), see Figure 7-4. The response indicates whether the username password pair is valid, and if so, can provide additional information. One of the very important aspects of the response is a User ID value that must be submitted with all the subsequent SMBs sent to the server. This is used for user authentication.

Figure 7-4 SMB Sesssetup Connection



After the client has logged in, it then proceeds to connect to the file tree by sending a SMB Tree Connect command (`TconX`) to the server, see Figure 7-5. Here TconX stands for tree connect. The client sends a Tcon or SMB TconX specifying the network name of the share to which they want to connect, and if all is well, the server responds with a TID that the client will use in all future SMBs relating to that share.

Figure 7-5 SMB TconX Connection



After connecting to a tree, the client can now open a file with an open SMB, followed by reading it with read SMBs, writing it with write SMBs, and closing it with close SMBs.

Samba for MPE/iX Configuration File Options

The Samba for MPE/iX configuration file contains the runtime configuration information for Samba for MPE/iX. This file contains the sections and parameters. There are four special sections: the **[global]** section, the **[printers]** section, **[homes]** section and other sections. This file also contains the information required for each share (service) and defines attributes like associated directory path, read or write access for each share.

The Samba for MPE/iX configuration file is named "`smb.conf`" which resides in the `/usr/local/samba/lib` directory on HP e3000 system. This chapter documents the possible configuration options that the users can specify in the "`smb.conf`" file. There are many configuration options available, but only the configuration options and uses defined in this manual are supported by HP.

[Global] Section

This section is for parameters which apply to the server as a whole rather than to a specific service. It can also be used to specify default values for service-specific parameters which are then inherited by other services, referred to later in the configuration file.

[Printers] Section

This section works in conjunction with the printcap file and allows it to configure a large number of printer shares without having to add separate detailed sections for each of them. The printer names and optional aliases are listed in the printcap file; and the configuration parameters are defined in this section.

[Homes] Section

This section provides access to the user's home directories without having to add a separate section for each of them. The share name is considered to be a valid user id and the path defaults to that user's home directory.

Other Sections

These sections explicitly define the file and printer shares.

Global Configuration Options

The global configuration options can be defined in the **[Global]** Section in the "`smb.conf`" file.

Options cover the following configuration options which are supported for use by HP:

- Configuration file option
- Browser option
- Network interface configuration
- Mapping PC usernames to MPE usernames
- Setting the maximum SMB packet size
- Disconnecting idle clients
- Setting logging behaviors
- Login/logout commands
- User selectable Name resolve order
- Global printer service option

Configuration File Option

`config file`	The config file parameter allows you to specify the pathname for the configuration file used by Samba for MPE/iX.
Example:	`config file = /usr/local/samba/lib/smb.conf`

Browser Option

`workgroup`	The workgroup parameter specifies the name of the workgroup; the Samba for MPE/iX server will appear as part of the browse list.
Example:	`workgroup = SambaiX`
`server string`	The server string parameter defines the server's comment string. This comment string will appear next to the machine name in the browse lists, such as the network neighborhood.
Example:	`server string = HP3000, File/Printer server`
Default:	`server string = samba 1.9.16p9`
`default service`	This parameter specifies the name of a service to which the client will be connected, if the service actually requested doesn't exist. Typically the default service is some sort of public, read-only service.
Example:	`default service = public`
Default:	`none`

Mapping PC Usernames to MPE/iX Usernames

`username map`	This username map parameter allows you to map PC style usernames to MPE/iX-style usernames. You can specify the location of your username map file with the username map parameters.
Example:	`username map = /usr/location/samba/lib/user.map`

	The syntax of the username map file is simple. Each line consists of a MPE/iX-style name like `manager.sys` and a list of possible PC style username like `webuser`, separated by an equal sign. A sample username map in the `user.map` file is defined as follows.
Example:	`manager.sys = webuser`

Network Interface Configuration

`interfaces`	The interfaces option allows you to inform Samba for MPE/iX of each interface to which you want it to provide services, by supplying IP address and subnet mask of your HP e3000 system.
Example:	`interfaces = 192.1.2.3/255.255.0`

Setting the Maximum SMB Packet Size

`max xmit`	The max xmit parameter allows you to set the maximum packet size which Samba for MPE/iX can negotiate with a client. This is the maximum packet size that SMBD will accept from a client, setting an upper limit on the packet size that will be negotiated with a client at session setup.
Example:	`max xmit = 8000`
Default:	`max xmit = 65535`

Disconnecting Idle Clients Option

`dead time`	An inactive client will consume server resources even though it is not doing anything. The deadtime parameter defines an integer value describing the number of minutes of inactivity before a session is automatically disconnected. The “deadtime” is considered to begin when a client has no open files. The default “deadtime” of zero indicates that no client should ever be dropped because of inactivity.
Example:	`5` (in minutes)
Default:	`0` (in minutes)

Setting Logging Behavior

`max log size`	The max log size option specifies the maximum size in kilobytes to which log files can grow. The default value of the maximum log file size is 5000 in kilobytes. If the file exceeds the specified size, it is renamed by adding the `.old` extension.
Example:	`max log size = 10000` (in kilobytes)
Default:	`5000` (in kilobytes)
`log file`	The log file parameter allows you to specify the pathname of log file used by SMBD and NMBD processes.
Example:	`log file = /usr/local/samba/var/log.smb`
`debug level`	The debug level parameter allows the debug logging level to be specified in the Samba for MPE/iX configuration file. This option defines the level of trace messages that you want to log into the logfile.
	The typical range of the debug level can be from 0 to 5. Large values cause more detailed information to be logged. Most of these debug levels exist to help users to debug the server activity.
Example:	`debug level = 3`

Default: `debug level = 0`

Login/Logout Commands

`preexec` The preexec parameter allows you to specify a command to be run whenever the service is connected.

Example: `callci /usr/local/samba/lib/tellop tcon %S %u %m %I`

Generates the following example output to the console: `9:41 #J36/50/FROM/MGR.SAMBA/tcon on IPC$ by MGR.SAMBA from rkm-nt`

`postexec` The postexec parameter allows you to specify a command to be run whenever the service is disconnected.

Example: `callci /usr/local/samba/lib/tellop tdis %S %u %m %I`

Generates the following example output to the console: 9:41 #J36/70/FROM/MGR.SAMBA/tdis on IPC$by MGR.SAMBA from rkm-nt

Name Resolve Order

In Samba version 2.0.7 for MPE/iX, the name resolve order has been made user selectable. The resolution can be done in several different ways: `broadcast`, `lmhosts`, `DNS lookup`, `WINS`.

`name resolve order` The order in which the names need to be resolved can be specified as shown:

Example: name resolve order = lmhosts bcast

The `samp-lmhosts` file is provided in `/usr/local/samba/lib` directory.

`samp-lmhosts` file looks like: `12.34.56.78 mpexl/cup.hp.com`

Default: `lmhosts` host WINS bcast

Global Printer Service Options

The global printer service options allows you to specify the location of the "`printcap`," printer command parameter used by Samba for MPE/iX.

The following global printer configuration options are supported for use by HP:

`load printers` The load printers parameter is used in conjunction with printcap file and **[printers]** section. It is a boolean variable that controls whether all printers in the "`printcap`" file will be loaded for browsing.

If the load printers parameter is set to true, all printers defined in the printcap file will be loaded for browsing by default.

Example: `load printers = yes`

Default: `load printer = no`

`printcap name` The printcap name option specifies the location of the `printcap`. Samba for MPE/iX uses the `printcap` to determine all printers available on the system if the general **[printers]** service is used instead of defining each printer in its own service.

Example: `printcap name = /usr/local/samba/lib/printcap`

`print command`	The print command parameter defines the shell command which Samba for MPE/iX will use to submit a print job. After Samba for MPE/iX has finished spooling a print job to the disk, it calls this command. After processing the file, this command must remove the spoolfile, unless you don't mind spool files building up on your system.

This parameter can use the following print-specific macros:

`%s`	The full path of the print spool file.
`%p`	The name of the printer to which the job is to be submitted.

Example:

```
print command = /usr/local/samba/lib/rawlp %s %p; rm %s
```

On MPE/iX, the **rawlp** utility is available on the system and is used to send the file contents to a spooler like "`lp -oraw`".

Controlling User Access Rights

`allow hosts`	Default: `none`
`deny hosts`	These parameters allow users to define a set of client IP addresses which will be granted access to service. If an “allow hosts option” is present, only hosts matching the pattern are allowed to access the service. If a “deny hosts option” exists, only hosts not matching the pattern will be granted access.
Example:	`allow hosts = 192.1.2.3`
Default:	`none`
`valid users`	Default: `none`
`invalid users`	If neither of these parameters are set, then any authenticated user will be granted access to the service. The valid users parameter may contain a comma-delimited list of users who will be allowed to access the service. The invalid users parameter may contain a similar comma-delimited list of users who will never be granted access to the service. These parameters use MPE/iX style user syntax (for example, `user.acct`) to specify users. The password format used when you log on from a PC client should be `userpassword`, `acctpassword`.
Example:	`valid users = mgr.samba`
Default:	`none`
`guest account`	The shares can be configured to accept connections without a validated user ID and password, then you can use the “guest account” parameter to assume the guest logon identify for accessing files and printers.
Example:	`guest account = mgr.samba`
Default:	`none`
`revalidate`	This parameter forces the revalidation of password. When Samba for MPE/iX successfully validates a client’s password, it passes a token back to client. This is used by the client to connect to other shares. If `revalidate=true`, then Samba for MPE/iX expects a valid username and password pair again without relying on the token. For example, after connecting to “temp,” if the client tries to connect to another share, Samba for MPE/iX revalidates the password.
Example:	`revalidate = yes`
Default:	`no`

Share Configuration Options

This section covers the share configuration options that you use when you configure for a specific disk or printer-share in the Samba for MPE/iX configuration file.

Setting the Shared Directory

`path`	The path parameter specifies the pathname of the shared directory.
Example:	`path = /usr/local/samba/docs`
	For printer services, this parameter describes the directory used to temporarily spool files sent from clients for printing before they are spooled to the local HP e3000 printer.
Example:	`path = /usr/local/samba/spool`

Browser Option

`browseable`	This parameter controls whether this share is seen in the list of available shares in the browse list.
Example:	`browseable = yes`
Default:	`browseable = yes`
`Available`	This parameter lets you remove a service from availability. If available is no, all attempts to connect to the service will fail. Using this option preserves the service's settings and is usually more convenient than commenting out the service.
Example:	`available = no`
Default:	`available = yes`

Comment Option

`comment`	The “comment” parameter specifies the comment message in the share services.
Example:	`comment = share “public” service for guest users.`

Printing Access

`print ok`	The “print ok” option is specified in the **[prints]** section to enable the share for printing access.

Controlling Read/Write Access

`guest ok`	If `guest ok` is true, then guest access will be allowed. The access rights of a client connecting as guest will be those of the username set in the “guest account.”
Example:	`guest ok = yes`
Default:	`guest ok = no`
`guest only`	If `guest only` is true, then access of service/share is only granted with the rights of usernames given in the “guest account” parameter.
Example:	`guest only = yes`
Default:	`guest only = no`
`create mode`	The `create mode` is used to define the permission used by share services. This option sets an octal value representing the file permissions available to a file created by Samba for MPE/iX.
Example:	`create mode = 0744`
	The value of `0744` causes the group and other write and execute bit to be removed from a file created by Samba.
`read only`	Example: `read only = yes`
	Default: `read only = yes`
`write ok`	The `read only = yes` is identical to `write ok = no`. If `write ok` is true, clients will be granted read/write access to a share. The same effect can be achieved by setting read only to false.
Example:	`write ok = no`
Default:	`write ok = no`

Sample Configuration File — samp-smb.conf

When you want to use Samba for MPE/iX, you should copy the Samba for MPE/iX sample configuration file to `/usr/local/samba/lib/smb.conf` and adjust this file as needed. The sample configuration file `samp-smb.conf` resides in the `/usr/local/samba/lib` directory. Please refer to Appendix A, “Samba for MPE/iX Sample Comfiguration File.”

Configuring the Shares for File Sharing

The PCs can access the server side filespaces using Samba for MPE/iX. Whenever the clients want to connect to the server, the server side validates the username and password, which are sent by the client, and grants access to the requests share if it is appropriate.

You can configure the file service with guest access and the Samba for MPE/iX server can grant to the guest users without a validated user ID and password.

Share level security is the default security level in Samba for MPE/iX. The following example shows the configuration steps you can use to configure with **[global]** and **[service]** section with `security = share`:

1. Add in the **[global]** section the following parameter: `security = share`
2. To add a share, the entries can be given in the example below:

   [sample shares]

   ```
   comment = shared space
   guest ok = no
   write ok = yes
   path = /sample/test
   ```
3. Add a username mapping in "`user.map`" file. For example: mgr.sample = pcusername
4. When you connect a share from a PC, the password format that you enter from a PC should be `userpassword, acctpassword`.

NOTE For accessing share/user security modes, both `SAMBA` account and `MGR.SAMBA` user should have PM capabilities.

Configuring a Printer Section for Printer Sharing

The PCs can access the server side printer using Samba for MPE/iX. With printer sharing the client creates a file on the server directory associated with the printer, and then lets the server process trigger a configurable command to push the file into the MPE spooler.

The **[printers]** section works in conjunction with the printcap file and allows you to configure a large number of printer shares without having to add separate detailed sections for each of them. The Samba server can work for both LP and network printers. The printer names and option aliases are listed in the `printcap` file.

Here is an example of printer names in the samp-printcap file which resides in `/usr/local/samba/lib`:

samp-printcap file:

```
LP|6|HP3000 System LP
```

Here is a example for the configuration option that you may configure with **[global]** and **[printers]** sections in the Samba for MPE/iX configuration file — `smb-conf`:

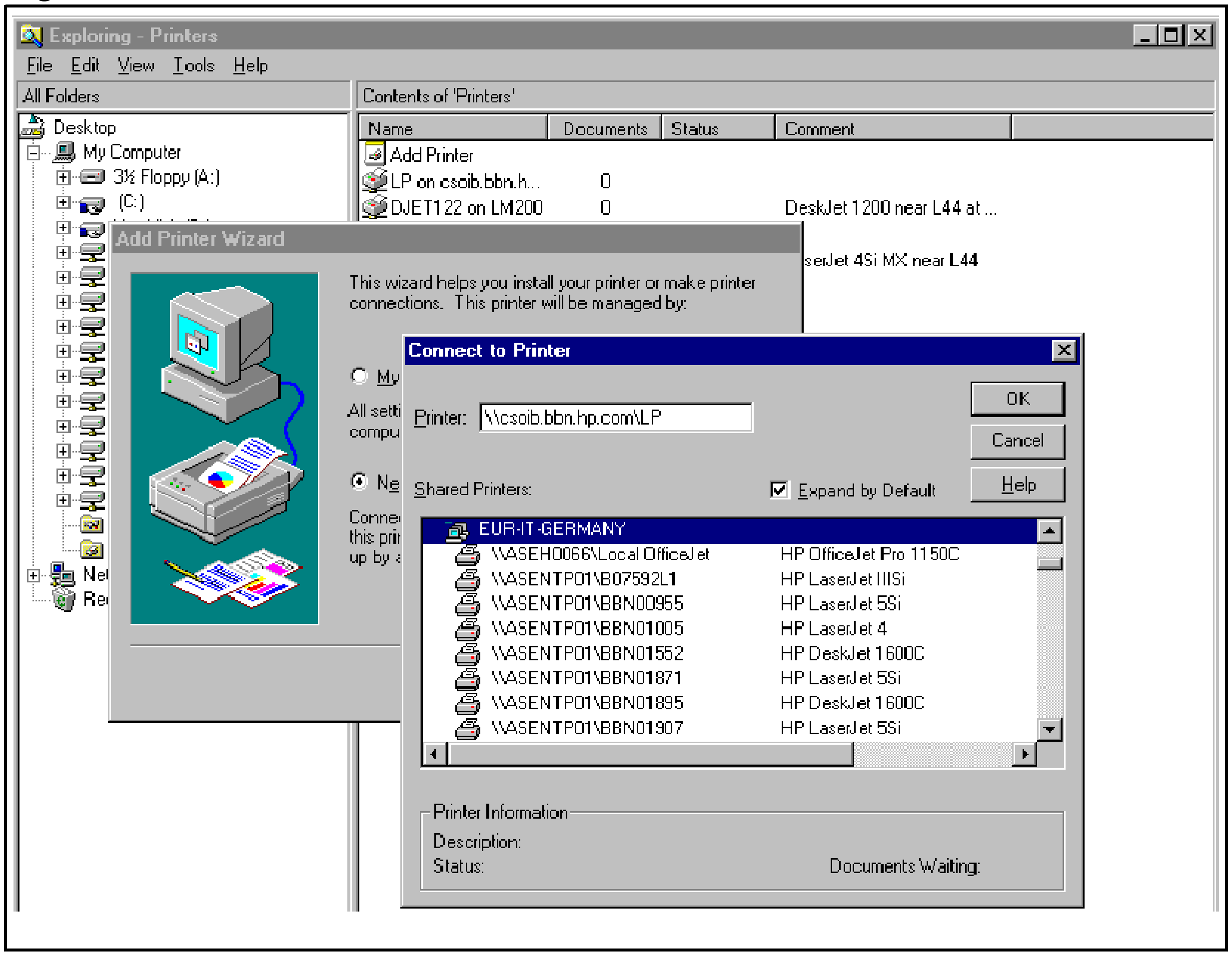
```
[global]

# You need to supply IP address and subnet mask of your HP e3000 with the interface parameter

interface = ip address/subnet mask

# printcap file lists printer names for use by [printer] section

printcap name = /usr/local/samba/lib/printcap

# shares may be configured to accept connections without a validated user id and password, and it then
assumes the guest logon for accessing the printers.

guest account = mgr.samba

[printers]

# enable this service for printing but not for file access

print ok = yes
write ok = no

# current version of Samba for MPE/iX only allows guest users for printer sharing

guest ok = yes

guest only = yes

# the “staging” directory for print requests

path = /user/local/samba/spool

# The rawlp utility sends file contents to spooler like “lp -oraw”

print command = /usr/local/samba/lib/rawlp %s %p; rm %s
```

NOTE Printer sharing only works for guest users.

The current configuration option for printer sharing needs to be set “guest ok” and “guest only.”

Add a printer, as shown in Figure 7-6. With printer sharing, the printers are accessible to HP e3000.

Figure 7-6 ADD a Printer



Contents of 'Printers'

Name	Documents	Status	Comment
Add Printer			
LP on csoib.bbn.h...	0		
DJET122 on LM200	0		DeskJet 1200 near L44 at ...
			serJet 4Si MX near L44

This wizard helps you install your printer or make printer connections. This printer will be managed by:

Printer: \\csoib.bbn.hp.com\LP

Shared Printers: [✓] Expand by Default

EUR-IT-GERMANY

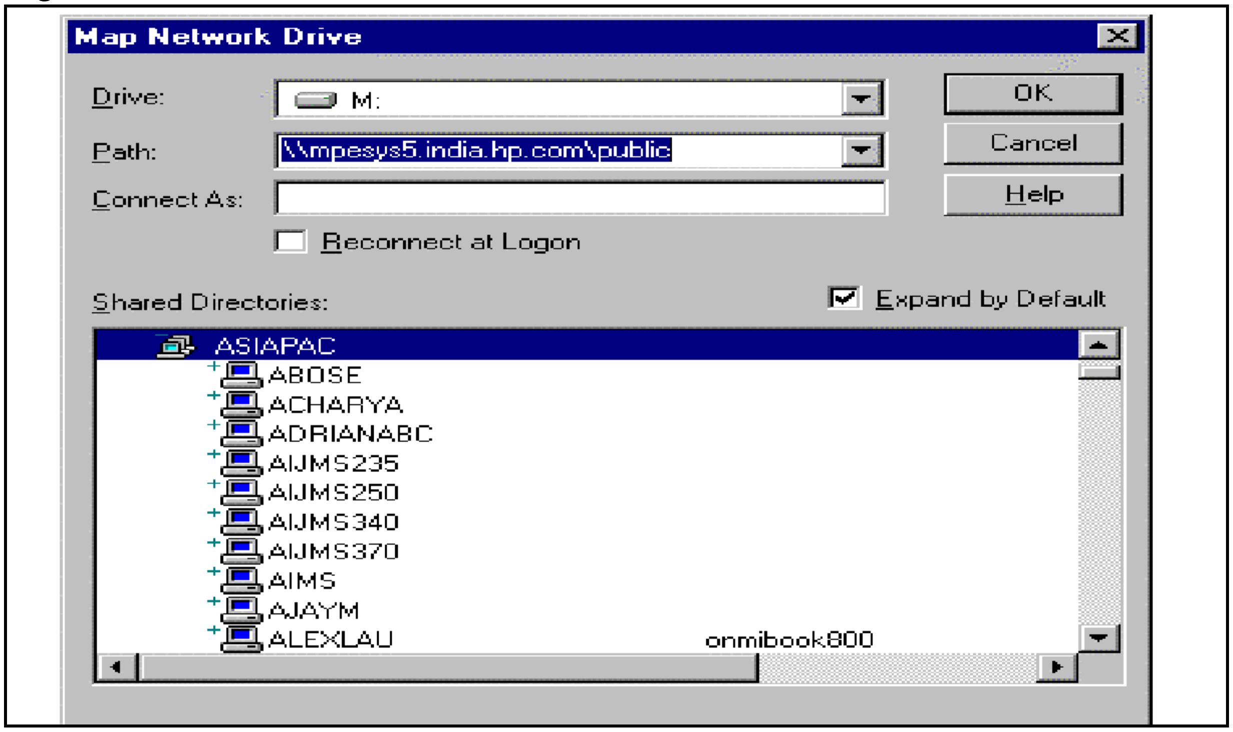
\\ASEH0066\Local OfficeJet	HP OfficeJet Pro 1150C
\\ASENTP01\B07592L1	HP LaserJet IIISi
\\ASENTP01\BBN00955	HP LaserJet 5Si
\\ASENTP01\BBN01005	HP LaserJet 4
\\ASENTP01\BBN01552	HP DeskJet 1600C
\\ASENTP01\BBN01871	HP LaserJet 5Si
\\ASENTP01\BBN01895	HP DeskJet 1600C
\\ASENTP01\BBN01907	HP LaserJet 5Si

Printer Information
Description:
Status: Documents Waiting:

You can connect your server shares using the NT explorer, as shown in Figure 7-7.

The menu tool includes a “map network drive” which brings up the small windows shown in Figure 7-7. You connect a network driver by typing in a share name with `\\servername\sharename` syntax in the “path” box.

Figure 7-7 Connect to the HP e3000 Shares



Map Network Drive

Drive: M:

Path: \\mpesys5.india.hp.com\public

Connect As:

Reconnect at Logon [ ]

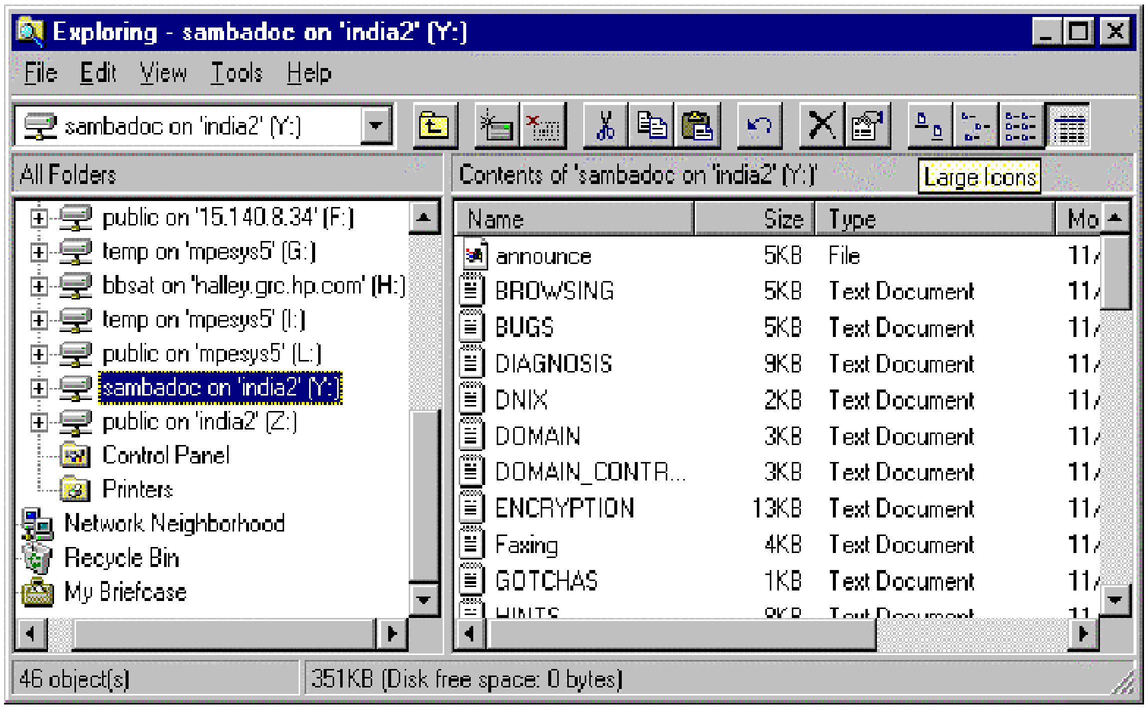
Shared Directories:

Expand by Default [✓]

```
ASIAPAC
    ABOSE
    ACHARYA
    ADRIANABC
    AIJMS235
    AIJMS250
    AIJMS340
    AIJMS370
    AIMS
    AJAYM
    ALEXLAU                  onmibook800
```

You can view the contents of the share from NT explorer, as shown in Figure 7-8. Click the share name at NT explorer window; it will list the files residing in this share.

Figure 7-8 View the HP e3000 Share


Exploring - sambadoc on 'india2' (Y:)
File Edit View Tools Help
sambadoc on 'india2' (Y:)
All Folders
Contents of 'sambadoc on 'india2' (Y:)'
Large Icons
public on '15.140.8.34' (F:)
temp on 'mpesys5' (G:)
bbsat on 'halley.grc.hp.com' (H:)
temp on 'mpesys5' (I:)
public on 'mpesys5' (L:)
sambadoc on 'india2' (Y:)
public on 'india2' (Z:)
Control Panel
Printers
Network Neighborhood
Recycle Bin
My Briefcase

Name	Size	Type	Mo
announce	5KB	File	11/
BROWSING	5KB	Text Document	11/
BUGS	5KB	Text Document	11/
DIAGNOSIS	9KB	Text Document	11/
DNIX	2KB	Text Document	11/
DOMAIN	3KB	Text Document	11/
DOMAIN_CONTR...	3KB	Text Document	11/
ENCRYPTION	13KB	Text Document	11/
Faxing	4KB	Text Document	11/
GOTCHAS	1KB	Text Document	11/

46 object(s)   351KB (Disk free space: 0 bytes)

Description and Usage of SWAT

Remote Configuration:	Samba Web Administration Tool (SWAT).
Before invoking SWAT:	Before SWAT can be run, the following lines in the configuration files need to be updated. SWAT is available for guest users only.

In the file `SERVICES.NET.SYS`, the following line should be added to include SWAT service:

```
     swat      901/tcp      #SWAT Tool
```

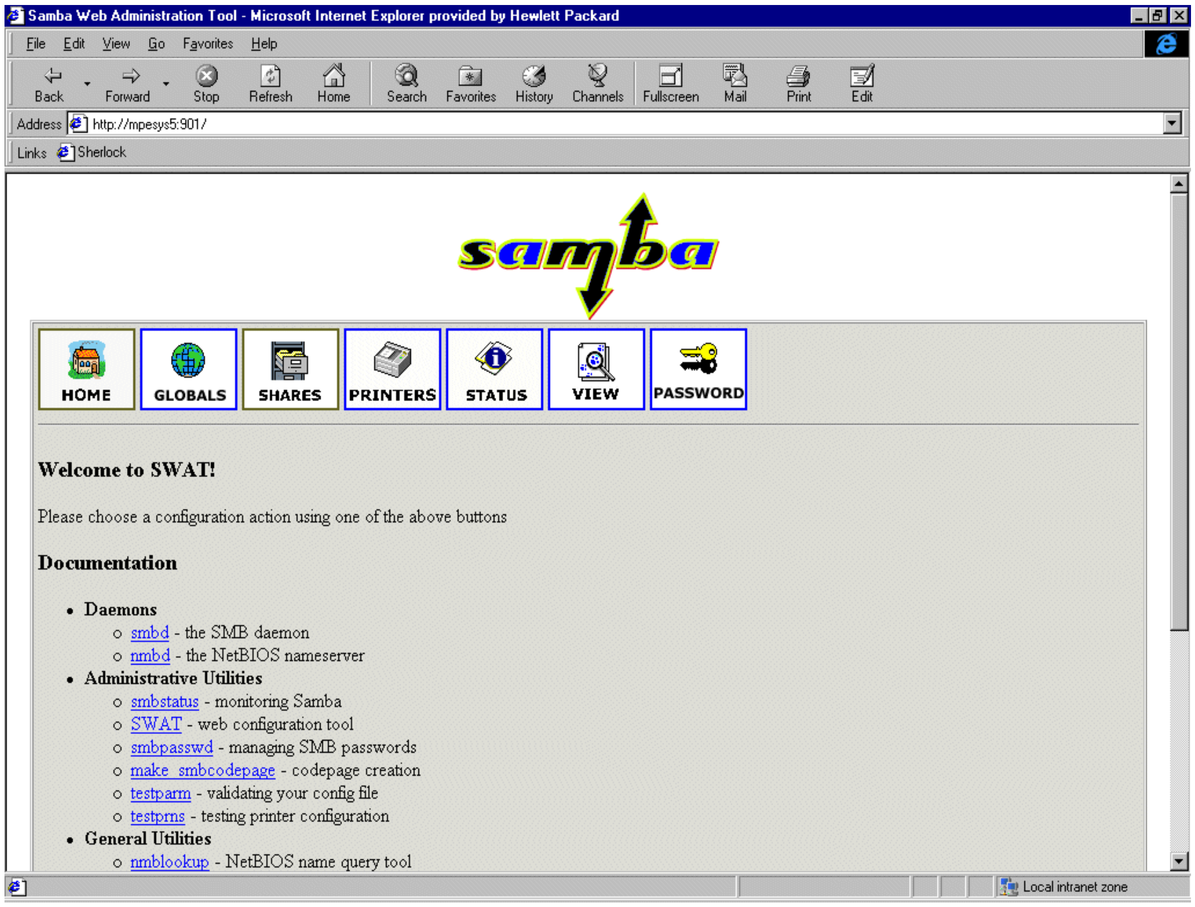
In the file `INETDCNF.NET.SYS`, the following line should be added to include SWAT service:

```
swat   stream tcp nowait.400 MGR.SAMBA /SAMBA/SMB20/bin/swat swat -a
```

How to invoke SWAT:

SWAT can be invoked by starting your favorite web browser with the following arguments in the “go to” field: `http://sambaservername:901/`. Here 901 is the port where SWAT operates, refer to Figure 7-9.

Figure 7-9 SWAT


Samba Web Administration Tool - Microsoft Internet Explorer provided by Hewlett Packard
File Edit View Go Favorites Help
Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit
Address http://mpesys5:901/
Links Sherlock
samba
HOME GLOBALS SHARES PRINTERS STATUS VIEW PASSWORD
Local intranet zone

Welcome to SWAT!

Please choose a configuration action using one of the above buttons

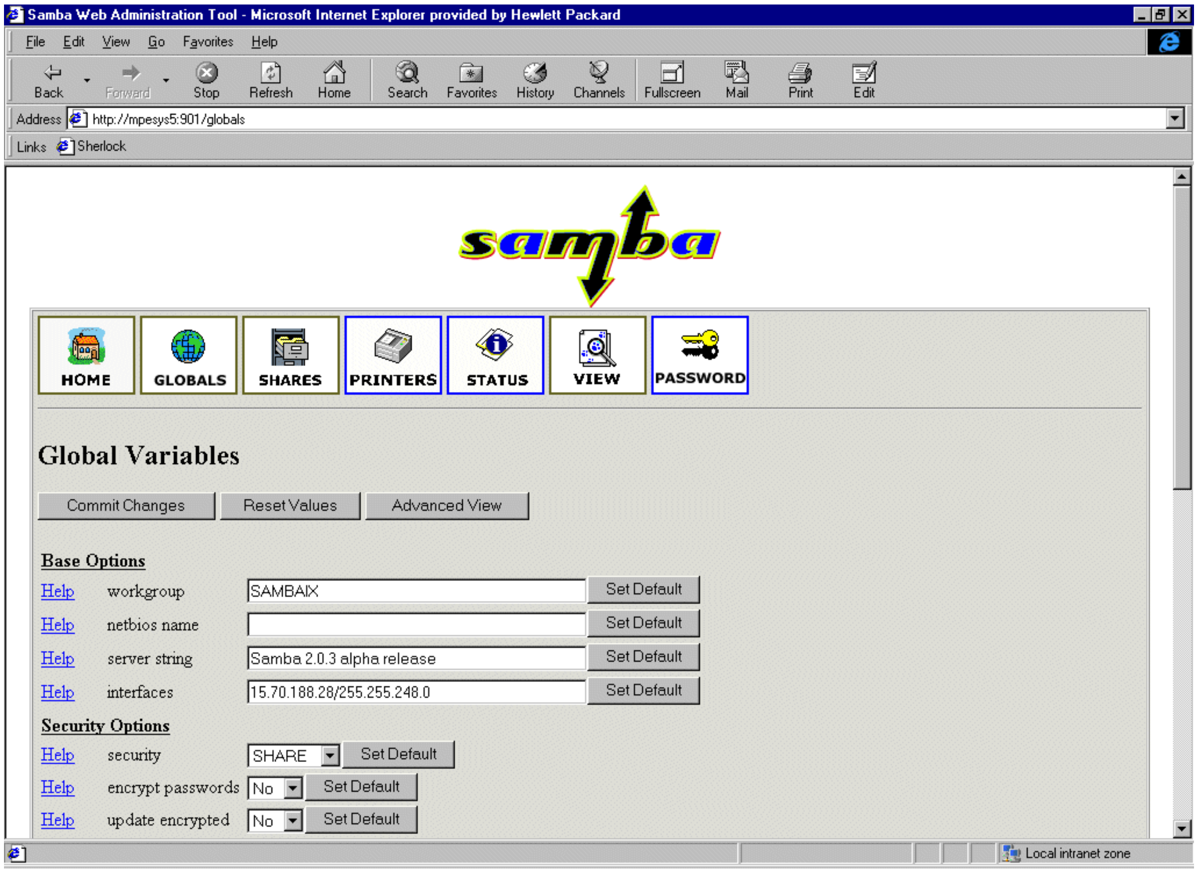
Documentation

- **Daemons**
  - smbd - the SMB daemon
  - nmbd - the NetBIOS nameserver
- **Administrative Utilities**
  - smbstatus - monitoring Samba
  - SWAT - web configuration tool
  - smbpasswd - managing SMB passwords
  - make_smbcodepage - codepage creation
  - testparm - validating your config file
  - testprns - testing printer configuration
- **General Utilities**
  - nmblookup - NetBIOS name query tool

SWAT can be used to open pages with links to online help and documentation, as shown in Figure 7-9. This is done from a remote location with the aid of a Web browser.

SWAT is used to provide a Web interface to view and configure `smb.conf`. It provides the flexibility of altering the configuration file to reflect changes with respect to shares. View or configure Global Variables using SWAT as shown in Figure 7-10.

Figure 7-10 Global Variables


Samba Web Administration Tool - Microsoft Internet Explorer provided by Hewlett Packard
File Edit View Go Favorites Help
Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit
Address http://mpesys5:901/globals
Links Sherlock
samba
HOME GLOBALS SHARES PRINTERS STATUS VIEW PASSWORD
Commit Changes Reset Values Advanced View
Local intranet zone

Global Variables

Base Options

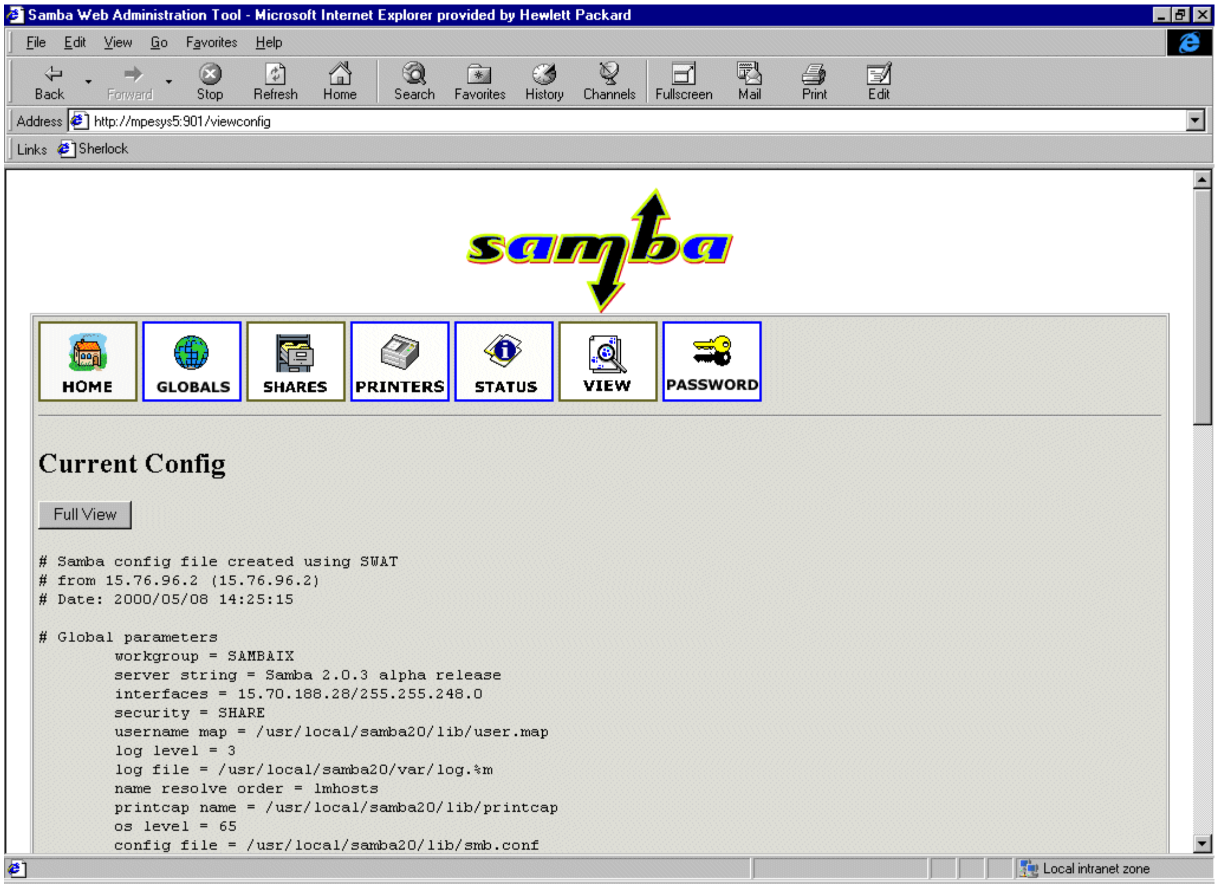
Help	workgroup	SAMBAIX	Set Default
Help	netbios name		Set Default
Help	server string	Samba 2.0.3 alpha release	Set Default
Help	interfaces	15.70.188.28/255.255.248.0	Set Default

Security Options

Help	security	SHARE	Set Default
Help	encrypt passwords	No	Set Default
Help	update encrypted	No	Set Default

Use SWAT to view the currently configured `smb.conf` file in abbreviated and full views, as shown in Figure 7-11.

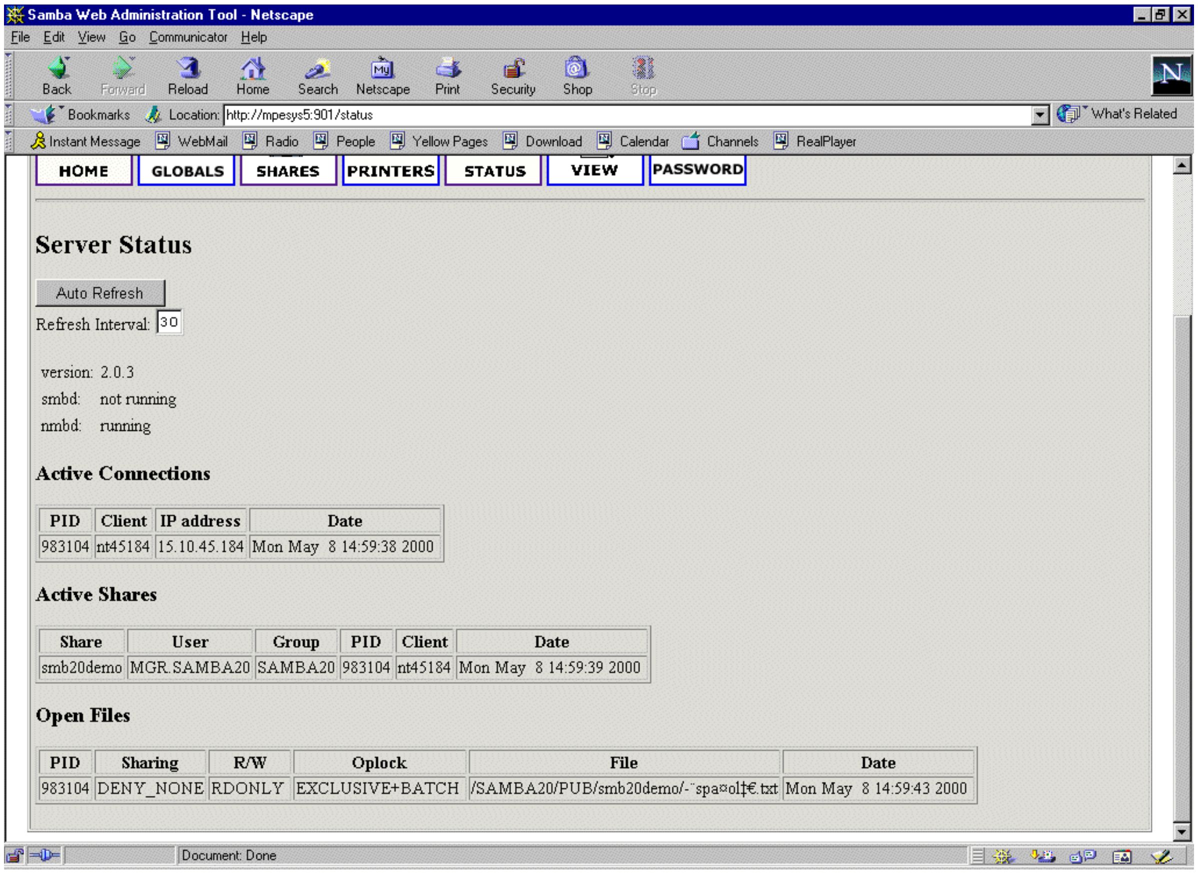
Figure 7-11 Current Config


Samba Web Administration Tool - Microsoft Internet Explorer provided by Hewlett Packard
File Edit View Go Favorites Help
Back Forward Stop Refresh Home Search Favorites History Channels Fullscreen Mail Print Edit
Address http://mpesys5:901/viewconfig
Links Sherlock
samba
HOME GLOBALS SHARES PRINTERS STATUS VIEW PASSWORD
Current Config
Full View
Local intranet zone

```
# Samba config file created using SWAT
# from 15.76.96.2 (15.76.96.2)
# Date: 2000/05/08 14:25:15

# Global parameters
        workgroup = SAMBAIX
        server string = Samba 2.0.3 alpha release
        interfaces = 15.70.188.28/255.255.248.0
        security = SHARE
        username map = /usr/local/samba20/lib/user.map
        log level = 3
        log file = /usr/local/samba20/var/log.%m
        name resolve order = lmhosts
        printcap name = /usr/local/samba20/lib/printcap
        os level = 65
        config file = /usr/local/samba20/lib/smb.conf
```

A snapshot of active connections, shares and open files can be provided by SWAT, as shown in Figure 7-12. The **Server Status** can be actively monitored by SWAT.

Figure 7-12 Server Status


Samba Web Administration Tool - Netscape
File Edit View Go Communicator Help
Back Forward Reload Home Search Netscape Print Security Shop Stop
Bookmarks Location: http://mpesys5:901/status What's Related
Instant Message WebMail Radio People Yellow Pages Download Calendar Channels RealPlayer
HOME GLOBALS SHARES PRINTERS STATUS VIEW PASSWORD
Auto Refresh
Document: Done

Server Status

Refresh Interval: 30

version: 2.0.3
smbd: not running
nmbd: running

Active Connections

PID	Client	IP address	Date
983104	nt45184	15.10.45.184	Mon May 8 14:59:38 2000

Active Shares

Share	User	Group	PID	Client	Date
smb20demo	MGR.SAMBA20	SAMBA20	983104	nt45184	Mon May 8 14:59:39 2000

Open Files

PID	Sharing	R/W	Oplock	File	Date
983104	DENY_NONE	RDONLY	EXCLUSIVE+BATCH	/SAMBA20/PUB/smb20demo/-¨spa¤ol‡€.txt	Mon May 8 14:59:43 2000

How to use SWAT:

To use the SWAT interface, just point and click on any of the options on the front page banner. The following are the brief descriptions of what each link in the banner stands for:

Home	Samba help and documentation page
Globals	Link to global variable and configuration options
Shares	This link allows you to select the available shares for configuration or lets you create/delete shares from the record.
Printers	This link makes it possible to choose existing printers from the printers section of `smb.conf` file and change the configuration for each one of them.
Status	The status of the Server can be polled by clicking on this link, `smbd` and `nmbd` running status can also be checked. In addition, information on active connections, active share and active files that are open can be retrieved, allowing easy monitoring of server usage.
View	This link gives an abbreviated view of the `smb.conf` file. A full view can also be obtained by clicking on the “Full View” button.

Starting and Stopping Samba for MPE/iX

This section covers the steps to start or stop Samba for MPE/iX.

Starting Samba for MPE/iX

Before you start to run Samba for MPE/iX server or client components, you should have set up the TCP/IP networking on your HP e3000 system as well as your PC. On the HP e3000 system, you should have a proper IP address and subnet mask configured in NMMGR as well as `NETCONTROL START` successfully executed. You must choose to start SMBD and NMBD either as listener jobs or under control of INETD.

Disable Resource Sharing

If your system has `NBDAEMON.PUB.HPLANMGR` running, then SMBD and NMBD will not be able to use ports 137 and 139 as NBDAEMON already binds to them. The workaround solution is to stop the PDSERVER process. The NBMON and NBDAEMON processes will not start because of this workaround. This can be done by modifying the file `PDSSERV.NET.SYS` by changing the line 7 from 1 to 0. This will set up PDSSERVE for non-reserved servers.

The following shows the steps of making non-reserved servers:

1. Modify the file `PDSSERV.NET.SYS` and change the line 7 from 1 to 0.
2. Shutdown the network.
3. Stream `JCONFJOB.NET.SYS`.
4. Start the network backup.
5. The command `nscontrol status=services` should show non-reserved PDSERVERs.

Verify Link Configuration

The default assumes that LAN link configuration in NMMGR is SYSLINK. You need to run the following command to get the IP address and subnet mask of your HP e3000 system; you will need this information for future Samba for MPE/iX configuration file updates with the “interfaces” parameter.

1. Logon as `manager.sys`
2. Enter the command `Netcontrol status; net=LAN1`

The following example displays when you run the command `netcontrol status; net = lan1`.

```
NETWORK NAME:        LAN1

NETWORK IP ADDRESS:  $0F0DC750 15.13.188.80

NETWORK SUBNET MASK: $0FF000000 255.0.0.0
```

Add PM Capability

To access share security modes, both `samba` and `mgr.samba user` accounts should have PM capabilities.

1. Logon as `manager.sys`
2. Add PM capability to `samba` account
3. Add PM capability to `mgr.samba` user

Starting SMBD and NMBD Listener Jobs

1. Logon as `mgr.samba`
2. Copy the sample configuration file `samp-smb.conf`, `samp-printcap` and `samp-user.map` to `smb.conf`, `printcap` and `user.map`. Modify the entries to suit your Samba for MPE/iX environment. The `samp-smb.conf`, `samp-princap` and `samp-user.map` files reside in the `/usr/local/samba/lib` directory.
3. Check your Samba for MPE/iX configuration files with **TESTPARM** utility. The **TESTPARM** utility resides in the `/usr/local/samba/bin` directory. Run the following command: `shell/ix> testparm /usr/local/samba/lib/smb.conf`.
4. Start your SMBD listener and NMBD server.
5. If you choose to run the Samba for MPE/iX version 1.9.16p9, please use the jobs supplied as `JSMB.SAMBA.SYS` and `JNMB.SAMBA.SYS` and stream them. If you choose to run the version of Samba for MPE/iX 2.0.3, use the jobs supplied as `JSMB20.SAMBA.SYS` and `JNMB20.SAMBA.SYS` and stream them. If you choose to run the version of Samba, for MPE/iX 2.0.7, use the jobs supplied as `JSMB207.SAMBA.SYS` and `JNMB207.SAMBA.SYS`
6. Use `SHOWJOB` to see if the jobs stay alive; it can look as follows:

```
JOBNUM     STATE     JIN     JLIST     JOB NAME

#J30       EXEC      10S     LP        NMBMON,MGR.SAMBA

#J31       EXEC      10S     LP        SMBMON,MGR.SAMBA
```

Starting Samba for MPE/iX Under the INETD Control

If you choose to run SMBD and NMBD processes under control of INETD, you should have new entries in `SERVICES.NET.SYS` and `INETDCNF.NET.SYS`. You will then have to create symbolic links to make `SERVICES.NET.SYS` link to `/etc/services` and `INETDCNF.NET.SYS` symbolic links to `/etc/inetd.conf` respectively. Perform the following steps:

1. Logon as `manager.sys`.
2. Copy `SERVSAMP.NET.SYS` file to `SERVICES.NET.SYS` if `SERVICES.NET.SYS` doesn't exist. The following two entries should exist in file `SERVICES.NET.SYS`:

   ```
   nmbp 137/udp
   smbp 139/tcp
   ```

3. Copy `INCNFSMP.NET.SYS` file to `INETDCNF.NET.SYS` if `INETDCNF.NET.SYS` doesn't exist. If you run the Samba for MPE/iX version 1.9.16p9, the following two entries should exist in file `INETDCNF.NET.SYS`:

   ```
   nmbp  dgram   udp  wait  MGR.SAMBA  /SYS/SAMBA/NMBD  nmbd
   smbp  stream  tcp  nowait MGR.SAMBA /SYS/SAMBA/SMBD  smbd
   ```

   If you run the version of Samba for MPE/iX 2.0.7, the following two entries should exist in file `INETDCNF.NET.SYS`:

   ```
   nmbp dgram  udp  wait  MGR.SAMBA  /SYS/SAMBA/NMBD207  nmbd
   smbp stream tcp  nowait MGR.SAMBA /SYS/SAMBA/SMBD207  smbd
   ```

4. Use the following two commands to create symbolic links to make `SERVICES.NET.SYS` link to `/etc/services` and `INETDCNF.NET.SYS` links to `/etc/inetd.conf`, respectively:

   ```
   :newlink /etc/services, /SYS/NET/SERVICES
   :newlink /etc/inetd.conf, /SYS/NET/INETDCNF
   ```

5. Stream `JINETD.NET.SYS` to start SMBD listener and NMBD server (or use INETD `-c` to reread the configuration file if INETD is already running.)
6. Use `SHOWOUT JOB= Jobnumber`
7. Print `Oxxx.OUT.HPSPOOL` to check for any problems in the spool files.

In case of problems, check for the job listings for useful error messages and look into the Samba for MPE/iX log file `/usr/local/samba/var/log.smb` and `log.nmb` for hints. You can control the amount of log messages with the "debug level" directive inside the config file.

NOTE The new version of Samba for MPE/iX 2.0.7 is released as the official patch/6.5. The Samba for MPE/iX 2.0.7 software resides inside the SAMBA account in HFS directories under /SAMBA/SMB207 after you install the official release patch for Samba. The current version of Samba for MPE/iX 1.9.16p9 still exists inside the SAMBA account in HFS directories under /SAMBA/PUB.

You can run only one version of Samba for MPE/iX at a time.

Stopping Samba for MPE/iX

It is important to shutdown Samba for MPE/iX before bringing the system down. You can use the following commands to stop Samba for MPE/iX:

1. Use `SHOWJOB` to see if the jobs stay alive; it can look as follows:

```
JOBNUM     STATE     JIN     JLIST     JOB
#J30       EXEC      10S     LP        NMBMON,MGR.SAMBA
#J31       EXEC      10S     LP        SMBMON,MGR.SAMBA
```

2. Use the following two commands to stop Samba for MPE/iX:

```
:abortjob          #smbjobnumber

:abortjob          #nmbjobnumber
```

NOTE Clients connected and writing to files will loose data if an `abortjob` is done with clients active.

Initial Test With smbclient Utility

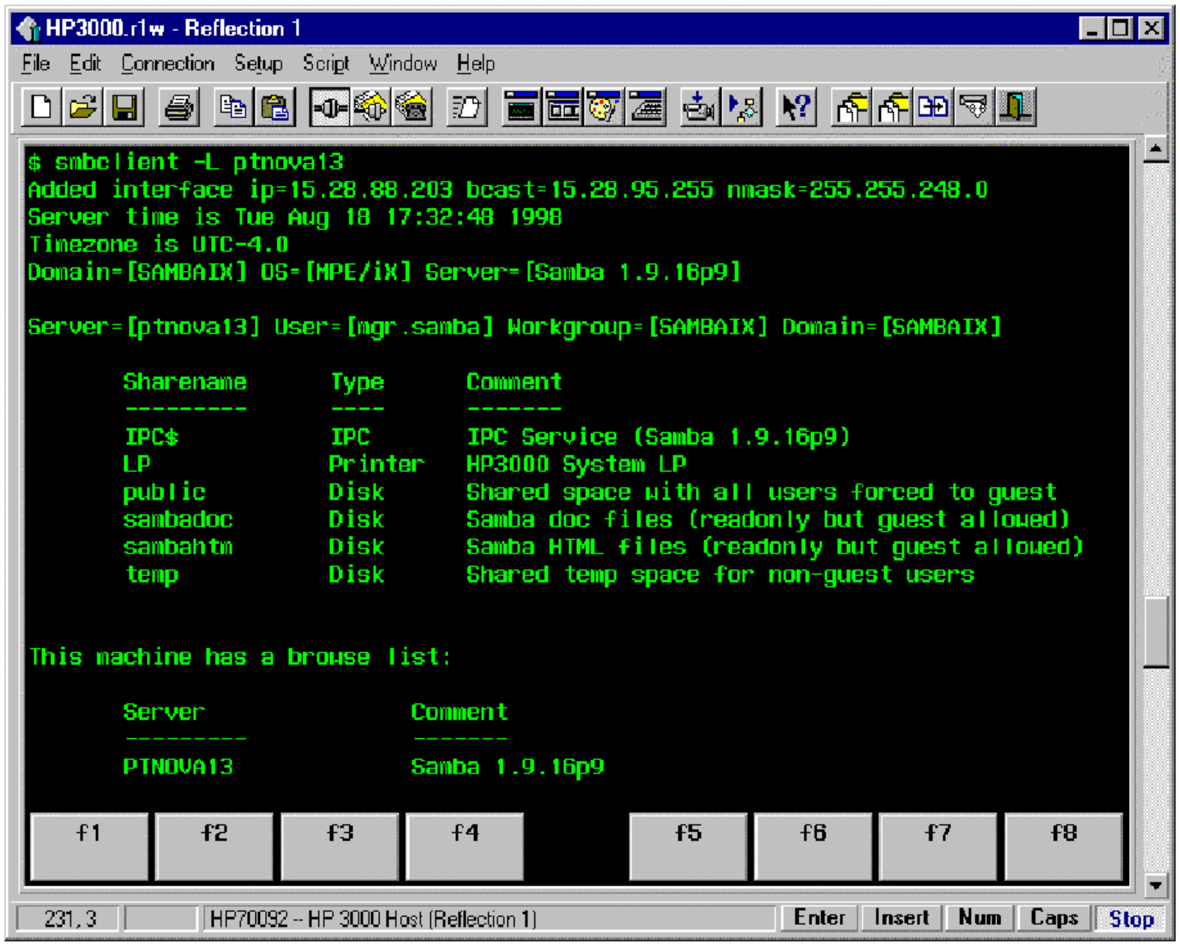
The **smbclient** utility provides access to SMB servers with an FTP-like user interface. You can run **smbclient** utility on POSIX/Shell environment.

Logon to your MPE/iX system as `mgr.samba`:

```
: sh.hpbin.sys

shell/iX> cd bin

shell/iX> smbclient -L <sambaserver>
```

This command should display a list of available shares (services) that matches your configuration file. If NMBD is running, a list of workgroups and related computers that NMBD could find on your network/subnet will be displayed, see Figure 7-13.

Figure 7-13 smbclient for MPE/iX (1)

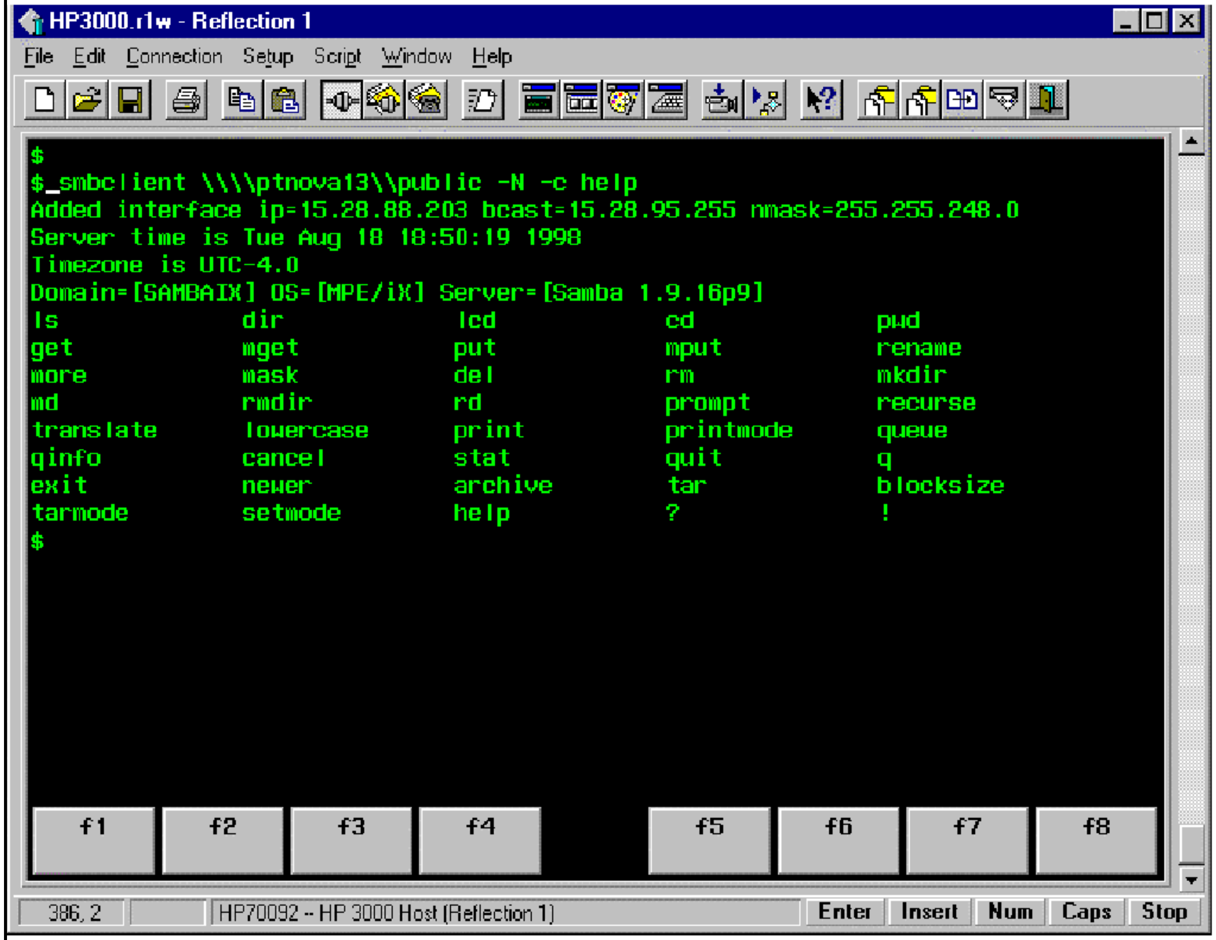

HP3000.r1w - Reflection 1
File Edit Connection Setup Script Window Help
f1 f2 f3 f4 f5 f6 f7 f8
231, 3
HP70092 -- HP 3000 Host (Reflection 1)
Enter Insert Num Caps Stop

```
$ smbclient -L ptnova13
Added interface ip=15.28.88.203 bcast=15.28.95.255 nmask=255.255.248.0
Server time is Tue Aug 18 17:32:48 1998
Timezone is UTC-4.0
Domain=[SAMBAIX] OS=[MPE/iX] Server=[Samba 1.9.16p9]

Server=[ptnova13] User=[mgr.samba] Workgroup=[SAMBAIX] Domain=[SAMBAIX]

       Sharename      Type      Comment
       ---------      ----      -------
       IPC$           IPC       IPC Service (Samba 1.9.16p9)
       LP             Printer   HP3000 System LP
       public         Disk      Shared space with all users forced to guest
       sambadoc       Disk      Samba doc files (readonly but guest allowed)
       sambahtm       Disk      Samba HTML files (readonly but guest allowed)
       temp           Disk      Shared temp space for non-guest users


This machine has a browse list:

       Server                Comment
       ---------             -------
       PTNOVA13              Samba 1.9.16p9
```

```
shell/iX> smbclient \\\\<sambaserver>\\sambadoc -N -c help
```

This command should connect to the sambdoc share on your HP e3000 using -N to suppress password prompt and effectively become guest user and display the contents of on-line help screen of smbclient, see Figure 7-14.

Figure 7-14 smbclient for MPE/iX (2)


HP3000.r1w - Reflection 1
File Edit Connection Setup Script Window Help
f1 f2 f3 f4 f5 f6 f7 f8
386, 2
HP70092 -- HP 3000 Host (Reflection 1)
Enter Insert Num Caps Stop

```
$
$_smbclient \\\\ptnova13\\public -N -c help
Added interface ip=15.28.88.203 bcast=15.28.95.255 nmask=255.255.248.0
Server time is Tue Aug 18 18:50:19 1998
Timezone is UTC-4.0
Domain=[SAMBAIX] OS=[MPE/iX] Server=[Samba 1.9.16p9]
ls             dir            lcd            cd             pwd
get            mget           put            mput           rename
more           mask           del            rm             mkdir
md             rmdir          rd             prompt         recurse
translate      lowercase      print          printmode      queue
qinfo          cancel         stat           quit           q
exit           newer          archive        tar            blocksize
tarmode        setmode        help           ?              !
$
```

NOTE All smbclient examples used the -c option to specify the command on the command line. The smbclient program has an interactive mode which looks like FTP. Due to limitations of the select() system call on MPE/iX, the interactive mode does not yet work properly. At present, it can be worked around by using the -c option of smbclient

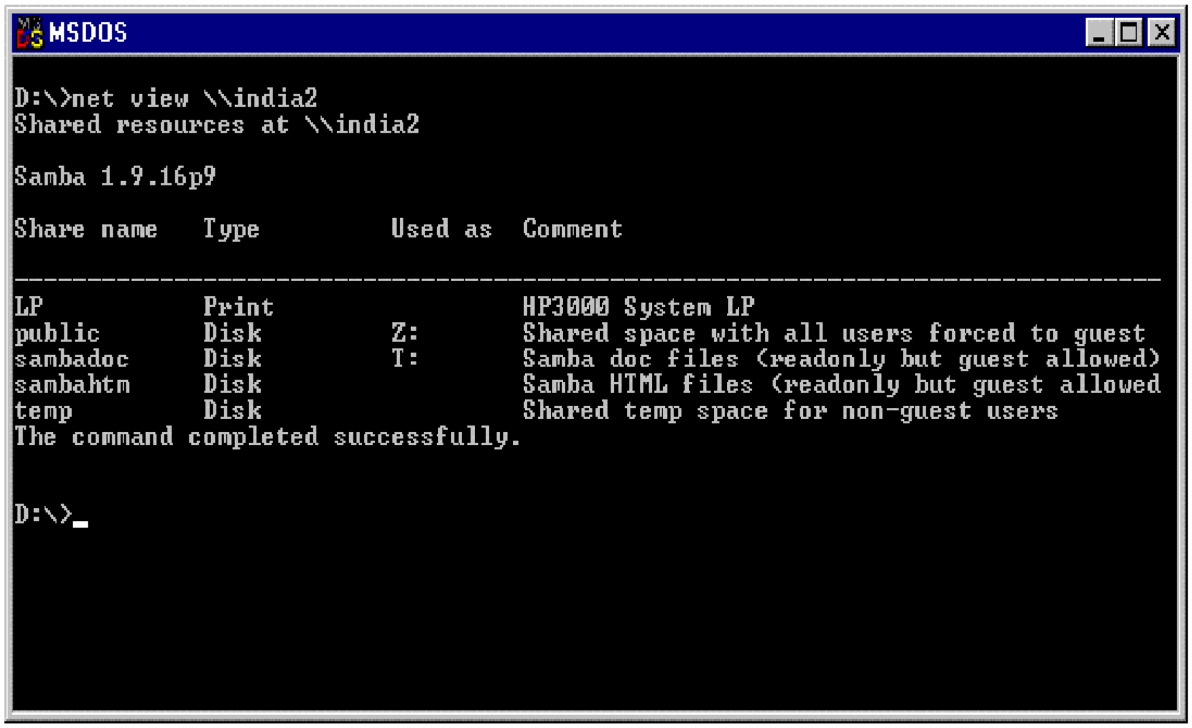
Initial Test From a PC Client at DOS Prompt

You can open a DOS command window and issue the command line using the following commands for initial test from a PC client:

```
C:\> net view\\servername
```

This command, will display a list of available shares for the server, see Figure 7-15.

Figure 7-15 Display Available Shares From a PC Client



```
D:\>net view \\india2
Shared resources at \\india2

Samba 1.9.16p9

Share name   Type         Used as  Comment

-------------------------------------------------------------------------------
LP           Print                 HP3000 System LP
public       Disk         Z:       Shared space with all users forced to guest
sambadoc     Disk         T:       Samba doc files (readonly but guest allowed)
sambahtm     Disk                  Samba HTML files (readonly but guest allowed
temp         Disk                  Shared temp space for non-guest users
The command completed successfully.


D:\>_
```

If you want to display a list of available shares on the Samba for MPE/iX server named “HP e3000” enter the following command at the DOS prompt:

Example: `C:\> net view \\HP e3000`

```
C:\>net use x:\\servername\servicename
```

This command will connect to a network drive X by entering the sharename `\\servername\servicename`.

If you want to connect to drive letter “X” from your PC to the “Sambdoc” service on Samba for MPE/iX server named “HP e3000,” type the following command at the DOC prompt:

Example: `C:\> net use x: \\HP e3000\sambdoc`

Samba for MPE/iX Share Level Security Mode

The process of user authentication depends whether Samba for MPE/iX is running in share level or user level. The "security" parameter in the configuration file is used to specify the share level or user level authentication. If the "security" parameter is set to "share," Samba for MPE/iX will tell clients it is granting access under share mode security. The process for granting access under share level security is:

- If the service is marked "`guest ok`" or "`public`", the client is granted access with the rights of the username given in the "`guest account`" parameter for the service.
- If a service is marked as "`guest only`" (not guest ok or public), access is granted with the rights of the username given in the guest account parameter for the service.
- If a client passed a username/password pair to Samba for MPE/iX and the username and password are validated, the client is granted access with the rights of the username.
- If the client registered a username with Samba for MPE/iX during a previous connection and now supplies the correct password for that username, access is granted.
- If the client validated a username/password pair with the Samba for MPE/iX server during a previous connections and now passes the correct corresponding access token, access is granted. This step will be skipped if the "`revalidate`" service parameter is true for this service.

Samba for MPE/iX Server Security Mode

Samba for MPE/iX server mode security is just one of the security policies of user level authentication. This mode of security is one of the types in processing user authentication. After the user is validated, access rights are enforced for the user:

To make Samba for MPE/iX operate in server security mode:

- Add `security = server` in the **[global]** section for `smb.conf` specifying `security = server` in `smb.conf`, the server security mode is on.
- Add password `server = <yourNTserver>`

  This option will allow Samba for MPE/iX to ask a remote SMB server for password checks, e.g., a Windows NT server. This option will be useful if you are integrating an MPE/iX into an already existing NT domain. It is better to set your Windows NT (primary or backup domain controller) server as the password server.

  Please set the password parameter to the DNS name of the Windows NT server.

After setting up the configuration, the client can proceed to login to the Samba for MPE/iX server. When connecting to a service using user level security, the client sends a session setup SMB that includes username and password. This step is not necessary while using shared level security.

In server level security, the Samba for MPE/iX server reports to the client in which it is in user level security. The client sends username and password pair. The Samba for MPE/iX server takes the username/password that the client sent and attempts to login to the "password server" by sending exactly the same username/password that it got from the client. If that server is in user level security and accepts the password, Samba for MPE/iX accepts the client's connection. This allows the Samba for MPE/iX server to use another SMB server as the "password server," the user authenticates against the NT password.

Some particular issues with Samba for MPE/iX and Windows NT: one of the problems with Windows NT is that NT refuses to connect to a server that is in user level security mode and doesn't support password encryption unless it first prompts the user for a password.

This means that even if you have the same password on the NT box and the Samba for MPE/iX server, you will get prompted for a password. Entering the correct password will get you connected.

New Functionalities

New functionalities supported in Samba for MPE/iX 2.0.7.

User-selectable name resolution order:

The resolution of NetBIOS names into IP addresses can be done in several different ways (`broadcast`, `lmhosts`, `DNS lookup`, `WINS`). In the Samba for MPE/iX version 2.0.7, it is a new parameter that allows administrators to select the methods of name resolution, and the order in which such methods are applied, check "Global Configuration Options."

Improved share mode handling:

The handling of share modes has been greatly improved in this new version of Samba for MPE/iX. The confidence level on share mode handling in Samba for MPE/iX is now much higher than it was previously.

Western European language support:

Samba for MPE/iX 2.0.7 supports Western European languages in filenames. This means that Western European versions of NT/95/98 should be able to create and view files with filenames in those languages. Currently codepage l850 and 437 are supported (ISO 8559-1). For non-European versions of NT/95/98, Western European language support can be configured as given below:

`Go to Control Panel -> keyboard -> input locales -> add`.

Now add the language for which you need support and set as default.

New MPE/iX legal characters:

Starting with MPE/iX 6.0 a few extra characters gained legal status. These characters are supported in Samba for MPE/iX 2.0.3 or 2.0.7. These characters are:

`~, \\, $, %, ^, *, +, |, {, }, :`

For technical information as to why the old file name mapping needs to be enhanced, refer to the Readme for Samba for MPE/iX.

Mapdiffs utility:

The **mapdiffs** utility is provided. This utility is used to check a given list of file or directory names for the name mapping differences between the Samba for MPE/iX 1.9.16p9 version and the new version of Samba for MPE/iX 2.0.3. or 2.0.7

How to use mapdiffs:

When you install this new version of Samba for MPE/iX, one must check the MPE/iX side file and directory names to see whether some of them have to be adjusted to the changed mapping methods.

The **mapdiffs** utility (under `/SAMBA/PUB/lib`) is provided to check a given list of file or directory names for the name mapping differences between the Samba for MPE/iX version 1.9.16p9 and the new Samba for MPE/iX 2.0.7. The renaming has to be done by hand.

The **mapdiffs** utility displays mapping test results, but the renaming has to be done by hand.

Usage: `find <fileset> | mapdiffs <option>`

where option:

```
   7cPC shows differences between version 1.9.16p9 and PC side
   7jPC shows differences between version 2.0.7 and PC side
   7c7j shows differences between version 1.9.16p9 and 2.0.7
   7j7c shows differences between version 2.0.7 and 1.9.16p9
   7c refers to Samba for MPE/i/X 1.9.16p9.
```

The resulting output can be used to judge filename conversion need.

Example:

```
   Shell/iX> find /SAMBA/SHR/public | mapdiffs
   7c: /SAMBA/SHR/public/New_20_Folder/my_24_file.java
   7j: /SAMBA/SHR/public/New_20_Folder/my$file.java
   7c refers to Samba for MPE/i/X 1.9.16p9
   7j refers to Samba for MPE/i/X 2.0.7 version
```

NOTE The file should be renamed before starting the new Samba for MPE/iX 2.0.7.

Change in the default security mode:

In previous versions of Samba for MPE/iX, the default security mode was "`security = share`". In this version of Samba, for MPE/iX 2.0.7, the default security has been altered to make "`security = user`" as the default. The user needs to note that the config file needs to be adjusted to avoid unexpected change in behavior.

Statfs:

A wrapper has been implemented to provide non-zero size of disk and free space.

NOTE Samba for MPE/iX 2.0.7 has been tested with Windows 2000.

Troubleshooting Samba for MPE/iX Server

This section covers a list of tests you can perform to validate or diagnose your Samba for MPE/iX server. If your server passes all these tests, it is probably working fine.

Prerequisites

In all of the tests it is assumed you have a Samba for MPE/iX server 1.19.16p9 or later running on your HP e3000. It is also assumed that the PC is running Windows for Workgroups, Windows 95 or Windows NT with a recent copy of the Microsoft TCP/IP stack. All these tests should be done with Windows for Workgroups (WfW), Windows 95,Windows 98 and Windows NT clients, as they all use different SMB's for file operations.

You need to have a sample share called "`public`" for testing purposes. Check to see if you have "`public`" share in `smb.conf` file:

```
[public]

     comment = files are shared

     path = /SAMBA/SHR/public

     read only = yes
```

Troubleshooting Procedures

Please follow these tests for diagnosing your Samba for MPE/iX server.

TEST 1:

In the directory in which you store your `smb.conf` file, run the command `testparm smb.conf`.

If it reports any errors, your `smb.conf` configuration file is faulty.

TEST 2:

On the client side; open MS-DOS prompt and run "ping SAMBAIXSERVER" from the PC and "ping CLIENTPC" from the HP e3000 system. If you don't get a valid response, your TCP/IP software is not correctly installed.

If you get a message saying "host not found" or similar, your DNS software or hostname is not correctly set up.

Ping might fail, if your host is running firewall software. You will need to relax the rules to let in the workstation in question, perhaps by allowing access from another subnet.

TEST 3:

Run the command "`smbclient -L SAMBAIXSERVER`" on the HP e3000 system. You should get a list of available shares back.

If you get a "connection refused" response, then the SMBD server could not be running.

If you get a "session request failed," the server refused the connection to SMBD. Check your config file (`smb.conf`) for syntax errors with "testparm" as well as the various directories where Samba for MPE/iX keeps its log and lock files.

Another common cause of these two errors is having something already running on port 139 (as in the case of NBMON/NBDAEMON) or SMBD already running under INETD.

And yet another possible cause for failure of TEST 3 is when the subnet mask and/or broadcast address settings are incorrect. Check to see whether the network interface IP Address/Broadcast Address/Subnet Mask settings are correct and Samba for MPE/iX has correctly noted these settings in the `log.nmb` file.

TEST 4:

Run the command "`nmblookup -B SAMBAIXSERVER __SAMBA__`" on the HP e3000. You should get the IP address of your Samba for MPE/iX server.

If you don't get the IP address, NMBD is incorrectly installed. Check your INETD, if you run it from there, or check to see whether the daemon is running and listening to UDP port 137.

Check your INETD entries related to `nmbd`, as discussed earlier.

TEST 5:

Run the command "`nmblookup -B CLIENTPC '*'`" on the HP e3000.

You should get the PCs IP address. If you don't get the PCs IP address, the client software on the PC is not installed correctly, the PC is not started, or you have the name of the PC wrong.

TEST 6:

Run the command "`nmblookup -d 2 '*'`" on the HP e3000.

This time try the same as the previous test, but try it via a broadcast to the default broadcast address. A number of NetBIOS/TCPIP hosts on the network should respond, although Samba for MPE/iX may not catch all of the responses in the short time it listens. You should see “got a positive name query response” messages from several hosts.

If this doesn’t give a similar result to the previous test, nmblookup isn’t correctly getting your broadcast address through its automatic mechanism. In this case you should experiment using the “interfaces” option in `smb.conf` to manually configure your IP address, broadcast and netmask.

If your PC, and server aren’t on the same subnet, you will need to use the -B option to set the broadcast address to that of the PC’s subnet.

This test will probably fail if your subnet mask and broadcast address are not correct. (Refer to TEST 3 notes).

TEST 7:

On the PC, type the command “`net view \\SAMBAIXSERVER`”. You will need to do this from within a “DOS prompt” window. You should get a list of available shares on the server.

If you get a “network name not found” or similar error NetBIOS name resolution is not working. This is usually caused by a problem in NMBD. To overcome the error, you could do one of the following (you only need to choose one):

- Fix the NMBD installation.
- Add the IP address of SAMBAIXSERVER to the “wins server” system in the advanced TCP/IP setup on the PC.
- Enable Windows name resolution via DNS in the advanced section of the TCP/IP setup.
- Add SAMBAIXSERVER to your `lmhosts` file on the PC.

TEST 8:

Run the command “`net use x: \\SAMBAIXSERVER\Public`”. You should get a “command completed successfully” message. If not, your PC software is incorrectly installed or your `smb.conf` is incorrect.

TEST 9:

Run the following command to test the print services.

- `smbclient '\\sambaserver\lp' -P -c` “print testfile”

If printing itself is a problem check the `/usr/local/samba/lib/printcap` file. Format of the file is simple.

```
printername | printer description
```

Printername must equal one of the printer names to which you normally print using MPE/iX. The description can be any free text.

```
LP|HP Laserjet in printing room
```

On the PC:

- net use `lpt1: \\sambaserver\lp` as guest

Print test page/pages to the printer connected to the Samba for MPE/iX server. At the command prompt type “`copy test.txt \\sambaixserver\lp`”.

TEST 10:

Some other tests, along with the ones mentioned previously, might be useful. These tests can be done to check the behavior of the Samba for MPE/iX server with these security policies:

1. Configure Samba for MPE/iX in User security mode:
   - Map a PC username to a valid MPE/iX `username.account` with passwords
   - Verify file and print access work
   - Verify files created by PC user are owned by correct MPE/iX username and account
   - Verify full file read and create access to the user's default home share.
2. Configure Samba for MPE/iX in Share security mode and set passwords on file shares.
   - Verify that the file and print access from PC users works.
3. Configure Samba for MPE/iX in Server security mode, pointing user validation to a NT server.
   - Verify that the users logged into the Windows NT domain being used as a validation server have the appropriate access to shares and printing on Samba for MPE/iX.
4. Perform PC connectivity and file/print access tests with SMBD and NMBD in daemon mode (for example, started from MPE/iX jobs JSMB and JNMB) as well as started from INETD as services.
5. Verify that all functionality works when the daemons or services are running as the default `mgr.samba`. If any functionality does not work, check to see if any changes are needed in the default capabilities of `mgr.samba`.

Using Logfiles of Samba for MPE/iX

In case of problems, check for the job listings for useful error messages and also look into the Samba for MPE/iX log file `/usr/local/samba/var/log.smb` and `log.nmb` for hints. You can control the amount of log messages with the “debug level” directive inside the config file `smb.conf`.

Increasing the log level to 3 or 4 can shed light on the cause of most problems. This also may lead to a large amount of details to be logged into these files.

You may have to increase the size of your log file if your debug level is more than 3.

NOTE Before using the logging feature of Samba for MPE/iX, make sure you check the IT Resource Center (ITRC) for information on any possible Samba for MPE/iX problems, URL: `http://us-support.external.hp.com/`.

8 DNS BIND/iX

BIND (Berkeley Internet Name Domain) is an implementation of the Domain Name System (DNS). It consists of a network of servers which provide a distributed database, including names and addresses of host machines. This information is accessible to client hosts which are running resolver software. This enables them to send queries to and receive replies from the servers.

The resolver software runs on MPE/iX versions preceding 6.0 so that the MPE/iX client hosts can query DNS servers running on other platforms. On MPE/iX 6.0 there is a full implementation of BIND which means that your MPE/iX host can now act as a DNS server on your network.

Introduction

This section of the Configuring and Managing MPE/iX Internet Services manual assumes that the reader has prior experience with DNS BIND as implemented on other operating systems, or has familiarity with the concepts involved. There are a number of good textbooks available on this subject to which the reader is recommended — the following is a brief overview of a sophisticated system.

The Domain Name System is a distributed and structured directory of information. One of its more frequent uses is the naming of host machines. A DNS host name will consist of several fields separated by dots, for example:

`quasar.india.hp.com.`

The host `quasar` exists in the domain `india`, which itself is a subdomain of `hp`, which is a subdomain of `com`, which is a subdomain of the root domain (identified as ".").

With this structured naming convention, the responsibility for maintaining accurate database information for a name domain can be delegated to a server which is managed by the organization who owns that domain. for example, DNS server hosts within HP maintain information about `hp.com`. Queries for names inside the domain `hp.com` will be referred to that server by servers in other domains. Within HP, the responsibility for `india.hp.com` can also be delegated to another local DNS server.

Before MPE/iX 6.0, hosts running MPE/iX were able to make DNS queries of servers running on other machines and operating systems. Now a full implementation of the server code has been introduced. DNS BIND/iX will enable your MPE/iX host to act as a DNS server, both responding to queries (from clients and other servers) as well as communicating with other DNS servers on the local network and the Internet.

The way this information is accessed is through client programs or code routines called "resolvers". When a program on a client host needs to obtain information about a domain, it will send a message to the local DNS server host. If the local server has this information, it will send back a reply immediately. If the local server does not have this information, it will research by sending queries to other servers, following the Domain Name System structure. Once the local server has found an answer for the client, it will then reply, but will also cache what it has learned in order to respond more speedily to subsequent queries.

DNS BIND/iX on MPE/iX 6.0 is an implementation of BIND version 8.1.1, which has introduced many new features since the more commonly used version 4.9.4, (with which the majority of experienced DNS users will be familiar).

This is the latest version of BIND, 8.1.1. with features like:

- DNS Dynamic updates
- DNS change notification
- completely new configuration syntax
- flexible and categorized logging system
- more efficient zone transfers

The package contains a host of utilities and administration tools:

- nslookup — query Internet name servers interactively
- dig — Domain Information Groper
- host — look up host names using domain server
- addr — get address of host

- dnsquery — give all the DNS details and Mail exchange records

Explanation of Terms

BIND, which stands for Berkeley Internet Name Domain, is the most commonly used implementation of DNS.

DNS is essentially a distributed data base, with control of the different elements of the data base maintained by individuals responsible for the domain served by that DNS server. The data is used by DNS servers to assist one host in identifying the location of another host anywhere in the system, translating a host name to its IP address, and visa versa.

The DNS distributed data base is much like a directory. It is organized in an inverted tree fashion, much like the unix directory structure, with the most inclusive node, or domain, at the top, with multiple levels of sub-domain names below, until at the end are the actual host names.

Information about each domain, specifying the sub-domains or hosts below it, are maintained in the DNS data base files. The convention is to call these files "db files" in BIND 4.X, and "zone files" in BIND 8.x. These files are made known to the respective DNS server through a configuration file, named.conf. In earlier versions of BIND, it was called `named.boot`.

When fully formed, a host name is made up of a sequence of labels separated by dots. When read from right to left, as DNS parses it, it describes a path leading from the most inclusive domain in its tree, through successively more local domains, until its own host name is reached.

Using the full host domain name, this is how a DNS server traverses the DNS data base, starting at the right-most, most inclusive domain, following data maintained by the various DNS administrators in their respective data files, until it finds the target host name, and its IP address.

A domain name is also made up of a sequence of labels separated by dots. Rather than describing a host, it describes a domain, under which other sub-domains and/or hosts exist. It can be located in the DNS data base by DNS servers the same way as was the host domain name.

Sometimes a particular DNS server will not manage an entire domain. Rather, the domain will be broken up into pieces, called "zones". Responsibility for these various zones is "delegated" to other DNS servers, and their respective DNS administrators. So, in DNS configuration files, instead of describing a domain for which it is responsible, the more general term "zone" is used.

It is also common, in fact recommended, for a DNS Server to have at least one "backup", another machine that will respond to queries when the main server is down. The main server is knows as the "master" and the backup as the "slave". In previous versions of BIND, they were known as "primary" and "secondary".

The rest of this section concerns itself with only "leaf" DNS servers, that is. servers that only serve hosts. These servers have no domains under it, only hosts.

There are four types of db or zone files used by a DNS server, each identified in the server's `named.conf` file:

- `zone.DOMAIN` — provides name-to-address mapping
- `zone.ADDR` — provides address-to-name mapping
- `zone.LOCAL` — a `zone.ADDR` file that provides loopback mapping
- `zone.CACHE` — a `zone.DOMAIN` file that identifies root name servers; also known as the "`zone.hint`" file.

Overview of DNS BIND/iX

In this implementation of BIND 8.1.1, the configuration and data files for the DNS server are found under the `/BIND/PUB` directory of the POSIX name space, though the DNS server is started by running a job from the MPE/iX name space — `JNAMED.PUB.BIND` which runs program `NAMED.PUB.BIND`.

The NAMED program maintains a cache of information, taken initially from its zone files (database files) augmented by information which it has retrieved from other DNS servers on the network.

Syslog is the standard event logging subsystem for UNIX, which has now been implemented as Syslog/iX on MPE/iX 6.0 running in the POSIX environment. DNS BIND/iX server logging is handled by Syslog/iX. In order to run the DNS server, you will first configure and start Syslog/iX. Details on configuring and running Syslog/iX can be found in Appendix E, “Configure and Run Syslog/iX,” of this manual.

The client (resolver) code has already been implemented in earlier releases of MPE/iX via library routines and the configuration file `RESLVCNF.NET.SYS` (linked to `/etc/resolv.conf`). `RESLVCNF.NET.SYS` contains information about the domain of the client host and the IP addresses of the local DNS servers who can be queried for information.

DNS BIND/iX Component Files

The major files for the implementation of DNS BIND/iX are found in `PUB.BIND` and `NET.SYS` in the MPE/iX name space, and under directories `/BIND/PUB` and `/etc` in the POSIX name space.

`JNAMED.PUB.BIN`

The job which runs the DNS server.

`NAMED.PUB.BIND`

The DNS server program.

`RESLVCNF.NET.SYS`

The DNS client (resolver) configuration file. Linked to `/etc/resolv.conf`.

`/etc/resolv.conf`

The DNS client (resolver) configuration file. Linked to `RESLVCNF.NET.SYS`.

`/BIND/PUB/etc/ named.conf`

The configuration file for the DNS server program. It used to be called `/etc/named.boot` in earlier versions of BIND.

`/BIND/PUB/etc/zone. <various>`

The zone files contain the data which will be loaded into the DNS server’s cache when it is started — these used to be called db or “database” files in earlier versions of BIND. They replace the `db.<various>` files.

Several example zone files have been included with the DNS BIND/iX product.

`/BIND/PUB/etc/ nslookup.help`

The help text for the nslookup utility.

`/BIND/PUB/bin/ nslookup`

Interactive name server query utility.

`/BIND/PUB/bin/ dnsquery`

DNS server query tool.

`/BIND/PUB/bin/ host`

Host information lookup tool.

`/BIND/PUB/bin/ addr`

Address lookup tool.

`/BIND/PUB/bin/ named- bootconf.pl`

Perl script to assist in converting `BIND 4.x named.boot` to `8.x named.conf.`

`/BIND/PUB/bin/ nsupdate`

Zone transfer program — called internally by nameservers to transfer zone information from primary to secondary servers

`/BIND/PUB/ public_html`

Linked to sub-directory `/BIND/PUB/doc-8.1.1/html`

In addition, there are the following directories included with this product:

`/BIND/PUB/ include`	Include code files.
`/BIND/PUB/lib`	Library routines

Server Configuration File named.conf

The configuration file, `named.conf`, has a completely new syntax. The configuration file in BIND 4.x was called `named.boot`.

The utility “`named-bootconf.pl`”, written in Perl, available with the package, can be used to convert 4.x (8.1.1) configuration files. The complete path of this file in the installation is `/BIND/PUB/bin/named-bootconf.pl`.

See Appendix D, “Server Configuration Migration,” for directions on running the `named-bootconf.pl` utility.

The file `named.conf` provides configuration information about the database, information for the DNS server program NAMED. The database information is divided into zones. A zone will be either a domain (for example, `india.hp.com`) or an IP network (for example, `4.10.15.IN-ADDR.ARPA`. A DNS server needs both types of zones in order to be able to resolve names to IP addresses, and IP addresses to names.

The `named.conf` configuration indicates to NAMED which zones it is going to be a server for, whether or not the server is a master or a slave for each zone, and points to the files where the database information is maintained. When a slave zone is configured, the address of the master server for that zone will also be included.

A DNS server which is the master for a zone is the one where the master copy of the data is maintained. A DNS server which is a slave for a zone may keep a copy of the data too, but will open a connection to the master server in order to obtain updates. This update process is called a “zone transfer”. A DNS server may be both the master server for some zones, and a slave server for others.

A template `/BIND/PUB/etc/named.conf` has been provided with the installation of DNS BIND/iX. You can use this file, following the commented instructions within it as a basis for your own `/BIND/PUB/etc/named.conf`.

Advanced users may need to refer to Appendix B, “BIND 8 Configuration File,” for a complete list of directives that can be configured for BIND 8. The following is the template `/BIND/PUB/etc/named.conf` file:

```
options {
        directory “/BIND/PUB/etc”;
// The following is the IP address of the MPE/iX system that is running NAMED.
// YOU MUST CHANGE THIS TO BE YOUR OWN IP ADDRESS!
        listen-on { nnn.nnn.nnn.nnn; ];
};
/*** List any servers here that you communicate with that are also running BIND 8.1 or greater. Replace
ALL OF THESE with your own servers, if any. ***/

server nnn.nnn.nnn.nnn {
        transfer-format many-answers;
};

// Defines the root. From ftp://rs/internic.net/domain/named.root.

zone “.” {
        type master;
        file “zone.hint”
};

//      DNS optimiation tricks for “special” addresses. You will need to
//      edit all of these files to specify the hostname of your own nameserver
//      and the e-mail address of the DNS maintainer.

zone “0.0.127.in-addr.arpa” {
        type master;
        file “zone.127.0.0”;
};

zone “0.in-addr.arpa” {
        type master;
        file “zone.bogus.0”;
};

zone “255.in-addr.arpa” {
        type master;
        file “zone .bogus.255”;
};

// A master zone. Substitute one of your own zones here.

// Slave zones. Replace ALL OF THESE with your own.

zone “csy.hp.com” {
        type slave;
        file “zone.slave”;
        master { nnn.nnn.nnn.nnn; nnn.nnn.nnn.nnn; }
```

Configuring Master Zones

A sample configuration unit for a master zone is shown here:

Example:

```
zone “43.10.15.IN-ADDR.ARPA” {
        type master;
        file “zone.15.10.43”;
};
```

The file `zone.15.10.43` will have entries like:

```
        IN      SOA   bindserver.india.hp.com.  bind_admin.india.hp.com. (
                                  104     ;  Serial
                                  10800   ;  Refresh every 3 hours
                                  3600    ;  Retry every hour
                                  604800  ;  Expire after a week
                                  86400 ) ;  Minimum ttl of 1 day
        IN      NS    bindserver.india.hp.com.
```

```
1        IN      PTR   m1.india.hp.com.
2        IN      PTR   m2.india.hp.com.
3        IN      PTR   m3.india.hp.com.
4        IN      PTR   m4.india.hp.com.
5        IN      PTR   m5.india.hp.com.
```

Configuring Slave Zones

A sample configuration unit for a slave zone is shown here:

```
zone “41.10.15.IN-ADDR.ARPA” {
      type slave;
      file “zone.15.10.41”;
      masters {
              15.70.188.45;
      };
};
```

The IP address of the server that is primary for that domain is specified in the masters { } section of the configuration. There could be more than one master for a given zone.

When the nameserver comes up, looking at this configuration, it makes a connection with the nameserver running on `15.70.188.45` and does zone transfer, if required. It also makes a local copy of this file.

Data Files

The files that the primary nameservers load their zone data from are called data files or zone files. They are also referred to as db files, short for database files.

The data files contain resource records that describe the zone. The resource records describe all the hosts in the zone.

Root Cache Data (Hint File)

Besides your local information, the nameserver also needs to know where the nameservers for the root domain are. This information must be retrieved from the Internet host `ftp.rs.internic.net`.

Explaining DNS Database Files

This is a typical DNS zone.domain file for the domain `maxx.net`. (Its name would be zone.maxx.net. It will translate from a host name to its IP address.)

```
;
; Addresses for the local domain

maxx.net.    IN      SOA   nova.maxx.net. tyager.nova.maxx.net. (

                          9602171        ; Serial
                          36000          ; Refresh every 10 hours
                          3600           ; Retry after 1 hour
                          360000         ; Expire after 100 hours
                          36000          ; Minimum TTL is 10 hours )

;   Define name servers
;
maxx.net.    IN      NS     nova.maxx.net.
maxx.net.    IN      A      204.251.17.241
```

```
;   Define localhost
;
localhost    IN      A      127.0.0.1

;   Set up hosts
;
maxx        IN      A       204.251.17.241
            IN      MX   5  nova.maxx.net.

maxx.net.     IN    MX   5  nova.maxx.net.
;
;   All mail for net delivered to nova
;
;*          IN     MX   10  nova.maxx.net.
www         IN     CNAME    nova.maxx.net.
ftp         IN     CNAME    nova.maxx.net.
news        IN     CNAME    nova.maxx.net.
mail        IN     CNAME    nova.maxx.net.
ns          IN     CNAME    nova.maxx.net.
loghost     IN     CNAME    nova.maxx.net.
lucy        IN     A        204.251.17.242
linux       IN     CNAME    lucy.maxx.net.
lucy        IN     MX   10  lucy.maxx.net.
messdos      IN     A        204.251.17.243
messdos      IN     MX   10  messdos.maxx.net.
pentium      IN     CNAME    messdos.maxx.net.
solaris      IN     A        204.251.17.244
solaris      IN     MX   10  solaris.maxx.net.
maxx4        IN     CNAME    solaris.maxx.net.
maxx5        IN     A        204.251.17.245
maxx5        IN     MX   10  maxx5.maxx.net.
maxx6        IN     A        204.251.17.246
maxx6        IN     MX   10  maxx6.maxx.net.
```

Most database file entries are known as DNS resource records. Generally, the resource records are shown in order: SOA, NS, followed by the other types, but this ordering isn't required. The data in each entry may be entered in upper, lower, or mixed case. All entries in the database file must start at the beginning of the line. Blank lines as well as any text following a semicolon is ignored.

SOA stands for Start of Authority. This acronym notifies named that operational parameters follow. The most important one is the Serial field. Every time you make a change to a database file, you must increment its serial number. Only by doing this will secondary servers know they need to reach into your system and pull out new name server data, a procedure known as a "zone transfer." Many DNS administrators use a date-time stamp for this field, like 9602171 for the first version on February 17, 1996.

First, focus on the SOA section:

```
maxx.net. IN SOA nova.maxx.net. tyager.maxx.maxx.net.
```

The "`maxx.net.`" field tells named the domain defined by this file. The name server will automatically append it to any host name that appears in the file. The trailing dot is not a type; it keeps named from trying to tack on your domain name. Without it, the resolver would be confused by named's expansion of my domain name to "`maxx.net.maxx.net`."

The IN stands for the "Internet" class of data. Even though other classes exist, they aren't in common usage. The "`nova.maxx.net`" field is the host on which these database files reside. Finally, "`tyager.nova.maxx.net`" represents the e-mail address of the DNS administrator, where the first dot (between `tyager` and nova) would be replaced by the @ symbol to create a valid address. (The @ symbol can't be used here because it has a reserved meaning in DNS database files.)

The open parenthesis at the end of the line allows you to split the SOA record across physical lines for readability:

```
           9602171          ; Serial
```

```
          36000           ; Refresh every 10 hours
          3600            ; Retry after 1 hour
          360000          ; Expire after 100 hours
          36000           ; Minimum TTL is 10 hours )
```

The "serial" field was discussed earlier.

The remaining four fields specify various time intervals (all values in seconds) used by the secondary name server:

`Refresh`	The time interval that must elapse between each poll of the primary by the secondary name server (here 36,000 seconds or 10 hours). If the "serial number" has been updated on the primary, the secondary assumes its data is stale and requests updated information as a "zone transfer."
`Retry`	The time interval used between successive connection attempts by the secondary to reach the primary name server in case the first attempt failed (here 3,600 seconds or one hour). Generally, less than the "refresh" time.
`Expire`	The time interval after which the secondary expires its data if it can't reach the primary name server (here 360,000 seconds or 100 hours). The secondary will refuse to service requests after this interval.
`Minimum`	The minimum time-to-live value, which specifies how long other servers should cache data from the name server (here 36,000 seconds or 10 hours).

There are several types of resource records, identified by the key word in field three of each record. You may present records in any order, but try to organize them for clarity. The `NS` (name server) record tells the hosts that query your server where the name servers for this domain can be found:

```
maxx.net.     IN     NS     nova.maxx.net.
```

You must include in this list at least one name server, that is the name of the server specified in the SOA record. You can list multiple name servers for your domain. In fact, your domain should have at least two name servers. Your Internet service provider will probably allow you to use their name server as a secondary for your domain, but it must have the trailing dots!

```
maxx.net     IN     A     204.251.17.241
```

The first `A` record, which resolves a fully-qualified host name to an IP address, is a special one. It defines an IP address for unqualified queries, that is, queries for the host `maxx.net`.

Other A records like this one:

```
lucy         IN     A      204.251.17.242
```

provide `name-to-address` mapping for a specific named host. The domain defined in this file (`maxx.net`) is appended to the host name you show in the first field.

The `CNAME` records create aliases for existing hosts. These examples illustrate a few common uses:

```
www     IN     CNAME     maxx.maxx.net.
ftp IN CNAME maxx.maxx.net.
```

You can give a host any alias you like, and as many aliases as you want. The host needn't answer to that name, that is, the alias doesn't need to be the host's true name as reported by hostname or uname.

The other vital type of record is `MX`. This tells SMTP e-mail software where to send mail for each named host:

```
lucy     IN     MX   10  lucy.maxx.net.
```

When a remote host's mail delivery program sees an e-mail address in your domain, it will query your name server for its applicable `MX` record or records. Every user on your LAN can receive e-mail, even if not every host is running its own e-mail software. The `MX` record for `lucy`, for instance, could easily redirect e-mail to another host on the LAN.

The number (10 in this case) in the fourth field represents a preference value. If you define multiple MX records for a host, delivery is attempted to lower-preference value hosts first. The actual value isn't important, only its relationship to other preference values.

On larger LANs it's a good idea to create backup e-mail servers. Smaller LANs can simply rely on the fact that most SMTP mailers will retry deliveries to the site for three days before returning a message to its sender.

The line, shown commented out here, would arrange to redirect e-mail for all hosts in this domain to a single machine:

```
;
; All mail for net delivered to nova
;
;*     IN     MX   10  nova.maxx.net.
```

This is a very good idea for LANs that benefit from a central e-mail repository.

Address-to-Name Mapping

Also called reverse mapping, the `zone.ADDR` db file allows resolvers to post queries armed with only the IP address of a host. This reverse mapping is used, for example, by Internet server software that prefers to log host names rather than less informative IP addresses.

Address-to-name mapping data will be provided for a DNS server by PTR entries in its `zone.ADDR` files, one for every network served by this DNS server, and its `zone.LOCAL` file.

Each entry will indicate the IP address in reverse order, then the host name. For example, for host littledog.maxx.net, whose IP address is `204.251.17.249`, in the `zone.ADDR` file it's PTR entry would look like:

```
249.17.251.204.     IN     PTR     littledog.maxx.net.
```

Why is it backwards? Recall that DNS does its parsing from right to left, from most inclusive to most specific. For IP addresses, it needs to parse in the same direction. But IP addresses, from right to left, go from most specific to most inclusive. So the simple answer is to reverse the IP address in the NDS PTR records. Now DNS can parse in the same direction, and resolve in the same order — from most inclusive to most specific.

A shortcut in PTR records is often used. It looks like this:

```
249         IN     PTR     littledog.maxx.net.
```

If the dot is left off the IP address in the PTR record, DNS will complete the IP address with the IP address of the domain, specified in the file's SOA record. This is also true for A records in name-to-address mapping db files. If the dot is left off, DNS will automatically try to complete the name with the full domain name in this zone. Paying attention to the terminating dot is important.

For the `zone.LOCAL` file we describe the loopback address just as you would expect it, now that we know we have to reverse it. The PTR entry in the `zone.LOCAL` file would look like:

```
     1.0.0.127.     IN     PTR     localhost.
```

or, using the shortcut:

```
     1             IN     PTR     localhost.
```

Only one line from `named.conf` remains to be discussed, the "cache" entry. This is a bit of a misnomer as it doesn't have anything to do with local caching. Instead, it defines the master root domain name servers for the Internet. You can retrieve this list from `ftp://nic.ddn.mil/netinfo/root-servers.txt`. You will need to check this site periodically to ensure you have the latest list.

This file lists the root domain servers in human-readable format. You'll need to reformat it for consumption by `named`. Here's what the cache file looks like:

```
;          Servers from the root domain
;          ftp://nic.ddn.mil/netinfo/root-servers.txt
;
.                   99999999     IN     NS   A.ROOT-SERVERS.NET
.                   99999999     IN     NS   B.ROOT-SERVERS.NET
.                   99999999     IN     NS   C.ROOT-SERVERS.NET
.                   99999999     IN     NS   D.ROOT-SERVERS.NET
.                   99999999     IN     NS   E.ROOT-SERVERS.NET
.                   99999999     IN     NS   F.ROOT-SERVERS.NET
.                   99999999     IN     NS   G.ROOT-SERVERS.NET
.                   99999999     IN     NS   H.ROOT-SERVERS.NET
.                   99999999     IN     NS   I.ROOT-SERVERS.NET

; Root servers by address

A.ROOT-SERVERS.NET   99999999     IN   A 198.41.0.4
B.ROOT-SERVERS.NET   99999999     IN   A 128.9.0.107
C.ROOT-SERVERS.NET   99999999     IN   A 192.33.4.12
D.ROOT-SERVERS.NET   99999999     IN   A 128.8.10.90
E.ROOT-SERVERS.NET   99999999     IN   A 192.203.230.10
F.ROOT-SERVERS.NET   99999999     IN   A 192.5.5.241
```

```
G.ROOT-SERVERS.NET   99999999     IN   A 192.112.36.4
H.ROOT-SERVERS.NET   99999999     IN   A 128.63.2.53
I.ROOT-SERVERS.NET   99999999     IN   A 192.36.148.17
```

Here, the dot (.) refers to the root domain and the `99999999` means a very long `time-to-live` value. The TTL value is no longer used for caching because the data isn't discarded if it times out, but administrators generally keep it around because it does no harm.

Your site may not have access to the Internet or may have protected its connection via a firewall. Often in this type of DNS configuration, one or more machines will be designated as a root server. In this case, the cache file will contain a list of internal root servers, and not the official Internet master root domain servers.

Testing Your Name Server

Perform simple checks on your name server's health with `nslookup`. This utility is standard with every TCP/IP-network-aware version of UNIX. There are other similar tools available — see "List of Utilities" later in this section for details.

You can find the source code for `dig` at several anonymous FTP archive sites, including: `ftp://ftp.wonderland.org/NetBSD/NetBSD-current/src/usr.sbin/named/dig/` for the NetBSD release. Use Archie to find other sites.

The `nslookup` utility can be used interactively, much like other programs, such as ftp. That is, if you invoke this program without command line arguments, it displays a prompt and waits for your command:

```
>server mpe3000

Default Name Server: mpe3000.cup.hp.com Address: 15.13.199.80
```

By default, `nslookup` performs queries based on host names you submit; just enter a host name after the prompt:

```
> romeo
Server:   mpe3000.cup.hp.com
Address:   15.13.199.80

Name:     romeo.cup.hp.com
Address:   15.13.194.242

> 15.12.194.242
Server:   mpe3000.cup.hp.com
Address:   15.13.199.80

Name:     romeo.cup.hp.com
Address:   15.12.194.242
```

You can check the resource records information about name server:

```
> set type=ns
> mpeworld
Name Server:   mpeworld.cup.hp.com
Address:   15.13.199.80

origin = dns.cup.hp.com
mail addr = dns-admin.dns.cup.hp.com
serial = 96092255
refresh = 10800 (3 hours)
retry = 3600 (1 hour) expire = 604800 (7 days)
minimum ttl = 86400 (1 day)
```

How to Run The DNS Server

1. Configure and start Syslog/iX see Appendix E, "Configure and Run Syslog/iX."
2. Examine `/BIND/PUB/etc/named.conf` and customize for your own environment.
3. Configure the zone data files referenced in your `/BIND/PUB/etc/named.conf`.
4. Add your server's IP address as the first nameserver entry in `/etc/resolv.conf` for all MPE and HPUX hosts that you wish to use this server for resolution queries. On MPE hosts, make sure that `/etc/resolv.cnf` is actually a symlink pointing to the real data at `RESLVCNF.NET.SYS`.
5. `:stream JNAMED.PUB.BIND`
6. Stop BIND by issuing the command `:ABORTJOB`.

Configuring the DNS Resolver

The file `RESLVCNF.NET.SYS` is the configuration file for the Domain Name resolver. It should be linked to `/etc/resolv.conf`. If the file does not already exist, then it can be copied from `RSLVSAMP.NET.SYS` to `RESLVCNF.NET.SYS` and then modified to contain information about your local domain and servers.

Each entry in the resolver file consists of a keyword followed by a value separated by white space. The keyword and its associated value must appear on a single line, and the keyword must start the line. Comment lines start with a pound sign (#) or semicolon (;).

`domain`
: Enter the default domain name. This string will be appended to queries passed to the local DNS server. The default names should be written without a trailing dot:

```
domain india.hp.com
```

It is important to get the syntax correct as the resolver does not report errors. If more than one instance of the domain keyword is present, the last instance will override. To specify multiple domains for an unqualified name lookup, use the search directive.

`search`
: The search directive is optional but overrides the domain directive for specifying which domains should be searched for unqualified host name lookups. You should add a search entry if users on a system commonly try to connect to nodes in another domain. The format is the search directive followed by up to six domains, separated by a white space.

```
search cup.hp.com hp.com
```

`nameserver`
: The nameserver directive tells the resolver the IP address of a name server to query. For example, the line:

```
nameserver 15.32.17.2
```

instructs the resolver to send queries to the name server running at IP address `15.32.17.2` instead of the local host.

The resolver will also allow you to specify up to three name servers using multiple nameserver directives. They will be tried in the order in which they appear in the RESLVCNF file, only passing to the next listed nameserver if the previous one is not responding. Note that the resolver will only query subsequent name servers if there is no response, if the previous nameserver has already replied that it cannot resolve a query, no further lookup will be attempted.

NOTE It is very important that you omit the leading zeros in the domain name resolver files. If you enter leading zeros here, the resolver routines will interpret the numbers as octal numbers.

`sortlist` This directive is a mechanism which lets you specify subnets and networks for the resolver to prefer if it receives multiple addresses as a result of a query. The format is the sortlist directive, followed by a list of network addresses may also include a subnet mask, which immediately follows the address, preceded by a slash symbol (/).

```
sortlist 128.32.42.0/255.255.255.0 15.0.0.0
```

`options` The options directive lets you set two internal resolver settings.

```
options debug
```

The above directive will set an internal flag which causes debugging information to be produced on standard output.

```
options ndots:2
```

The above directive sets the minimum number of dots a domain name query must contain before the resolver will assume that it is a fully qualified name and therefore does not need to append the default domain (or searchlist argument) before sending it to the server.

The options directive can combine both settings on the same line.

```
options debug ndots:2
```

`lines` Beginning with a pound sign (#) or a semicolon (;) in the first column, they are interpreted as comments and ignored by the resolver.

List of Utilities

- nslookup — query Internet name servers interactively

  Example:

  ```
  * nslookup quasar.india.hp.com
  Name Server: hpmpea2.cup.hp.com
  Address: 15.61.192.116

  Non-authoritative answer:
  Name: quasar.india.hp.com
  Address: 15.10.45.114
  ```

- dig — Domain Information Groper

  ```
  Example: shell/iX> dig
  ```

```
; <<>> DiG 8.1 <<>>
;; res options: init recurs defnam dnsrch
;; got answer:
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 6
```

```
;; flags: qr rd ra; QUERY: 1, ANSWER: 13, AUTHORITY: 0, ADDITIONAL: 12
;; QUERY SECTION:
;; ., type = NS, class = IN

;; ANSWER SECTION:
.                      2d23h2m52s IN NS  japan.cns.hp.com.
.                      2d23h2m52s IN NS  paloalto.cns.hp.com.
.                      2d23h2m52s IN NS  singapore.cns.hp.com.
.                      2d23h2m52s IN NS  andover.cns.hp.com.
.                      2d23h2m52s IN NS  atlanta.cns.hp.com.
.                      2d23h2m52s IN NS  bbnhs.cns.hp.com.
.                      2d23h2m52s IN NS  boise.cns.hp.com.
.                      2d23h2m52s IN NS  brahs.cns.hp.com.
.                      2d23h2m52s IN NS  colorado.cns.hp.com.
.                      2d23h2m52s IN NS  corvallis.cns.hp.com.
.                      2d23h2m52s IN NS  cupertino.cns.hp.com.
.                      2d23h2m52s IN NS  fortcollins.cns.hp.com.
.                      2d23h2m52s IN NS  gvahs.cns.hp.com.
;; ADDITIONAL SECTION:
japan.cns.hp.com.        2d23h36s IN A   15.74.137.1
paloalto.cns.hp.com.     2d23h36s IN A   15.1.200.2
singapore.cns.hp.com.    2d23h35s IN A   15.43.40.31
andover.cns.hp.com.      2d23h35s IN A   15.4.152.7
atlanta.cns.hp.com.      2d23h36s IN A   15.24.240.5
bbnhs.cns.hp.com.        2d23h36s IN A   15.195.32.10
boise.cns.hp.com.        2d23h35s IN A   15.10.216.25
brahs.cns.hp.com.        2d23h36s IN A   15.195.104.10
colorado.cns.hp.com.     2d23h36s IN A   15.13.48.11
corvallis.cns.hp.com.    2d23h36s IN A   15.7.240.32
cupertino.cns.hp.com.    2d23h35s IN A   15.36.88.4
fortcollins.cns.hp.com.  2d23h35s IN A   15.6.184.40

;; Total query time: 0 msec
;; FROM: mpeworld to SERVER: default -- 0.0.0.0
;; WHEN: Mon May 18 22:15:45 1998
;; MSG SIZE sent: 17 rcvd: 494
```

- host — look up host names using domain server.

  Example:

```
shell/iX> host quasar.india.hp.com
quasar.india.hp.com has address 15.10.45.114
quasar.india.hp.com mail is handled (pri=90) by hpmdd58.india.hp.com
quasar.india.hp.com mail is handled (pri=100) by palsmtp.hp.com
quasar.india.hp.com mail is handled (pri=150) by atlsmtp.hp.com
quasar.india.hp.com mail is handled (pri=10) by quasar.india.hp.com quasar.india.hp.com mail is handled
(pri=50) by fakir.india.hp.com
```

- addr — get address of host
- dnsquery — Give all the DNS details and Mail exchange records.

Example:

```
shell/iX> dnsquery quasar.india.hp.com
;; ->>HEADER<<- opcode: QUERY, status: NOERROR, id: 45601
;; flags: qr aa rd ra; QUERY: 1, ANSWER: 6, AUTHORITY: 7, ADDITIONAL: 10
;; quasar.india.hp.com, type = ANY, class = IN
quasar.india.hp.com.       1D IN MX     50 fakir.india.hp.com.
quasar.india.hp.com.       1D IN MX     90 hpmdd58.india.hp.com.
quasar.india.hp.com.       1D IN MX     100 palsmtp.hp.com.
quasar.india.hp.com.       1D IN MX     150 atlsmtp.hp.com.
quasar.india.hp.com.       1D IN MX     10 quasar.india.hp.com.
quasar.india.hp.com.       1D IN A      15.10.45.114
india.hp.com.              1D IN NS     fakir.india.hp.com.
india.hp.com.              1D IN NS     cauvery.india.hp.com.
india.hp.com.              1D IN NS     valmki.india.hp.com.
india.hp.com.              1D IN NS     hpmdd58.india.hp.com.
india.hp.com.              1D IN NS     palrel2.hp.com.
india.hp.com.              1D IN NS     atlrel2.hp.com.
fakir.india.hp.com.        1D IN A      15.10.40.3
```

```
hpmdd58.india.hp.com.      1D IN A      15.70.168.58
palsmtp.hp.com.            8H IN A      156.153.255.242
palsmtp.hp.com.            8H IN A      156.153.255.226
atlsmtp.hp.com.            8H IN A      156.153.255.210
atlsmtp.hp.com.            8H IN A      156.153.255.202
quasar.india.hp.com.       1D IN A      15.10.45.114
cauvery.india.hp.com.      1D IN A      15.10.40.5
valmiki.india.hp.com.      1D IN A      15.17.112.100
sahana.india.hp.com.       1D IN A       15.10.43.22
```

NOTE In order to run the various utilities, you will need to modify your PATH variable, adding the following two directories:

```
/BIND/PUB/sbin
/BIND/PUB/bin
```

DNS and Electronic Mail

One of the advantages of the Domain Name System over host tables is its support of advanced mail routing. DNS offers a mechanism for specifying backup hosts for mail delivery. The mechanism also allows hosts to assume mail handling responsibilities for other hosts. This lets diskless workstations that don't run mailers, for example, have mail addressed to them processed by their server. These features give administrators more flexibility in configuring electronic mail on their network.

MX Records

DNS uses a single type of resource record to implement enhanced mail routing, the MX record. MX records specify a mail exchanger for a domain name, a host that will either process or forward mail for the domain name.

In order to prevent mail routing loops, the MX record has an extra parameter, besides the domain name of the mail exchanger, a preference value like: `peets.mpk.ca.us IN MX 10 relay.hp.com` specifies that `relay.hp.com` is a mail exchanger for `peets.mpk.ca.us` at preference value `10`.

DNS BIND Troubleshooting Steps

1. **Resources:** Find a resource who is experienced with DNS BIND/iX! If you're entering into this without DNS BIND/iX experience, you're off to a difficult start. Problems with this product are generally caused by poor configuration, so it's critical to have a DNS BIND literate engineering resource available for problem classification and management.
2. **Check the Obvious:** Those with experience in DNS BIND troubleshooting will have built up a number of quick "sanity checks" that they use. Often, these will result in a quick resolution without having to progress onto the next stages. If you don't have the experience (and can't find someone that does... recommended) or find that you're still unable to find the answer, you'll need to progress to the next steps.

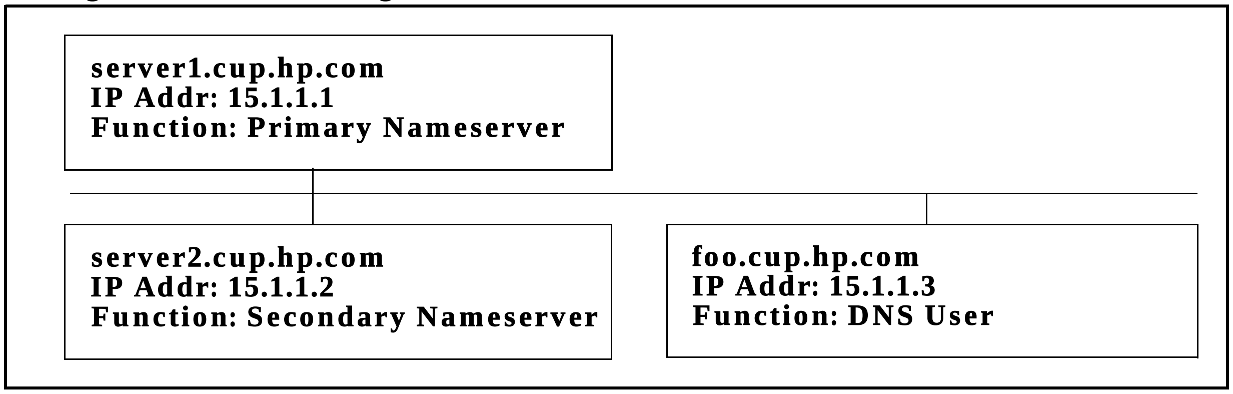
3. **Detailed Problem Description:** Historical information is very valuable... is this a new DNS BIND installation, or has the site suddenly started to experience problems? No matter what the history, you will need to find out and document the exact symptoms being experienced.

   It Used to Work: Find out if the DNS Administrator is aware of any configuration or network topology changes that could be tied to the recent DNS BIND problems. Make a note of anything they can suggest. Generally, these problems are caused by an incorrect configuration change, or some change in network topology, resulting in lost connectivity to systems required by the DNS environment (no route to a required system, an internal or external nameserver is down, system name/IP address change, poor configuration, and so forth.

   New Configuration: In 99% of DNS BIND problems, the cause is poor configuration. Unfortunately, DNS is not an easy service for the novice to configure. There are many pitfalls waiting to trip a user. In a new configuration situation, you'll find the following steps will probably be needed.

4. **Topology Information:** Obtain and document a detailed description of the DNS topology used in this environment, Information on all the involved systems will be needed. It's important to be able to picture how all the systems connect to one another and the inter-dependencies any have with one another. If possible, an ASCII diagram of the topology is very often worth the effort (labeling each node with its system and DNS information, see Figure 8-1).

Figure 8-1 Labeling Nodes



5. **Configuration Gathering:** Once you have a good understanding of the history, symptoms, and topology, it's time start examining the DNS configuration at the site. Relying on assumptions does not work with DNS BIND troubleshooting.

   This information is needed from each system.

   - From ALL Systems:

     a. Review the following files:

     ```
     /etc/resolve.conf
     /etc/nsswitch.conf (If present)
     results for all lan interfaces
     ```

     b. Run the following commands:

     ```
     nettool.net.sys “conf;summ;gui”
     linkcontrol@,S
     netcontrol <NIname>;STATUS for each appropriate NI
     ```

     c. From Nameservers:

     ```
     All the information detailed above in “From ALL Systems”
     /etc/named.conf (Or the customers equivalent)
     The system’s db files
     ```

Look in the `/etc/named.conf` file and the directory directive will tell you where to look for these. They are prefixed with db or zone, so may look like these examples:
`db.cache, db.root, db.127.0.0,. db.cup, etc.`

6. **Configuration Validation:** Once the configuration information is gathered, it's time to sit down and wade through it all, looking for problems. By now you should have a good idea of how this DNS BIND topology fits together. Consider the symptoms, the history, the topology, and verify the levels of configuration that might be responsible for these problems.

   Experience is the best tool, but there is one very good resource available that will help in troubleshooting DNS BIND:

   DNS & BIND is a book written by Paul Albitz and Cricket Lui. The 2nd edition has recently been published, with some useful additions for the newer, post 4.8.3, versions of BIND (4.9.3 is covered in some detail). Published by O'Reilly & Associated, Inc. [2nd Edition ISBN: 1-56592-236-0]

7. **Troubleshooting Tools:** The following tools can be useful in troubleshooting DNS BIND problems:

nslookup	(Available on all systems)
ping	(Available on all systems)

   Further information on the use of these tools can be found in the book *DNS & BIND*, as well as in the system man pages.

9 HP WebWise MPE/iX Secure Web Server

HP WebWise MPE/iX Secure Web Server offers secure encrypted communications between browser and server via the SSL and TLS protocols, as well as strong authentication of both the server and the browsers via X.509 digital certificates. The current release of the HP WebWise MPE/iX Secure Web Server is A.03.00 and is composed of:

- Apache 1.3.22
- `Mod_ssl` SSL security add-ons for Apache
- MM shared memory library
- Openssl cryptographic/SSL library
- RSA BSAFE Crypto-C cryptographic library (for the RC2, RC4, RC5, and RSA algorithms)

This is the second release of HP WebWise MPE/iX Secure Web Server. It was labeled version A.03.00 because it is replacing the A.02.00 version of Apache. There was not A.02.00 version of WebWise.

System Requirements

The following software requirements must be met prior to installing HP WebWise MPE/iX Secure Web Server A.03.00:

- MPE/iX 7.5 or later.
- HP highly recommends installing the latest NSTxxxxx network transport patch.

Support

HP WebWise MPE/iX Secure Web Server A.03.00 is supported through the HP Response Center as part of MPE/iX FOS support.

Product Overview and Feature Set

HP WebWise MPE/iX Secure Web Server offers secure encrypted communications between browser and server via the SSL and TLS protocols, as well as strong authentication of both the server and the browsers via X.509 digital certificates. HP WebWise MPE/iX Secure Web Server is A.03.00 and is composed of:

- Apache 1.3.22
- Mod_ssl 2.8.5 SSL security add-ons for Apache
- MM 1.1.3 shared memory library
- Openssl 0.9.6b crytographics/SSL library
- RSA BSAFE Crypto-C 5.2 cryptographic library (for the RC2. RC4, RC5, and RSA algorithms)

HP WebWise MPE/iX Secure Web Server is NOT:

- *NOT* a substitute for a firewall (explicitly allow acceptable connections, etc.)
- *NOT* a substitute for good host security practices (change default passwords, keep the OS up-to-date, etc.)
- *NOT* a substitute for good application security practices (use appropriate file and user security, carefully validate all input data, etc.)
- *NOT* a substitute for good human security practices (communicate the importance of protecting sensitive or proprietary data, no password sharing, etc.)

WebWise is just one component in a secure environment and by itself does nothing to prevent the number one cause of web server break-in events — poorly written **CGI applications**. Well-written **CGI applications** must rigorously validate every byte of data sent by a browser, and must refuse to process any input data containing unexpected characters.

New Apache Functionality since 1.3.14

Most of the Apache Software Foundation development work since 1.3.14 consists of portability enhancements and bug fixes for various problems including security issues. Some minor new functionality has also been added, as partially listed below:

- A new `LogFormat` directive of %c to display the connection status when each request is completed.
- `mod_auth` has been enhanced to allow access to a document to be controlled, based on the owner of the file being server. `Require file-owner` will only allow files to be served where the authenicated username matches the use that owns the document. `Require file-group` works in a similar way checking that the group matches.

SSLv2.0, SSLv3.0, and TLSv1.0 Protocols

These protocols lie between the HTTP and TCP/IP protocol layers and provide secure, authenticated, encrypted communications between the HP WebWise MPE/iX Secure Web Server server and browser clients.

X.509 Digital Certificates

Signed by external trusted Certificate Authorities, X.509 certificates provide authentication for both the HP WebWise MPE/iX Secure Web Server and browser clients.

Flexible Encryption Cipher Configuration

HP WebWise MPE/iX Secure Web Server permits you to configure a wide variety of encryption ciphers, ranging from high-grade domestic-only algorithms to algorithms suitable for export.

Additional Log Files

Two new log files, `ssl_engine_log` and `ssl_request_log`, allow you to log various events associated with secure web requests.

Migrating from Previous Versions of Apache

The `/APACHE/PUB/JHTTPD` job stream file from previous versions of Apache is not compatible with HP WebWise MPE/iX Secure Web Server. You must manually create a new `JHTTPD` job stream file by using the WebWise `/APACHE/PUB/JHTTPD.sample` template.

The /APACHE/PUB/conf/httpd.conf configuration file from previous versions of Apache may or may not be compatible with WebWise depending on the previous Apache version.

1.3.4	NOT compatible; you MUST use `/APACHE/PUB/conf/httpd.conf.sample` as a template to create a new httpd file
1.3.9	compatible, but SSL functionality is not enabled. To enable SSL functionality, you MUST use `/APACHE/PUB/conf/httpd.conf.sample` as a template to create a new httpd.conf. file.
1.3.14	compatible, but SSL functionality is not enabled. To enable SSL functionality, you MUST use `/APACHE/PUB/conf/httpd.conf.sample` as a template to create a new httpd.conf. file.

In addition to updating `/APACHE/PUB/conf/httpd.conf`, it is strongly recommended to update all of the other configuration files in the same directory by using the corresponding *.sample files.

Several new configuration subdirectories have been created to contain additional configuration files required by the SSL functionality. For complete details about configuring the SSL functionality, please see the *Configuring the Software* section of this manual.

Migrating from WebWise A.01.00

HP WebWise MPE/iX Secure Web Server version A.03.00 was designed to be a drop-in replacement for Apache, and does not attempt to upgrade or migrate any files from the WebWise A.01.00 `/APACHE/SECURE/` directory tree.

You must manually use the A.03.00 *.sample files in the `/APACHE/PUB/conf` directory tree to create new standard configuration files, and then propagate any local customizations that you made in the `A.01.00` `/APACHE/PUB/conf` directory tree.

You will need to copy your server key and certificate from the old A.01.00 locations of `/APACHE/SECURE/conf/ssl.key/server.key` and `/APACHE/SECURE/conf/ssl.crt/server.crt` to the new A.03.00 locations of `/APACHE/SECURE/conf/ssl.key/server.key` and `/APACHE/SECURE/conf/ssl.crt/server.crt`.

Any A.01.00 application in `/APACHE/SECURE/cgi-bin` or any data content in `/APACHE/SECURE/htdocs` can either be moved to the corresponding A.03.00 directories in `/APACHE/PUB`, or left in place after adjusting the new A.03.00 configuration files to refer to the old A.01.00 locations.

WebWise A.01.00 accessed web page content as the user `SECURE.APACHE`, but WebWise A.03.00 accesses web page content as the user `WWW,APACHE`. This is the same user as used by Apache A.02.00.

Bundled Modules

The following modules are statically linked into HP WebWise MPE/iX Secure Web Server (this list can be viewed by running HTTPD with the `-l` option: `/APACHE/CURRENT/HTTPD -l`):

- `mod_access`
- `mod_actions`
- `mod_alias`
- `mod_asis`
- `mod_auth`
- `mod_auth_anon`
- `mod_autoindex`
- `mod_cern_meta`
- `mod_cgi`
- `mod_define`
- `mod_digest`
- `mod_dir`
- `mod_env`
- `mod_expires`
- `mod_headers`
- `mod_imap`
- `mod_include`
- `mod_info`
- `mod_log_agent`
- `mod_log_config`
- `mod_log_referer`
- `mod_mime`
- `mod_mime_magic`
- `mod_negotiation`
- `mod_proxy`
- `mod_rewrite`
- `mod_setenvif`
- `mod_so`
- `mod_speling`
- `mod_ssl`
- `mod_status`

- `mod_unique_id`
- `mod_userdir`
- `mod_usertrack`
- `mod_vhost_alias`

Version Identification

To view the WebWise version, run the HTTPD program file with the -v option. Each WebWise release has an open source version number (for example, Apache 1.3.22) and an MPE/iX version number (i.e., A.03.00).

```
shell/iX> ./HTTPD -v
Server version: Apache 1.3.22 (HP MPE/iX WebWise A.03.00)
Server built: Jan 15 2002 15:47:50
```

Product Installation Architecture

Early versions of Apache for MPE/iX were installed under `PUB.APACHE`. Starting with Apache 1.3.14 and continuing with WebWise A.03.00, each web server version is installed in its own directory tree under the `APACHE` account and in a group named by its MPE/iX version. For example, WebWise A.03.00 has an MPE/iX version number of `A.03.00 (VUUFF)` so it resides in `/APACHE/A0300` (`/APACHE/VUUFF`). The next release of WebWise would reside in `/APACHE/A0400` and so on. A version-specific group is created for each new release of WebWise and all the files for that release are installed under that group.

The `APACHE` account and `PUB` group are still used, with file access still through the `/APACHE/PUB` directory. Symbolic links point from files and directories in `PUB.APACHE` to their corresponding files and directories in the version-specific group.

The installation also creates a symlink named `CURRENT` that points to the active version-specific group, since the system may contain multiple version-specific groups, for example (`/APACHE/A0200, /APACHE/A0300`, etc.). To view which version of WebWise is the current version:

```
shell/iX> ll /APACHE/CURRENT
lrwxrwxrwx 1 MGR.APACHE APACHE 5 Mar 27 20:03 CURRENT -> A0300
```

The symlinks in `PUB.APACHE` point indirectly via the `CURRENT` symlink into the version-specific group. For instance, the bin directory will point to the bin directory of the `CURRENT` version, so that a reference to `/APACHE/PUB/bin/htpassword` accesses `/APACHE/A0300/bin/htpasswd`.

```
shell/iX> ll /APACHE/PUB/bin
lrwxrwxrwx 1 MGR.APACHE APACHE 9 Mar 27 20:21
/APACHE/PUB/bin ->
/APACHE/CURRENT/bin
```

Users should modify or add files below the PUB group and never in the version-specific group. The version-specific group only contains files distributed as part of the WebWise product. This makes it possible to remove old releases by simply remove the entire `/APACHE/VUUFF` directory. Examples of files that should reside under `/APACHE/PUB` are configuration files, the WebWise startup job (`JHTTPD`), documents served to clients in htdocs/, and cgi scripts.

The installation creates new files or directories under `/APACHE/PUB` if needed for operation with a new WebWise version.

With new WebWise releases, the previous version-specific group is not purged. When satisfied with the new version, the user can execute

`:PURGEGROUP` on the previous version-specific group to remove it from the machine.

```
:PURGEGROUP /APACHE/VUUFF
```

`To backdate, the CURRENT symlink should be purged and recreated to point to previous version-specific group.`

```
shell/iX> cd /APACHE
shell/iX> rm CURRENT
shell/iX> ln -s VUUFF CURRENT
```

Major Components

HP WebWise MPE/iX Secure Web Server consists of a job stream (`JHTTPD`) which runs the server program (`HTTPD`), a set of configuration files, a complete set of online documentation, and miscellaneous utilities and scripts.

The full set of WebWise distribution files is contained within the `/APACHE/VUUFF` directory tree, and customers should not modify any of these files.

The files and directories that customers should reference and/or modify are as follows:

`/APACHE/PUB/`	The MPE group and HFS directory under which all HP WebWise MPE/iX Secure Web Server customer modifiable files reside. `MGR.APACHE` should be the only user with any kind of access to this group.
`HTTPD`	Symlink to web server daemon program. This program requires PM capability, and `MGR.APACHE` should be the only user with any kind of access to this program.
`JHTTPD`	The job stream which runs the HTTPD daemon.
`JHTTPD.sample`	Sample `JHTTPD` job stream.
`bin/`	Symlink pointing to the `/APACHE/CURRENT/bin` directory which contains various utility programs and scripts used for managing HP WebWise MPE/iX Secure Web Server. A summary of the major ones:
`apxs`	A perl script which assists in the creation of DSO modules. Note that perl is not distributed with HP WebWise MPE/iX Secure Web Server or supported by HP.
`htpasswd`	A program used to create the user/password database file required for HTTP Basic Authentication.
`openssl`	A program used for key and certificate management. HP only supports the usage shown in this document.
`sign.sh`	A shell script used to sign certificates. HP only supports the usage shown in this document.
`cgi-bin/`	This subdirectory is specified by the ScriptAlias configuration directive and contains demo CGI scripts.
`conf/`	This subdirectory contains all of the HP WebWise MPE/iX Secure Web Server configuration files, with the primary one being httpd.conf. `MGR.APACHE` should be the only user capable of writing to these files and subdirectories. Additional SSL-related configuration subdirectories below conf/:
`ssl.crl/`	Subdirectory containing Certificate Revocation Lists from the Certificate Authorities (CAs) who have signed your client browser's certificates. Useful only if you are doing client authentication.
`ssl.crt/`	Subdirectory containing your required web server certificate in the file server.crt. `MGR.APACHE` should be the only user with read access to this directory and the files contained within.
`ssl.csr/`	Subdirectory containing your web server Certificate Signature Request(s) (CSRs) that were used to obtain your server certificate(s).
`ssl.key/`	Subdirectory containing your web server key in the file server.key. Your key is EXTREMELY sensitive information and should be protected by both owner-only file permissions and a pass phrase. `MGR.APACHE` should be the only user with read access to this directory and the files contained within.

`htdocs/`	This subdirectory contains the content that will be visible to browser users accessing your web server. If a user specifies a URL of http://your.host.name/foo.html, HP WebWise MPE/iX Secure Web Server will return the file called `/APACHE/PUB/htdocs/foo.html`.
`icons/`	This subdirectory contains the standard icons used in web pages generated by HP WebWise MPE/iX Secure Web Server
`include/`	Symlink pointing to the `/APACHE/CURRENT/include` directory which contains the C language header files required for compiling DSO modules.
`libexec/`	This subdirectory contains the mod_example sample DSO.
`logs/`	This subdirectory contains the server log files:
`access_log`	Every browser access attempt will be logged here, for both regular HTTP and secure SSL types of access.
`error_log`	General server error conditions are logged here, typically configuration errors or CGI script errors.
`httpd.pid`	Contains the `POSIX PID` of the currently running `HTTPD` parent process. May be used with the POSIX kill command to perform various administrative functions.
`ssl_engine_log`	General SSL error conditions are logged here. Message with high importance are also logged to the error_log.
`ssl_request_log`	Every browser access attempt using the SSL protocol will be logged here, showing the protocol, cipher, and URL being accessed.
`man/`	Symlink pointing to the `/APACHE/CURRENT/man` directory which contains man page documentation about the HTTPD server program and the utilities in the bin subdirectory.
`proxy/`	This subdirectory contains the cached data if HP WebWise MPE/iX Secure Web Server is being used as a caching proxy server.
`ssl/`	Symlink pointing to the `/APACHE/CURRENT/ssl` directory which contains various support files for the openssl command line utility, including man page documentation.

Preparing HP e3000 for Network Access

Before an HP e3000 can act as a web server, it must be available for network access via TCP/IP.

- Configure TCP/IP on the system.
- Have a domain name associated with the system's IP address.

Apache communicates on the network using the HTTP Hypertext Transfer Protocol, which in turn, uses TCP/IP. NS Transport (the TCP/IP transport subsystem) is configured on the HP e3000 using NMMGR. In NMMGR, configure the system's IP address and subnet mask in screen `NEXTPORT.NI.NIname.PROTOCOL.IP`. TCP should be configured with the recommended values shown in Table 9-1., using the NMMGR screen `NEXTPORT.GPROT.TCP`. Information on TCP/IP parameters is available in the *NS 3000/iX NMMGR Screens Reference Manual* from `http://docs.hp.com/mpeix/all/index.html`.

Table 9-1 Recommended TCP/IP Values

TCP/IP Parameters	Value
Maximum number of connections	20,000
Retransmission Interval Lower Band	1 second
Maximum time to wait for remote response	120 seconds
Initial Retransmission Interval	2 seconds
Maximum Retransmission Interval	2 seconds
Connection Assurance Interval	120 seconds
Maximum Connection Assurance Retransmissions	2

After completing the system's TCP/IP configuration, run`:NETCONTROL START` from the CI command line and verify that it ran successfully. Also verify that the system can respond over the network by running ping either from an HP e3000 or another system.

```
:run ping.net.sys;info=”15.99.200.390”

64 byte(s) from $0F0DC0CF : icmp seq = 11, time = 2 ms
64 byte(s) from $0F0DC0CF : icmp seq = 12, time = 3 ms
64 byte(s) from $0F0DC0CF : icmp seq = 13, time = 2 ms
< CONTROL-y >

c:\ping yourserver.com
Pinging yourserver.com [15.99.200.390] with 32 bytes of data
Reply from 15.99.200.390: bytes=32 time<10ms TTL=199
Reply from 15.99.200.390: bytes=32 time<10ms TTL=199
Reply from 15.99.200.390: bytes=32 time<10ms TTL=199
```

You will also want a domain name. This is a unique identifier such as "`yourserver.abc.com`" which is used (instead of the IP address) to direct requests from a browser to a web server. Request a domain name from the administrator of the Domain Name Server (DNS) on your network.

Configure the web server with one or more Domain Name Servers (DNS). These DNS servers will resolve the system's name into its IP address. To configure, edit `RESLVCNF.NET.SYS` or edit `/etc/resolv.conf` (which links to `RESLVCNF.NET.SYS`).

- Add one or more nameserver lines. Each line should contain the IP address of a valid DNS.

- Add one domain line that contains the DNS domain name for the domain to which your web server belongs. This domain name should not include the web server's hostname (:`NMMGR` node name).
- The DNS server listed on each nameserver line must contain both a valid "A" record and "PTR" record. The content of these records must agree with the actual hostname of the web server and the actual domain name in `RESLVCNF.NET.SYS`.

For example, if the fully qualified domain name if the web server is yourserver.abe.com:

```
shell/ix> uname -n
YOURSERVER
```

```
shell/ix > cat /etc/resolv.conf
#domain <domain>
#nameserver <primary server's IP address>
#nameserver <secondary server's IP address>
#
#
doamin abc.com
nameserver 25.33.100.134
nameserver 25.33.125.172
```

Configuring the Software

Follow these steps to configure the software for WebWise.

1. `:HELLO MGR.APACHE,PUB`
2. `:XEQ SH.HPBIN.SYS -L`
3. `$ cd /APACHE/PUB`
4. `$ cp JHTTPD.sample JHTTPD`
5. `$ cd conf`
6. `$ cp access.conf.sample access.conf`
7. `$ cp httpd.conf.sample httpd.conf`
8. `$ cp magic.sample magic`
9. `$ cp mime.types.sample mime.types`
10. `$ cp srm.conf.sample srm.conf`
11. Edit the newly created `httpd.conf` file and replace all occurrences of the “`yourserver.yourdomain.com`” host name with the actual host name of your HP e3000. Change the ServerAdmin directive to specify the e-mail address of the person responsible for HP WebWise MPE/iX Secure Web Server.
12. Perform other local customizations appropriate for your site.

Server Keys and Certificates

This is a fairly large and complicated topic. You are STRONGLY ENCOURAGED to read about it in detail in the *Mod_ssl Manual*, Chapter 2 Introduction and Chapter 6 FAQ List, either at `http://www.modssl.org/docs/2.8/` or the copy that comes with your HP WebWise MPE/iX Secure Web Server (`/APACHE/CURRENT/htmanual/mod/mod_ssl/ssl_intro.html` and `ssl_faq.html`) and is accessible from `http://yourserver.yourdomain.com/manual/`.

Secure web servers require a unique private key and a unique server certificate in order to establish secure encrypted communication sessions. This software includes a default private key and server certificate so that you can immediately start the server and begin testing. But because the supplied private key and server certificate are not unique, they are NOT SECURE AND MUST NOT BE USED FOR PRODUCTION PURPOSES!

You must generate your own private key and either obtain or create your own server certificate in order to be secure. Keys and certificates contain extremely sensitive data and must be tightly controlled to prevent unauthorized access.

Log on as MGR.APACHE

Before starting any key or certificate management you should first log on as `MGR.APACHE` and make sure that all configuration files and directories are owned by `MGR.APACHE:`

```
1. :HELLO MGR.APACHE,PUB
2. :XEQ SH.HPBIN.SYS -L
3. $ export PATH=/APACHE/PUB/bin:$PATH
```

Create Your Private Server Key

Your private key is an *EXTREMELY* sensitive and confidential piece of information. Anybody who obtains your private key will be able to impersonate you. If you should ever lose your private key or have it stolen, your only recourse is to create a new private key and do a better job of protecting it.

Appropriate file system security is essential for the file which contains your private key. `MGR.APACHE` should be the owner of the key file, and the owner is the only user that should have any kind of access. `MGR.APACHE` should also be the owner of the directory in which the key file resides, and nobody besides the owner should have access to the directory.

For extra added security, it is recommended that you encrypt your server key with a pass phrase that is stored separately from the key. If you use a pass phrase, this will need to be supplied to the web server at start up time, either by inserting it directly into the `/APACHE/PUB/JHTTPD` job stream after the command that invokes HTTPD (caution — the pass phrase will be in plain text in the JHTTPD job stream, so you'll need to protect the job stream too), or by writing a special script or program that HTTPD will invoke to obtain the pass phrase. See the `mod_ssl` **SSLPassPhraseDialog** configuration directive documentation for details.

Key generation uses a random number generator which in order to be portable uses a rather simple random seed consisting of the current time, process ID, and some memory buffer contents. To increase the randomness for the initial random number, you should use the `openssl` *-rand* parameter to specify a file that contains possibly random data but definitely data that is unique to your machine. For example, because machines have different patches applied at different times, `/SYS/PUB/HPSWINFO` might be suitable as a *-rand* file containing unique data that will only exist on this one machine.

To create your private server key:

1. `$ cd conf/ssl.key`

2. `$ openssl genrsa -rand /SYS/PUB/HPSWINFO -des3 -out server.key 1024`

```
unable to load ’random state’
28199 semi-random bytes loaded
Generating RSA private key, 1024 bit long modulus
................+++++
.................+++++
e is 65537 (0x10001)
Enter PEM pass phrase:********
Verifying password - Enter PEM pass phrase:********
```

3. `$ openssl rsa -noout -text -in server.key`

(displays the details of your newly created server key)

```
read RSA private key
Enter PEM pass phrase:********
Private-Key: (1024 bit)
modulus:
    00:d2:d6:24:48:b4:52:92:0f:33:a1:0d:28:45:7a:
    88:96:91:f9:dc:d3:23:c6:a7:ba:e4:93:5e:d3:d3:
    9c:ba:18:27:ec:25:db:5b:1f:f5:26:9f:6b:8c:fe:
    d4:8d:3a:28:2e:00:f0:58:71:ef:29:ac:b6:23:36:
    ac:97:63:84:01:0b:35:90:34:6b:ff:35:b1:83:0a:
    81:a1:12:5a:d5:cf:00:44:62:70:72:f9:3c:8f:30:
    5f:dd:61:d1:fe:d6:83:9a:69:36:74:64:4d:16:3f:
    49:7a:0a:29:b3:cd:78:ef:c0:2b:a9:3a:97:10:f3:
    6c:df:87:61:d3:46:93:d8:6b
publicExponent: 65537 (0x10001)
privateExponent:
    00:ae:e8:8a:47:6a:99:49:a4:a4:df:4a:0c:0b:bf:
    c0:ca:b1:25:89:65:fc:3b:14:f1:3e:29:68:34:f1:
    4c:07:32:7d:04:32:cf:cc:c4:31:5b:ae:4b:ca:37:
    aa:5b:d3:50:7c:01:b9:62:96:7a:a3:a7:2d:9e:fe:
    ff:a5:c4:20:40:3e:ea:02:05:fa:9e:00:d6:a9:59:
    e0:46:13:ef:9a:ef:64:d1:8a:bd:e6:2b:82:06:c9:
    da:8b:15:e9:b8:fa:eb:a0:13:6c:94:ca:10:9c:dc:
    2a:59:f8:fc:c7:2d:e0:69:cb:5b:a5:32:ec:d2:56:
    e2:0f:b0:c5:39:b8:50:5b:f1
prime1:
    00:fa:06:99:8b:68:55:5b:a8:ff:25:5a:f5:82:26:
    4c:73:2d:a0:70:75:e6:72:2c:25:70:22:49:5d:1a:
    96:0e:32:ce:4f:d9:7f:31:94:2c:62:8b:02:3c:c8:
    8f:4f:04:58:5b:6a:c0:66:fe:a1:d1:35:21:0e:c1:
    bb:4d:66:a7:83
prime2:
    00:d7:df:d2:7e:68:7f:5c:04:fe:08:64:48:2e:ee:
    b5:8a:06:40:55:38:14:b4:f1:86:04:5b:98:78:77:
    cf:ab:c8:97:b4:e5:e7:ca:30:b5:8e:4d:93:23:7b:
    41:66:c7:29:8e:d4:f9:8a:0d:61:27:c3:36:b8:26:
    26:1e:bb:4e:f9
exponent1:
    00:80:ed:d4:51:da:1c:62:26:d4:63:6b:f3:3c:09:
    09:d5:3f:0b:03:d3:18:61:79:b8:58:89:a5:b1:38:
    1b:76:f8:e6:00:b1:14:70:f9:8a:a5:ca:2e:fe:2f:
    22:0f:4a:1b:52:10:cb:64:91:1b:da:a8:fe:02:01:
    0e:d8:0b:fe:87
exponent2:
    00:b0:5f:9d:52:4c:3c:6a:49:65:e8:23:4e:da:91:
    8b:df:36:56:4f:8a:1f:58:ea:d0:2d:35:4c:f0:78:
    2b:43:56:03:a4:f8:06:16:2b:0f:db:31:44:5b:43:
    f3:de:6e:30:65:13:5a:c2:51:46:24:bf:99:30:81:
    72:b9:bf:1d:b9
coefficient:
    45:06:9e:13:e6:a9:2a:eb:5a:e0:99:65:43:88:85:
        ed:e2:64:ee:e7:75:99:6e:c3:25:69:36:d5:14:3a:
        e1:20:60:04:a0:44:c0:8e:55:cd:bf:8a:18:97:aa:
        f7:f9:43:81:db:16:ea:c9:e2:1e:68:a9:f2:56:63:
        2e:8f:56:60
```

4. `$ chmod 400 server.key`

Create Your Certificate Signing Request (CSR)

Next you need to use your private server key to create a **CSR** which identifies your company and your web server. This is the same identity that will be presented to your web browser users, so choose carefully.

When `openssl` prompts you to enter a value for “Common Name (e.g., YOUR name)”, you need to enter the fully qualified domain name (**FQDN**) of your web server. For example, if you want people to access your web server via a URL prefix of `https://www.yourcompanyhere.com`, you would enter `www.yourcompanyhere.com` in response to this prompt. When `openssl` prompts you for the 'extra' attributes to be sent with your certificate request, leave them blank.

To create your CSR:

1. `$ cd ../ssl.csr`
2. `$ openssl req -new -key ../ssl.key/server.key -out server.csr`

```
Using configuration from /APACHE/A0300/openssl.cnf
Enter PEM pass phrase:********
You are about to be asked to enter information that will be incorporated
into your certificate request.
What you are about to enter is what is called a Distinguished Name or a DN.
There are quite a few fields but you can leave some blank
For some fields there will be a default value,
If you enter ’.’, the field will be left blank.
-----
Country Name (2 letter code) [AU]:US
State or Province Name (full name) [Some-State]:My State
Locality Name (eg, city) []:My City
Organization Name (eg, company) [Internet Widgits Pty Ltd]:My Company
Organizational Unit Name (eg, section) []:My Org
Common Name (eg, YOUR name) []:www.mycompany.com
Email Address []:webmaster@www.mycompany.com
Please enter the following ’extra’ attributes
to be sent with your certificate request
A challenge password []:
An optional company name []:
```

3. `$ openssl req -noout -text -in server.csr` *(displays the details of your newly created server CSR)*

```
Using configuration from /APACHE/A0300/openssl.cnf
Certificate Request:
    Data:
        Version: 0 (0x0)
        Subject: C=US, ST=My State, L=My City, O=My Company, OU=My Org,
CN=www.mycompany.com/Email=webmaster@www.mycompany.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (1024 bit)
                Modulus (1024 bit):
                    00:d2:d6:24:48:b4:52:92:0f:33:a1:0d:28:45:7a:
                    88:96:91:f9:dc:d3:23:c6:a7:ba:e4:93:5e:d3:d3:
                    9c:ba:18:27:ec:25:db:5b:1f:f5:26:9f:6b:8c:fe:
                    d4:8d:3a:28:2e:00:f0:58:71:ef:29:ac:b6:23:36:
                    ac:97:63:84:01:0b:35:90:34:6b:ff:35:b1:83:0a:
                    81:a1:12:5a:d5:cf:00:44:62:70:72:f9:3c:8f:30:
                    5f:dd:61:d1:fe:d6:83:9a:69:36:74:64:4d:16:3f:
```

```
                    49:7a:0a:29:b3:cd:78:ef:c0:2b:a9:3a:97:10:f3:
                    6c:df:87:61:d3:46:93:d8:6b
                Exponent: 65537 (0x10001)
        Attributes:
            a0:00
    Signature Algorithm: md5WithRSAEncryption
        8f:5b:d3:45:ae:52:6a:66:36:23:09:0b:b9:d1:5c:2b:52:12:
        00:98:78:97:39:5b:9d:f6:9f:82:b2:2c:3f:24:bb:e0:f0:47:
        19:02:9d:3e:9f:32:d0:be:9a:54:3d:bc:c0:ed:63:67:cd:a3:
        eb:68:a1:2d:7a:0f:94:87:f0:a8:14:f6:45:cf:bd:a9:bc:13:
        9a:4c:cc:fb:a7:ab:73:88:17:23:90:b3:49:58:7f:d5:02:55:
        f1:85:81:f8:ea:48:d9:40:bc:29:de:f8:ed:e3:04:9c:b9:b1:
        c2:ce:8d:c2:c8:43:e7:73:bc:e6:e5:9f:99:b5:73:98:dd:65:
        38:ba
```

4. `$ chmod 400 server.csr`

You're now ready to have your **CSR** signed by a **Certificate Authority** (**CA**). This results in the creation of a server certificate. You have two options — you can either have an external trusted CA sign your CSR, or you can create your own CA and use it to sign your CSR. Choose one of these options which are explained in detail.

Submit Your CSR to an External Trusted CA For Signing...

All web browsers come preconfigured with a list of trusted CAs. Certificates signed by these trusted CAs will in turn be trusted by the browsers. If your certificate is signed by a CA unrecognized by the browser, each browser user will get a warning dialog window each time they visit your web site. So if you're doing an Internet e-commerce application where you have no control over the customer's browser configuration, you will want to obtain your certificate from one of the default trusted CAs recognized by all browsers.

There are many trusted CAs; **VeriSign** (`www.verisign.com`) and **Equifax** (`www.equifaxsecure.com`) are just two examples. By using your browser's security-related features, you can list all of the CAs trusted by that particular browser.

You can either purchase a real certificate at this point, or alternatively you can usually obtain a free test certificate good for a limited time. In either case, the process is the same. You typically visit the CA's web site and submit a web registration form that includes a cut/paste of your CSR, and then the CA e-mails the resulting certificate to you.

You need to cut/paste your CSR in its raw **PEM** format, which looks like this if you display the contents of the `conf/ssl.csr/server.csr` file:

```
-----BEGIN CERTIFICATE REQUEST-----
MIIB4TCCAUoCAQAwgaAxCzAJBgNVBAYTAlVTMREwDwYDVQQIEwhNeSBTdGF0ZTEQ
MA4GA1UEBxMHTXkgQ2l0eTETMBEGA1UEChMKTXkgQ29tcGFueTEPMA0GA1UECxMG
TXkgT3JnMRowGAYDVQQDExF3d3cubXljb21wYW55LmNvbTEqMCgGCSqGSIb3DQEJ
ARYbd2VibWFzdGVyQHd3dy5teWNvbXBhbnkuY29tMIGfMA0GCSqGSIb3DQEBAQUA
A4GNADCBiQKBgQDS1iRItFKSDzOhDShFeoiWkfnc0yPGp7rkk17T05y6GCfsJdtb
H/Umn2uM/tSNOiguAPBYce8prLYjNqyXY4QBCzWQNGv/NbGDCoGhElrVzwBEYnBy
+TyPMF/dYdH+1oOaaTZ0ZE0WP0l6CimzzXjvwCupOpcQ82zfh2HTRpPYawIDAQAB
oAAwDQYJKoZIhvcNAQEEBQADgYEAj1vTRa5SamY2IwkLudFcK1ISAJh4lzlbnfaf
grIsPyS74PBHGQKdPp8y0L6aVD28wO1jZ82j62ihLXoPlIfwqBT2Rc+9qbwTmkzM
+6erc4gXI5CzSVh/1QJV8YWB+OpI2UC8Kd747eMEnLmxws6NwshD53O85uWfmbVz
mN1lOLo=
-----END CERTIFICATE REQUEST-----
```

Your signed certificate will arrive in raw **PEM** format, which looks like this:

```
-----BEGIN CERTIFICATE-----
MIICsTCCAhoCAQEwDQYJKoZIhvcNAQEEBQAwgaAxCzAJBgNVBAYTAlVTMREwDwYD
VQQIEwhNeSBTdGF0ZTEQMA4GA1UEBxMHTXkgQ2l0eTETMBEGA1UEChMKTXkgQ29t
cGFueTEWMBQGA1UECxMNTXkgQ29tcGFueSBDQTEeMBwGA1UEAxMVQ2VydGlmaWNh
dGUgQXV0aG9yaXR5MR8wHQYJKoZIhvcNAQkBFhBjYUBteWNvbXBhbnkuY29tMB4X
DTAwMDQxMzE4MzY0MVoXDTAxMDQxMzE4MzY0MVowgaAxCzAJBgNVBAYTAlVTMREw
DwYDVQQIEwhNeSBTdGF0ZTEQMA4GA1UEBxMHTXkgQ2l0eTETMBEGA1UEChMKTXkg
Q29tcGFueTEPMA0GA1UECxMGTXkgT3JnMRowGAYDVQQDExF3d3cubXljb21wYW55
LmNvbTEqMCgGCSqGSIb3DQEJARYbd2VibWFzdGVyQHd3dy5teWNvbXBhbnkuY29t
MIGfMA0GCSqGSIb3DQEBAQUAA4GNADCBiQKBgQDS1iRItFKSDzOhDShFeoiWkfnc
0yPGp7rkk17T05y6GCfsJdtbH/Umn2uM/tSNOiguAPBYce8prLYjNqyXY4QBCzWQ
NGv/NbGDCoGhElrVzwBEYnBy+TyPMF/dYdH+1oOaaTZ0ZE0WP0l6CimzzXjvwCup
OpcQ82zfh2HTRpPYawIDAQABMA0GCSqGSIb3DQEBBAUAA4GBABlROc1/xpG+FlPd
lekq+E1oc42sOMiLaWe6orfffh74DbuTgxvTWTK8Wo31W8Reqj7jqOAeGvF46mWH
Vq1mFM/Jh9oMQYb2IAjbuA1/7kefkMHdgf6NMC3L0cbCKs6bF7nDJGjWYb9sXcTM
shYJMLBXyKW+cmrvJIqoMnq8DZUv
-----END CERTIFICATE-----
```

Save this data as `/APACHE/PUB/conf/ssl.crt/server.crt` and then proceed to the “Installing Your Certificate” section. You can display the details of your new server certificate by doing:

```
$ openssl x509 -noout -text -in /APACHE/PUB/conf/ssl.crt/server.crt
```

...Or Sign Your CSR With Your Own CA

First, create a private key and certificate for your **CA**. The CA requires a unique Distinguished Name different from the server certificate(s) you will be signing. One way to do this is to use a unique Organizational Unit Name when you create the CA certificate. For example, if your organization is XYZ Corporation, you might want to make the Organizational Unit Name be XYZ Corporation Certificate Authority.

1. `$ cd ../ssl.key`
2. `$ openssl genrsa -des3 -out ca.key 1024`

   ```
   1128 semi-random bytes loaded
   Generating RSA private key, 1024 bit long modulus
   .......................................+++++
   ....................................................+++++
   e is 65537 (0x10001)
   Enter PEM pass phrase:********
   Verifying password - Enter PEM pass phrase:********
   ```

3. `$ openssl rsa -noout -text -in ca.key` *(displays the details of your newly created CA key; output omitted)*
4. `$ openssl req -new -x509 -days 365 -key ca.key -out ca.crt`

   ```
   Using configuration from /APACHE/A0300/ssl/openssl.cnf
   Enter PEM pass phrase:********
   You are about to be asked to enter information that will be incorporated
   into your certificate request.
   What you are about to enter is what is called a Distinguished Name or a DN.
   There are quite a few fields but you can leave some blank
   For some fields there will be a default value,
   If you enter '.', the field will be left blank.
   -----
   Country Name (2 letter code) [AU]:US
   State or Province Name (full name) [Some-State]:My State
   Locality Name (eg, city) []:My City
   Organization Name (eg, company) [Internet Widgits Pty Ltd]:My Company
   ```

```
Organizational Unit Name (eg, section) []:My Company CA
Common Name (eg, YOUR name) []:Certificate Authority
Email Address []:ca@mycompany.com
```

5. `$ openssl x509 -noout -text -in ca.crt` *(displays the details of your newly created CA certificate)*

```
Certificate:
    Data:
        Version: 3 (0x2)
        Serial Number: 0 (0x0)
        Signature Algorithm: md5WithRSAEncryption
        Issuer: C=US, ST=My State, L=My City, O=My Company, OU=My Company CA, CN=Certificate
Authority/Email=ca@mycompany.com
        Validity
            Not Before: Apr 13 18:29:50 2000 GMT
            Not After : Apr 13 18:29:50 2001 GMT
        Subject: C=US, ST=My State, L=My City, O=My Company, OU=My Company CA, CN=Certificate
Authority/Email=ca@mycompany.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (1024 bit)
                Modulus (1024 bit):
                    00:a8:f9:f5:38:07:dd:6b:84:51:a6:34:43:15:fa:
                    ae:3c:08:24:dc:60:6d:ea:e4:ab:8d:13:f3:bb:48:
                    b9:e9:eb:e9:a7:74:58:87:4b:10:4b:a1:09:c0:c4:
                    7b:88:5e:9c:14:7b:da:bd:9f:5f:d2:b9:19:51:f0:
                    c3:a4:43:10:ec:13:6a:f9:72:25:e2:fe:6e:57:67:
                    0d:7a:dc:3f:a5:63:d2:d2:32:69:f3:d2:6d:1b:f3:
                    70:06:70:28:eb:a8:9f:06:ad:f1:ab:a3:30:db:a7:
                    54:37:f7:75:85:90:26:d0:28:e8:f6:d6:65:93:82:
                    ef:02:88:f4:c7:0b:91:1f:35
                Exponent: 65537 (0x10001)
        X509v3 extensions:
            X509v3 Subject Key Identifier:
89:B4:C8:ED:17:82:61:39:C5:1D:9F:E9:12:73:75:C8:31:EA:DF:33
            X509v3 Authority Key Identifier:
keyid:89:B4:C8:ED:17:82:61:39:C5:1D:9F:E9:12:73:75:C8:31:EA:DF:33
                DirName:/C=US/ST=My State/L=My City/O=My Company/OU=My Company CA/CN=Certificate
Authority/Email=ca@mycompany.com
                serial:00
            X509v3 Basic Constraints:
                CA:TRUE
    Signature Algorithm: md5WithRSAEncryption
        a7:3d:21:6a:b8:bf:f2:67:01:81:e6:05:56:89:8a:21:ab:bf:
        d5:43:48:ad:06:af:51:66:2a:02:77:ba:30:41:57:26:a5:7c:
        eb:00:a0:77:bf:b8:2b:03:91:59:92:1c:0b:8d:fc:16:27:c1:
        75:d3:90:1c:fd:de:9b:21:e1:34:27:2c:1c:4c:36:9c:7a:5f:
        16:bf:df:66:85:43:35:9e:b2:e8:2d:04:08:af:b1:60:84:3f:
        3e:5f:67:2b:38:75:38:2d:58:28:36:a2:56:19:fb:b3:66:d2:
        fd:8e:b9:30:02:5d:43:f9:57:bb:1f:b9:40:5d:32:b3:c0:4c:
        ba:dd
```

6. `$ chmod 400 ca.key ca.crt`

Then sign your CSR with your CA certificate and move all files to their correct secure locations:

1. `$ sign.sh ../ssl.csr/server.csr`

```
CA signing: ../ssl.csr/server.csr -> ../ssl.csr/server.crt:
Using configuration from ca.config
Enter PEM pass phrase:********
Check that the request matches the signature
Signature ok
The Subjects Distinguished Name is as follows
countryName           :PRINTABLE:'US'
stateOrProvinceName   :PRINTABLE:'My State'
localityName          :PRINTABLE:'My City'
organizationName      :PRINTABLE:'My Company'
organizationalUnitName:PRINTABLE:'My Org'
commonName            :PRINTABLE:'www.mycompany.com'
```

```
emailAddress          :IA5STRING:'webmaster@www.mycompany.com'
Certificate is to be certified until Apr 13 18:36:41 2001 GMT (365 days)
Sign the certificate? [y/n]:y

1 out of 1 certificate requests certified, commit? [y/n]y
Write out database with 1 new entries
Data Base Updated
CA verifying: ../ssl.csr/server.crt <- CA cert
../ssl.csr/server.crt: OK
```

2. `$ rm -fR ca.db.*`
3. `$ cd ..`
4. `$ mv ssl.csr/server.crt ssl.crt/server.crt`
5. `$ openssl x509 -noout -text -in ssl.crt/server.crt` *(displays the details of your newly created self-signed server certificate)*

```
Certificate:
    Data:
        Version: 1 (0x0)
        Serial Number: 1 (0x1)
        Signature Algorithm: md5WithRSAEncryption
        Issuer: C=US, ST=My State, L=My City, O=My Company, OU=My Company CA, CN=Certificate
Authority/Email=ca@mycompany.com
        Validity
            Not Before: Apr 13 18:36:41 2000 GMT
            Not After : Apr 13 18:36:41 2001 GMT
        Subject: C=US, ST=My State, L=My City, O=My Company, OU=My Org,
CN=www.mycompany.com/Email=webmaster@www.mycompany.com
        Subject Public Key Info:
            Public Key Algorithm: rsaEncryption
            RSA Public Key: (1024 bit)
                Modulus (1024 bit):
                    00:d2:d6:24:48:b4:52:92:0f:33:a1:0d:28:45:7a:
                    88:96:91:f9:dc:d3:23:c6:a7:ba:e4:93:5e:d3:d3:
                    9c:ba:18:27:ec:25:db:5b:1f:f5:26:9f:6b:8c:fe:
                    d4:8d:3a:28:2e:00:f0:58:71:ef:29:ac:b6:23:36:
                    ac:97:63:84:01:0b:35:90:34:6b:ff:35:b1:83:0a:
                    81:a1:12:5a:d5:cf:00:44:62:70:72:f9:3c:8f:30:
                    5f:dd:61:d1:fe:d6:83:9a:69:36:74:64:4d:16:3f:
                    49:7a:0a:29:b3:cd:78:ef:c0:2b:a9:3a:97:10:f3:
                    6c:df:87:61:d3:46:93:d8:6b
                Exponent: 65537 (0x10001)
    Signature Algorithm: md5WithRSAEncryption
        19:51:39:cd:7f:c6:91:be:16:53:dd:95:e9:2a:f8:4d:68:73:
        8d:ac:38:c8:8b:69:67:ba:a2:b7:df:7e:1e:f8:0d:bb:93:83:
        1b:d3:59:32:bc:5a:8d:f5:5b:c4:5e:aa:3e:e3:a8:e0:1e:1a:
        f1:78:ea:65:87:56:ad:66:14:cf:c9:87:da:0c:41:86:f6:20:

       08:db:b8:0d:7f:ee:47:9f:90:c1:dd:81:fe:8d:30:2d:cb:d1:
        c6:c2:2a:ce:9b:17:b9:c3:24:68:d6:61:bf:6c:5d:c4:cc:b2:
        16:09:30:b0:57:c8:a5:be:72:6a:ef:24:8a:a8:32:7a:bc:0d:
        95:2f
```

6. `$ mv ssl.key/ca.crt ssl.crt/ca.crt`

Installing Your Certificate

Certificates (and keys) are sensitive information and must be protected from unauthorized usage:

1. `$ cd /APACHE/PUB/conf/ssl.crt`
2. `$ make` *(to rebuild the certificate hash symbolic links)*

```
ca-bundle.crt   ... Skipped
ca.crt          ... dc91dd8e.0
server.crt      ... 2f66b362.0
snakeoil-ca-dsa.crt ... 0cf14d7d.0
```

```
snakeoil-ca-rsa.crt ... e52d41d0.0
snakeoil-dsa.crt ... 5d8360e1.0
snakeoil-rsa.crt ... 82ab5372.0
zzyzx-ca-rsa.crt ... f28a2a0f.0
```

3. `$ chmod 400 /APACHE/PUB/conf/ssl.*/*`

Starting the Web Server

Simply `:STREAM JHTTPD.PUB.APACHE` to start your web server. The server may spend as much as the first 5 minutes or so in a tight CPU loop generating temporary cryptographic keys before it will be ready to respond to browser requests. No records will be written to any of the log files in the `logs/` directory during this time.

Using the Web Server

Simply point your web browser to:

- `http://www.yourcompanyhere.com/` *(for non-secure access; assumes a standard listening port of 80)*
- `https://www.yourcompanyhere.com/` *(for secure access; assumes a standard listening port of 443)*

Web server content located under the **DocumentRoot** of the secure virtual server is automatically secured when viewed with a `https://` URL. For CGI applications, no special programming is necessary to take advantage of this security, though additional security-related environment variables are available. See the “Environment Variables” section of the *Mod_ssl manual*.

The web server creates numerous log files in `/APACHE/PUB/logs` that will grow without bound. You will want to periodically examine and purge these. You should only purge log files when the server is down, or after restarting the server as shown:

1. `:HELLO MGR.APACHE,PUB`
2. `:XEQ SH.HPBIN.SYS -L`
3. `$ cd logs`
4. `$ mv access_log access_log.snapshot` (the server is still writing to `access_log.snapshot`)
5. `$ mv error_log error_log.snapshot` (the server is still writing to `error_log.snapshot`)
6. `$ mv ssl_engine_log ssl_engine_log.snapshot` (the server is still writing to `ssl_engine_log.snapshot`)
7. `$ mv ssl_request_log ssl_request_log.snapshot` (the server is still writing to `ssl_request_log.snapshot`)
8. `$ kill -HUP $(cat httpd.pid)`
9. Process and optionally purge the `*.snapshot` files; the server is no longer writing to them.

Adding Content

There are several ways you can add content to your HP WebWise MPE/iX Secure Web Server:

- Create additional files and directories below the DocumentRoot of `/APACHE/PUB/htdocs`.
- Use the **Alias** configuration directive to point to content directories outside of the **DocumentRoot**.
- Create symbolic links below the **DocumentRoot** of `/APACHE/PUB/htdocs` which point to content outside of the DocumentRoot subdirectory. Note that this only works with the default configuration setting of Options **FollowSymLinks**.
- Create user-based content accessible via URLs of the format `http://your.host.name/~USER.ACCOUNT/foo.html`. HP WebWise MPE/iX Secure Web Server will look for a file called `/ACCOUNT/GROUP/public_html/foo.html` where `GROUP` is the home group of the MPE user `USER.ACCOUNT`.

Note that in all cases your content files and directories must have appropriate security that allows them to be read by the HP WebWise MPE/iX Secure Web Server runtime user of `WWW.APACHE`.

Troubleshooting

Server Issues

If the HP WebWise MPE/iX Secure Web Server job JHTTPD aborts, first check the $STDLIST spoolfile for any error messages, followed by the `error_log`, followed by the `ssl_engine_log`.

If the HP WebWise MPE/iX Secure Web Server job appears to be running normally, but browser users are receiving error messages instead of data, check the `access_log` to see if the server is receiving their request. The `access_log` will show the IP address (or hostname) of the browser, the requested URL, and resulting HTTP return code, and the amount of bytes transferred. A return code of 200 means success, 401 means that access was denied to this URL, and 404 means that the URL was not found.

The `error_log` and `ssl_engine_log` may have additional information regarding unsuccessful entries that appear in the `access_log`. The verbosity of the `error_log` and `ssl_engine_log` may be increased by editing the **LogLevel** and **SSLLogLevel** configuration directives respectively.

If a browser user is having SSL-related problems, check the `ssl_request_log` to see if the expected protocol and cipher is being used.

Browser Issues

If the browser gets no response from the server, check that the JHTTPD job is still running, and verify that the correct TCP/IP ports are being listened to by examining `conf/httpd.conf`. Note that a URL of the form `http://your.host.name/foo.html` assumes a default port of 80, and a URL of the form `https://your.host.name/foo.html` assumes a default port of 443.

If Microsoft Internet Explorer returns an error saying “The page cannot be displayed”, or Netscape Communicator returns an error saying “A network error occurred while Netscape was receiving data”, verify that you’re trying to browse an `https://` URL from a port listening for the SSL/TLS protocol, and that your browser is speaking the same version of the SSL/TLS protocol that is expected by the server.

If your browser always begins a certificate dialog when you browse to the server, it could be due to any of the following reasons:

- Your server certificate wasn’t signed by one of the browser’s trusted CAs. Either obtain a new server certificate from one of those trusted CAs, or add the current CA to your browser’s list of trusted CAs.
- Your server certificate has expired. Obtain a new server certificate.
- Your server certificate hostname doesn’t match the URL hostname. Either obtain a new server certificate containing the proper hostname, or use a URL with the proper hostname.

To verify the protocol and cipher your browser is using to talk to the server, either check the `logs/ssl_request_log` file on the server, or ask your browser for this information. If using Microsoft Internet Explorer, right-click anywhere on the web page, then left-click on the Properties menu item. If using Netscape Communicator, right-click anywhere on the web page, then left click on the View Info menu item.

Performance

For best performance, files returned to the browser user should be in bytestream format. For example, .html, .htm, .shtml, .shtm, .txt, .gif, .jpeg, and .jpg files, should be in bytestream format instead of in MPE-type format. Bytestream files are more compatible with HP WebWise MPE/iX Secure Web Server and with other POSIX applications than are MPE-type files. If you have a web page that calls many images which are not in bytestream format (**BA**), you could have noticeable performance degradation.

If any of your files under the document root (htdocs) are either MPE fixed ASCII (**FA**), MPE variable ASCII (**VA**), or MPE variable binary (**VB**) files, you should consider converting them to bytestream files using the "**tobyte**" utility. Program files (fixed binary (**FB**) files with an **NMPRG** filecode) should never be converted.

A file's filetype can be determined using either the POSIX `file` command or the CI `listfile` command:

```
shell/iX> file index*.html
```

```
index.html: MPE/iX 256-byte variable length binary (filecode: 0)
index1.html: MPE/iX 80-byte fixed length ascii (filecode:0)

shell/iX> callci listfile ./index.html,2

PATH= /APACHE/PUB/htdocs/

CODE ------------LOGICAL RECORD------- ----SPACE---- FILENAME

       SIZE  TYP     EOF   LIMIT R/B   SECTORS #X MX
       128W  VB       19  204800   1      32    1  8 index.html
        80B  FA       54  204800   1      32    1  8 index1.html
```

To convert an ASCII-type file (.htm*, .shtm*, or .txt), use the tobyte utility with the -at option. If it is a binary-type file (such as .jpeg, .jpg, or .gif), do not use the -at option:

```
tobyte -at /APACHE/PUB/htdocs/index.html /APACHE/PUB/htdocs/newindex.html
```

For more information on the "tobyte" utility, use the POSIX help facility (i.e., man tobyte).

If your HP WebWise MPE/iX Secure Web Server seems slow in responding, you might try running the HP WebWise MPE/iX Secure Web Server job stream file, JHTTPD, in the C queue instead of in the default D queue. The changes shown below allow HP WebWise MPE/iX Secure Web Server to run in the C queue while keeping the default execution level for jobs in the D queue. The jobpri command must be executed on the console or in a SYSSTART file.

```
!job jhttpd,mgr.apache,pub;pri=cs;outclass=,2
```

```
jobpri cs
```

Note that HP WebWise MPE/iX Secure Web Server consumes considerable CPU time at startup. If you elect to run HP WebWise MPE/iX Secure Web Server in the C queue, processes in the D and E queues may be starved while HP WebWise MPE/iX Secure Web Server is starting.

Working with Dynamic Shared Objects (DSOs)

DSOs are add-on modules that extend the functionality of Apache. These modules are self-contained code that can provide a wide-range of additional Apache capabilities such as custom authentication and authorization, custom logging, or creating new configuration directives.

Users can create their own Apache modules or use those written by others. For instance, the Apache Module Registry (`http://modules.apache.org/`) is a web site with downloadable Apache modules. Some of these modules are freely available while others have various license restrictions.

DSOs on MPE/iX can utilize Apache's full Application Programming Interface (API) as well as Apache's full Extended Application Programming Interface (EAPI).

A DSO is an Apache module with the same structure as the modules compiled into the Apache binary. But instead of being statically linked into the Apache program, the DSO module is created as a shared library (NMXL). DSOs are loaded at Apache startup into Apache's process space.

No recompilation of Apache is necessary to use DSOs. However, DSOs require a DSO-enabled Apache. Apache for MPE/iX is enabled for DSOs starting with Apache 1.3.9 (A.01.00).

Using DSO modules keeps Apache memory usage low by running an Apache binary with core features only and adding additional features with DSOs. DSOs also provide flexibility. An installation can pick and choose which features to include in their web server.

Creating Apache Modules

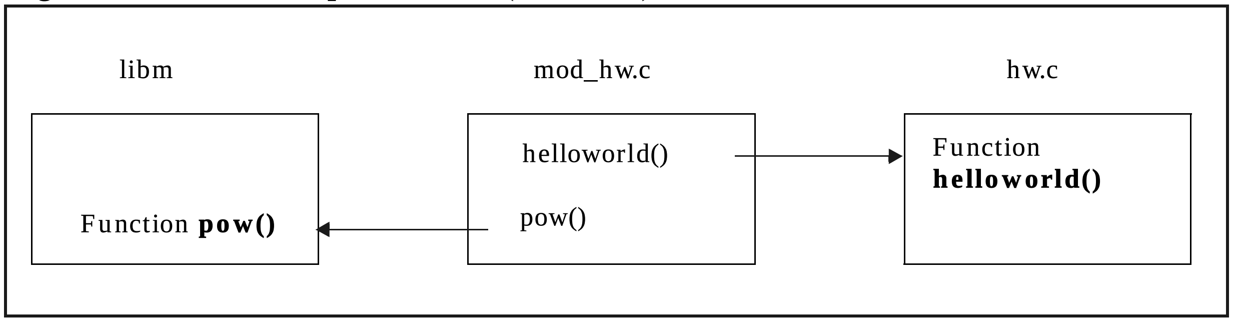
DSOs should be written in the C Programming language. DSOs written in C must be compiled on MPE/iX.

Two ways that Apache module's can be created are:

1. From a template, such as **mod_example.c**, or from an existing module.
2. With the **apxs** utility.

A sample module, **mod_hw**, will be used to illustrate these two methods for creating a DSO module in C. The **mod_hw** structure is shown in Figure 9-1.

Figure 9-1 Sample Module (mod_hw)



The **mod_hw** consists of two source files, **mod_hw.c** and **hw.c**. The file **mod_hw.c** contains the module structure and makes an external function call to **pow()** in the math library (`/lib/libm`). The **mod_hw.c** also makes an external function call to **helloworld()**, defined in **hw.c**. The output of **mod_hw** prints "`Hello World`" and also prints the result of raising 12 to the power of 2.

This module demonstrates how to build a DSO that calls external functions. Using **mod_hw** as an example, you will see how to compile and link an Apache module that calls an external function from an object file and calls an external function from a system library.

Note that modules are named **mod_xxx.so** by convention. To follow this convention, the sample module is called mod_hw.so.

Tools

There are a number of options available when choosing tools to build an Apache module for MPE/iX. Some of these tools are open source tools from the GNU Project, a provider of free software. The GNU tools are used on many operating system platforms for development of open source code, including MPE/iX.

Module compilations on MPE/iX can be done with the GNU C compiler, **gcc**, or with the MPE/iX POSIX compiler, **c89**. HP recommends using **gcc** for compiling open source modules since most open source code is designed for compilation by **gcc**. For example, Apache for MPE/iX is compiled with **gcc**. Use **c89** when calling MPE/iX intrinsics or using long pointers.

When using a **Makefile** to build a module, it can be executed with **GNU make** or with the MPE/iX **POSIX make**. **GNU make** is recommended for executing a **Makefile** created by **apxs** since this file is generated by open source code. The GNU tools' installation script installs **GNU make** in `/usr/local/bin/make`. **MPE/iX make** resides in `/bin/make`.

Modules can be lined with GNU **ld** or with the MPE/iX **LinkEditor**. HP recommends using **LinkEditor** for linking Apache modules since the **LinkEditor** creates shared libraries that work well with dynamic loading.

Make, **gcc**, and **ld** are part of the GNU tools which are downloadable from `http://jazz.external.hp.com/src/gnu/gnuframe.html`. Support contracts for **gcc** are available from `http://www.gccsupport.com`. **LinkEditor**, **c89** and `/bin/make` are supported by HP.

The Apache C header files are required when compiling an Apache module. These header files are distributed with the Apache product and reside in `/APACHE/PUB/include`.

Module Creation Using a Template

Any existing Apache module can be used as a template for a new module. **Mod_example.c** is distributed with Apache in `/APACHE/PUB/libexec` and makes a useful template for a simple module. When compiled and linked as the shared library (NMXL) **mod_example.so**, this module is a fully working DSO. The module `libexec/mod_example.so` has already been pre-built.

For a more functional module, try a different module as your template. For instance, to create a new module that does authentication, starting with one of Apache's authentication modules may be more appropriate. If you want to create a module that has its own configuration directives, start with another module that already does this.

To create the module file "**mod_hw.c**" from file "**mod_example.c**", log on as `MGR.APACHE` so that the file is created with the right ownership:

```
:HELLO MGR.APACHE
:XEQ SH.HPBIN.SYS -L
shell/iX> mkdir hw
shell/iX> cd hw
shell/iX> cp /APACHE/PUB/libexec/mod_example.c mod_hw.c
```

Change all references inside **mod_hw.c** from **mod_example**, **example_module**, **example_handler**, etc. to **mod_hw**, **hw_module**, **hw_handler**, etc., and modify/add any other code, as needed. Creating a separate directory for the module, such as **hw**, separates it from other modules under development.

To compile a module, certain compile options must be specified and the Apache C header files must also be included. Below, **gcc** creates two object files, **hw.o** and **mod_hw.o**, using the necessary options and include files. Use the **-c** option for compilation:

```
shell/iX> gcc -DMPE -D_POSIX_SOURCE -D_SOCKET_SOURCE
-DNO_DBM_REWRITEMAP -DUSE_HSREGEX -DEAPI -DSHARED_MODULE
-I/APACHE/PUB/include -c mod_hw.c hw.c
```

Next, link the module. The link steps will be different when calling external functions that reside in archive or shared libraries. Other examples of linking are shown later.

To link, the MPE/iX **LinkEditor** can be called from the CI or the POSIX shell:

```
:linkedit
```

or

```
shell/iX> callci linkedit
```

```
LinkEd> buildxl xl=./mod_hw.so;limit=5
LinkEd> addxl from=./mod_hw.o,./hw.o;to=./mod_hw.so;
rl=/lib/libm.a,/lib/libc.a;merge;share
1 OBJECT FILE HAS BEEN ADDED.
```

The "**rl=**" option is used to specify which archive libraries are used to resolve external function calls. The math library (`/lib/libm.a`) is specified here to resolve **pow()** in **mod_hw.o.** `/lib/libc.a` is not actually needed by the sample code. But it is a good practice to always specify **libc** since most modules and other libraries are likely to need functions from this library. If **libc** is not specified explicitly as shown here, the MPE/iX C library will be used by default (`LIBC.LIB.SYS`). Since Apache is built with **libc**, we recommend explicitly specifying `/lib/libc` instead of defaulting to `LIBC.LIB.SYS`. `/lib/libc` and `LIBC.LIB.SYS` are not identical. The order of the libraries listed by "**rl=**" is important and **libc** should always be specified last. The

merge directive is necessary when functions are called across object boundaries such as **mod_hw.o** calling **helloworld()** in **hw.o**. The `share` option is needed when global data is shared between multiple object files. The `share` option is not actually needed by the sample code.

The compile and link steps can be put in a **Makefile** to facilitate multiple builds of a module. As an example, refer to the section “Modified APXS Makefile (mod_hw)”.

Mod_hw.so is now ready to be configured into Apache. To do this, refer to the section “Creating Apache Modules”.

Module Creation Using the APXS Utility

Modules can also be created using the **bin/apxs** utility "Apache eXtenSion" tool. Details on using **apxs** are found in the apx manual page, `http://www.apache.org/docs/programs/apxs.html`. Apxs is a Perl script and requires a working Perl interpreter on the HP e3000. The Perl interpreter is not distributed or supported as part of FOS but is available as freeware via http://jazz.external.hp.com/src/hp_freeware/perl/.To prepare a system for running apxs:

- Install the GNU tools.
- Install the Perl interpreter.
- Set up a Perl symbolic link.

```
shell/iX> ln -s /PERL/PUB/PERL /usr/local/bin/perl
```

Apxs has a number of options. The **-g** and **-n** options will create a module skeleton with a corresponding Makefile. Log on as `MGR.APACHE` in order to execute **apxs** and to create a module with `MGR.APACHE` as the owner.

```
:HELLO MGR.APACHE
:XEQ SH.HPBIN.SYS -L
shell/iX> ./bin/apxs -g -n hw
Creating [DIR]  hw
Creating [FILE] hw/Makefile
Creating [FILE] hw/mod_hw.c
shell/iX> cd hw
shell/iX> ls
Makefile   mod_hw.c
```

Apxs -g -n will create directory "hw" with the module source file **mod_hw.c** and its **Makefile**. This directory is where the module is developed. Note that the **mod_hw.c** file created here is not the same as the sample module code. To continue following this example, use the code listings given for **mod_hw.c** and **hw.c**.

Makefile can be used for compiling and linking the module. The default **Makefile** created here by apxs uses apxs for compiling and linking. We recommend changing this to use **gcc** and **LinkEditor** as shown in the section "Modified APXS Makefile (mod_hw)". The modified Makefile still calls **apxs** for getting the correct compile options and include files but does not use apxs for compiling and linking.

Makefile can easily be modified for customization. For the sample module, **mod_hw**, the additional source file, **hw.c**, was added to **Makefile**. Using a **Makefile** is a convenient and flexible way to build modules.

Here is the output from executing **mod_hw's** modified apxs **Makefile**:

```
shell/iX> cd /APACHER/PUB/hw
shell/iX> make

gcc -o mod_hw.o ‘/APACHE/PUB/bin/apxs -q CFLAGS‘ -I‘/APACHE/PUB/bin/apxs -q INCLUDEDIR‘ -c mod_hw.c
gcc -o hw.o ‘/APACHE/PUB/bin/apxs -q CFLAGS‘  -I‘/APACHE/PUB/bin/apxs -q INCLUDEDIR‘ -c hw.c
callci "linkedit ’buildxl xl=./mod_hw.so;limit=5’"
HP Link Editor/iX (HP30315A.06.15) Copyright Hewlett-Packard Co 1986

LinkEd> buildxl xl=./mod_hw.so;limit=5

LinkEd> addxl from=./mod_hw.o,./hw.o;to=./mod_hw.so; rl=/lib/libm.a,/lib/libc.a
;merge;share
1 OBJECT FILE HAS BEEN ADDED.
```

Linking Libraries into a DSO

When a DSO requires external library functions, as does **mod_hw**, these can be resolved using either archive libraries or shared libraries. With archive libraries, external calls are resolved at link time and the functions are incorporated into your DSO. With shared libraries, external calls are resolved at run time. At run time, the loader searches the shared libraries for these external functions.

This section discusses the linking of a module. Linking is independent of the method used to create and compile the module code.

Archive libraries

Archive libraries may be either custom archive libraries (built by others) or system archive libraries. System archive libraries are "**.a**" files residing in `/lib` and `/usr/lib`.

The following shows how to build **hw.c** as an archive library then link it into **mod_hw.so**:

```
shell/iX> cd /APACHE/PUB/hw
shell/iX> gcc -c -DMPE -D_POSIX_SOURCE -D_SOCKET_SOURCE -DNO_DBM_REWRITEMAP
-DUSE_HSREGEX -DEAPI -DSHARED_MODULE -I/APACHE/PUB/include hw.c
shell/iX> ar -rv hw.a hw.o
ar: creating hw.a

a - /APACHE/PUB/hw/hw.o
1 OBJECT FILE HAS BEEN ADDED.

shell/iX> callci linkedit
HP Link Editor/iX (HP30315A.06.15) Copyright Hewlett-Packard Co 1986
LinkEd> buildxl xl=./mod_hw.so;limit=5
LinkEd> addxl from=./mod_hw.o;to=./mod_hw.so;merge;share;rl=./hw.a,/lib/libm.a,
/lib/libc.a
1 OBJECT FILE HAS BEEN ADDED.
```

Shared libraries

Shared libraries (XLs) can also be used for resolving external function calls from a DSO. One method is to relink the Apache program with an XL list of the required shared libraries and to copy each shared library into MPE/iX namespace. Another method is to link a DSO using dependent libraries the (**altxl** option to the **LinkEditor**) and to copy each shared library into MPE/iX namespace. Either way, all shared libraries must reside in an MPE/iX group and account and must follow the MPE/iX naming conventions. This is necessary because Apache is a Privileged Mode (PM) program.

Symbolic links from the MPE/iX namespace to a shared library in the HFS namespace will not satisfy the PM capability constraint. Each shared library must actually reside in MPE/iX namespace. The following commands show how to copy the `libm` and `libc` system shared libraries into MPE/iX namespace and how to use the **altprog** option to **LinkEditor** to add these shared libraries to the Apache program file:

```
:HELLO MGR.APACHE
:XEQ SH.HPBIN.SYS -L
shell/iX> cp /lib/libm.sl XLM
shell/iX> cp /lib/libc.sl XLC
shell/iX> callci linkedit
LinkEd> buildxl xl=./hw/mod_hw.so;limit=10
LinkEd> addxl from=./hw/mod_hw.o,./hw/hw.o;to=./hw/mod_hw.so;merge;share
LinkEd> altprog ./HTTPD;cap=ia,ba,ph,pm;xl=XLM,XLC
```

When using system libraries as XLs, such as **libm.sl** and **libc.sl**, remember to recopy these libraries after a system update in order to get their new versions. To verify that HTTPD has been successfully relinked with your NMXL(s):

```
LinkEd> listprog ./HTTPD

PROGRAM        : ./HTTPD
XL LIST        : XLM XLC
CAPABILITIES   : BA, IA, PM, PH
```

Here is a POSIX script that shows how libraries might be set up programmatically. It uses **hw.o** as the archive library, **hw.a**:

```
shell/iX> cat xlbuild.sh
#!/bin/sh
#
# set the location of Apache
AP=/APACHE/PUB
#
# create the old libraries
rm -f ${AP}/XLC ${AP}/XLM ${AP}/XLHW
#
# copy the latest versions
cp /lib/libc.sl ${AP}/XLC
cp /lib/libm.sl ${AP}/XLM
#
#create a custom XL
callci "xeq linkedit.pub.sys 'buildxl xl=${AP}/XLHW'"
callci "xeq linkedit.pub.sys 'addxl from=${AP}/hw/hw.a;to=${AP}/XLHW;share;merge'"
#
# remove fragmentation and minimize the internal tables
callci "xeq linkedit.pub.sys 'cleanxl ${AP}/XLHW;compact'"
#
# Relink Apache with the new NMXL list
callci "xeq linkedit.pub.sys 'altprog ${AP}/HTTPD;cap=ia,ba,ph,pm;xl=\"${AP}/XLHW,${AP}/XLM,${AP}/XLC\"'"
```

Configuring Apache Modules

Once a DSO has been compiled and linked, it needs to be configured. DSOs can be configured manually or they can be configured with **apxs**. Configuration consists of copying the DSO module to a known location then updating `httpd.conf` to find and execute the DSO.

Manual Configuration

By convention, DSOs written in C reside in /APACHE/PUB/libexec. After copying a DSO to this location, the **AddModule** and **LoadModule** directives must be added to `httpd.conf`. An example of where to place **AddModule** and **LoadModule** is shown in the `httpd.conf` file for **mod_example**. Additional directives may be necessary to configure a DSO's handler, depending on what the DSO is trying to accomplish.

```
:HELLO MGR.APACHE
:XEQ SH.HPBIN.SYS -L
shell/iX> cp hw/mod_hw.so libexec/mod_hw.so
shell/iX> vi conf/httpd.conf
...
# Note: The order is whch modules are loaded is important.
# Don't change the order below without expert advice
#
# Example:
# LoadModule foo_module libexec/mod_foo.so
# LoadModule example_module libexec/mod_example.so
LoadModule hw_module libexec/mod_hw.so
...
AddModule mod_cern_meta.c
AddModule mod_expires.c
AddModule mod_headers.c
AddModule mod_usertrack.c
#AddModule mod_example.c
AddModule mod_hw.c
AddModule mod_unique_id.c
AddModule mod_so.c
AddModule mod_setenvif.c
...
```

Mod_hw includes a handler so the following additional directives are added to `httpd.conf`:

```
...
<IfModule mod_hw.c>
  <Location /hw>
    SetHandler hw-handler
  </Location>
</IfModule>
...
```

The **LoadModule** directive takes two arguments. The first is the name of the module to load. This is the module's structure name taken from the source file **mod_hw.c**. The second argument is the path to the shared object file to load. The path can be relative to the server root (/APACHE/PUB), as shown here, or it can be an absolute path.

APXS Configuration

To use **apxs** for configuration, use the install option of **Makefile**. This will copy a module into `libexec` and automatically update `httpd.conf` with the **AddModule** and **LoadModule** directives. Additional configuration changes may be necessary (such as manually configuring the **hw-handler** as shown in the manual configuration) depending on what the module does:

```
:HELLO MGR.APACHE
:XEQ SH.HPBIN.SYS -L
shell/iX> cd hw
shell/iX> make install
/APACHE/PUB/bin/apxs -i -a -n ’hw’ mod_hw.so
cp mod_hw.so /APACHE/PUB/libexec/mod_hw.so
chmod 755 /APACHE/PUB/libexec/mod_hw.so
[activating module ‘hw’ in /APACHE/PUB/conf/httpd.conf]
```

Testing a DSO

After configuration or at any time after modifying a DSO, restart Apache in order to load the module:

```
shell/iX> cd /APACHE/PUB/logs
shell/iX> kill -HUP ‘cat ./httpd.pid‘
```

or

```
kill -TERM ‘cat httpd.pid`;callci stream ../JHTTPD
```

To execute the **mod_hw** DSO, access the <Location> specified in the `httpd.conf` file. A DSO may be executed in a different way, depending on the DSO’s functionality:

```
http://yourserver.com/hw
```

The output of the **mod_hw** module prints “Hello World!” followed by the result of raising the number 12 to the power of 2. The following is the output seen in a browser:

```
Hello World!

The result of 12.00**2.00 is 144.00
```

Sample Module Code (mod_hw)

This section contains source code for the sample DSO module discussed in the previous sections, **mod_hw.so**. The module source code consists of two files, **mod_hw.c** and **hw.c**. **Mod_hw.c** contains the module structure and **hw.c** contains a function called by **mod_hw.c**.

mod_hw.c

Mod_hw.c is a simple Apache module. It calls **pow()** (in the math library, /lib/libm) and **helloworld()** in **hw.c**. This example is designed to illustrate the use of external function calls.

```
shell/iX>  cat mod_hw.c
#include <stdlib.h>
#include <math.h>
#include "httpd.h"
#include "http_config.h"
#include "http_core.h"
#include "http_log.h"
#include "http_protocol.h"


/* here’s the content handler */
static int hw_handler(request_rec *r) {


double root = 12;
double power = 2;


   r->content_type = "text/html";
   ap_send_http_header(r);

   helloworld(r);

   ap_rprintf(r, "\nresult of %.2lf**%.2lf is %.2lf",root,power,pow(root,power));


   return OK;

}

/* Make the name of the content handler known to Apache */
static handler_rec hw_handlers[] =
{

    {"hw-handler", hw_handler},
    {NULL}
};


/* Tell Apache what phases of the transaction we handle */
module MODULE_VAR_EXPORT hw_module =
{

   STANDARD_MODULE_STUFF,
   NULL,            /* module initializer                 */
   NULL,            /* per-directory config creator       */
   NULL,            /* dir config merger                  */
   NULL,            /* server config creator              */
   NULL,            /* server config merger               */
   NULL,            /* command table                      */
   hw_handlers,     /* [7]  content handlers              */
   NULL,            /* [2]  URI-to-filename translation   */
   NULL,            /* [5]  check/validate user_id        */
   NULL,            /* [6]  check user_id is valid *here* */
   NULL,            /* [4]  check access by host address  */
   NULL,            /* [7]  MIME type checker/setter      */
   NULL,            /* [8]  fixups                        */
   NULL,            /* [9]  logger                        */
   NULL,            /* [3]  header parser                 */
   NULL,            /* process initialization             */
   NULL,            /* process exit/cleanup               */
   NULL             /* [1]  post read_request handling    */
};
```

hw.c

This file defines a function called **helloworld()**.

```
shell/iX> cat hw.c
#include "httpd.h"
#include "http_config.h"
#include "http_core.h"
#include "http_log.h"
#include "http_protocol.h"


helloworld(request_rec *r)
{

   ap_rputs("<HTML>\n", r);
   ap_rputs("<HEADER>\n", r);
   ap_rputs("<TITLE>Hello There</TITLE>\n", r);
   ap_rputs("</HEADER>\n", r);
   ap_rputs("<BODY>\n", r);
   ap_rprintf(r, "<H1>Hello World!</H1>\n");


   ap_rputs("</BODY>\n", r);
   ap_rputs("</HTML>\n", r);
}
```

APXS Default Makefile (mod_hw)

This is the **Makefile** auto-generated by **apxs -g -n hw**.

```
##
##  Makefile -- Build procedure for sample hw Apache module
##  Autogenerated via ‘‘apxs -n hw -g’’.
##


#   the used tools
APXS=apxs
APACHECTL=apachectl


#   additional defines, includes and libraries
#DEF=-Dmy_define=my_value
#INC=-Imy/include/dir
#LIB=-Lmy/lib/dir -lmylib


#   the default target
all: mod_hw.so


#   compile the shared object file
mod_hw.so: mod_hw.c
        $(APXS) -c $(DEF) $(INC) $(LIB) mod_hw.c


#   install the shared object file into Apache
install: all
        $(APXS) -i -a -n ’hw’ mod_hw.so


#   cleanup
clean:
         -rm -f mod_hw.o mod_hw.so


#   simple test
test: reload
          lynx -mime_header http://localhost/hw


#   install and activate shared object by reloading Apache to
#   force a reload of the shared object file
reload: install restart


#   the general Apache start/restart/stop
#   procedures
start:
          $(APACHECTL) start
restart:
          $(APACHECTL) restart
stop:
          $(APACHECTL) stop
```

Modified APXS Makefile (mod_hw)

This **Makefile** is a modified version of the **apxs** auto-generated **Makefile**. It shows how to call **gcc** for compiling and **LinkEditor** for linking. The **APXS** variable was also changed to contain a fully qualified path to **apxs**. **Apxs** is used for getting the correct defines and includes. It is also used for installing the new module in the `libexec/` directory.

Make sure to use tabs (instead of spaces) when adding **callci** and **gcc** to the **MakeFile**.

```
shell/iX> cat Makefile
##
##  Makefile -- Build procedure for sample hw Apache module
##  Autogenerated via ‘‘apxs -n hw -g’’.
##
##  3/01 Modified Makefile to replace apxs by gcc and linkedit for compile and ##       link


#   the used tools
APXS=/APACHE/PUB/bin/apxs
APACHECTL=/APACHE/PUB/bin/apachectl


#   defines, includes and libraries
DEF=‘$(APXS) -q CFLAGS‘
INC=-I‘$(APXS) -q INCLUDEDIR‘
LIB=/lib/libm.a,/lib/libc.a


#   the default target
all: mod_hw.so


#   link the shared object file
mod_hw.so: mod_hw.o hw.o
        callci "linkedit ’buildxl xl=./mod_hw.so;limit=5’"
        callci "linkedit ’addxl from=./mod_hw.o,./hw.o;to=./mod_hw.so; \
        rl=$(LIB);merge;share’"
#   compile the object files
mod_hw.o: mod_hw.c
        gcc -o mod_hw.o $(DEF) $(INC) -c mod_hw.c
hw.o: hw.c
        gcc -o hw.o $(DEF) $(INC) -c hw.c


#   install the shared object file into Apache
install: all
        $(APXS) -i -a -n ’hw’ mod_hw.so


#   cleanup
clean:
        -rm -f mod_hw.o mod_hw.so hw.o

#   simple test
test: reload
        lynx -mime_header http://localhost/hw

#   install and activate shared object by reloading Apache to
#   force a reload of the shared object file
reload: install restart


#   the general Apache start/restart/stop
#   procedures
start:
        $(APACHECTL) start
restart:
        $(APACHECTL) restart
stop:
        $(APACHECTL) stop
```

Extended Apache Programming Interface (EAPI)

Apache 1.3.9 and later are built with an extended set of Apache APIs. This means that Apache 1.3.9 and later expects these EAPIs to be built into any DSO they call. This EAPI feature is included in Apache so that a DSO can be used by either Apache or WebWise, since WebWise requires EAPI for its SSL functionality.

When creating DSOs, you must compile with the `-DEAPI` option. This will include the necessary EAPI header files. These header files are distributed with Apache 1.3.9 and later and reside in the `/APACHE/PUB/include` directory.

DSOs created without `-DEAPI` may operate successfully but may generate a warning message in the **error_log** file.

Stopping the Web Server

Perform the following steps in order to stop your web server in an orderly manner:

1. `:HELLO MANAGER.SYS or :HELLO MGR.APACHE,PUB`
2. `:XEQ SH.HPBIN.SYS "-c ’kill $(cat /APACHE/PUB/logs/httpd.pid)’"`

`:ABORTJOB` should only be used as a last resort for stopping HP WebWise MPE/iX Secure Web Server. See Known Issues.

Known Issues

1. Using `:ABORTJOB` to stop HP WebWise MPE/iX Secure Web Server will result in leaked **SVIPC** semaphores. These semaphores are not expensive resources and HP WebWise MPE/iX Secure Web Server only uses a relative handful, but there is a finite number of semaphores allowed on a machine before you run out. The `IPCS.HPBIN.SYS` CI command file (*NOT* a shell script!) can be used to display SVIPC resources, and the `IPCRM.HPBIN.SYS` CI command file (*NOT* a shell script!) can be used to free leaked resources. To avoid resource leakage, always use the `kill` command to stop HP WebWise MPE/iX Secure Web Server.
2. Upon termination or restart via kill, the `error_log` will contain numerous warnings about child processes not exiting promptly.
3. In order to correctly view the online documentation web pages at `http://yourserver.yourdomain.com/manual/` in the English language, you must configure your web browser to accept language content type “en” (worldwide English). Some web browsers in the United States default to accepting only language type “en-us” (U.S. English), and so will not be able to view some of the mod_ssl-related “en” content. United States web browsers should be configured to accept both language types for best results.

Additional Documentation

- `http://yourserver.yourdomain.com/manual/` (online documentation included with WebWise)
- `http://jazz.external.hp.com/src/webwise/` (HP WebWise)
- `http://www.apache.org/` (Apache opensource project)
- `http://www.modssl.org/` (`Mod_ssl` opensource project)
- `http://www.engelschall.com/sw/mm/` (a library of shared memory functions)
- `http://www.openssl.org/` (OpenSSL opensource project)
- `http://www.rsasecurity.com/products/bsafe/cryptoc.html` (RSA BSAFE Crypto-C commercial product)

10 Sendmail for MPE/iX

Previously available as unsupported freeware, Sendmail is now bundled into MPE/iX 7.5 FOS as a fully supported product which allows you to send and receive SMTP-based e-mail. The initial A.01.00 release of Sendmail for MPE/iX is based on the 8.12.1 Internet open source version from sendmail.org. The porting changes that were required to get Sendmail 8.12.1 running on MPE/iX have been incorporated into the 8.12.2 source code available from `sendmail.org`.

System Requirements and Patches

Sendmail has the following prerequisites:

- MPE/iX 7.5
- HP highly recommends installing the latest NSTxxxxx network transport patch.
- Sendmail uses the POSIX time functions in order to timestamp messages, and these functions depend on the TZ environment variable being set properly. The best place to set TZ is in your system logon UDC, i.e., `SETVAR TZ "PST8PDT"` (Pacific Time Zone example). For further information about TZ, please see “man timezone” or `/SYS/LIB/TZTAB`.
- Syslog/iX must be configured and running so that Sendmail can log warnings, errors, and message traffic data. Note that some third-party spooling packages come with their own embedded syslog daemon that will prevent you from running Syslog/iX; if you are using such a spooling package, you will have to use the embedded syslog daemon to capture Sendmail logging events. Syslog/iX is documented in the Configuring and Managing MPE/iX Internet Services manual. If you will be using the FOS syslog daemon for the first time because of Sendmail, please ensure the SYSLOG account file ownerships are correct by performing the following steps:
  1. `:HELLO MANAGER.SYS`
  2. `:XEQ CHOWN.HPBIN.SYS '-R MGR.SYSLOG:SYSLOG /SYSLOG/PUB'`
- Your HP e3000 must be configured to use one or more DNS servers, and must have the correct entries in the DNS database corresponding to the configured hostname in :NMMGR. See “DNS Issues” below for more detail.
- Any network firewalls, routers, or switches that your HP e3000 communicates with must be configured to allow your HP e3000 to send and receive packets on port 25 (SMTP) and port 53 (DNS). See “Firewall Issues” below for more detail.

Support

Sendmail 8.12.1 for MPE/iX is supported through the HP Response Center as part of MPE/iX FOS support.

Product Overview and Feature Set

The feature set of Sendmail for MPE/iX is quite extensive; the following is only a partial list:

- Send and receive SMTP-based e-mail from sessions and/or batch jobs.
- Deliver local e-mail to mailboxes, files, or programs.
- A vast selection of tunable performance parameters.
- Highly flexible and extremely powerful configuration language.
- Access control for accepting or rejecting incoming e-mail.
- Message header rewriting capabilities.
- Modular feature set allows you to configure exactly the functionality you want; the following optional features have been configured by default in this distribution:
    - access_db
    - domaintable
    - genericstable
    - mailertable
    - virtusertable
- Open-source robustness and reliability.
- Compatibility with the HP-UX Sendmail file layout.

DNS Issues

The number one cause of Sendmail installation problems is due to improper system naming and/or a lack of DNS entries describing your HP e3000. Please verify the following before you attempt to run Sendmail for the first time:

- `/bin/uname` –n should report your HP e3000 hostname as a single token, i.e., “JAZZ” instead of "`JAZZ.EXTERNAL.HP.COM`". If you do not see a single token hostname, you must configure a proper hostname by using :NMMGR.
- `/SYS/NET/RESLVCNF` must contain a single “domain” statement that defines the domain part of your HP e3000’s fully qualified hostname. For example, `/bin/uname` –n should display “JAZZ” and `/SYS/NET/RESLVCNF` should contain a “domain external.hp.com” statement.
- `/SYS/NET/RESLVCNF` must contain one or more “nameserver” statements which specify the DNS server IP addresses that your HP e3000 will be querying to resolve host names. It is not necessary to run a DNS server such as BIND on your HP e3000 itself.
- Your HP e3000 must be defined within the DNS nameserver databases as having a valid “A” record that maps the HP e3000’s hostname to an IP address.
- Your HP e3000 must be defined within the DNS nameserver databases as having a valid “PTR” record that maps the HP e3000’s IP address to a hostname.

Sendmail for MPE/iX is distributed with a convenient script that you can run to check all of the above DNS configuration issues and more:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`
3. `shell/iX> /SENDMAIL/CURRENT/bin/dnscheck`

The dnscheck script will instruct you how to fix any problems that it detects. After making each fix, keep rerunning the script until no more problems are found.

Firewall Issues

The number two cause of Sendmail installation problems is due to a firewall or other network security device blocking your HP e3000 from being able to send and receive packets on port 53 (DNS) and port 25 (SMTP).

Sendmail uses port 53 (DNS) to resolve hostnames into IP addresses and IP addresses into hostnames. Sendmail may do multiple DNS resolutions for every e-mail message sent or received, and if a firewall is blocking these DNS packets, Sendmail may experience long delays and/or generate various error messages logged to syslog.

Sendmail may need to contact external DNS servers if you are attempting to exchange e-mail with the Internet. Some intranet environments may require you to reference a “forwarding DNS server” (which can traverse your border firewall to talk to the Internet) via a nameserver statement in `/SYS/NET/RESLVCNF`. Consult your local network administrator for advice on how to choose a proper DNS server.

Port 25 (SMTP) is used to connect to remote mail servers to deliver outgoing e-mail, and is also used on the HP e3000 to listen for incoming e-mail. If a firewall is blocking outbound port 25 packets, Sendmail may experience long delays and generate various error messages logged to syslog as well as bounce messages returned to the e-mail originator. If a firewall is blocking inbound port 25 packets, Sendmail will not be able to receive any incoming e-mail, and there will be no extra syslog messages.

Migration from Sendmail 8.9.1

Many HP e3000 machines have been running the unsupported freeware version of Sendmail 8.9.1 available from `http://www.bixby.org/mark/sendmailix.html`. The following considerations apply if you are migrating from 8.9.1 to 8.12.1:

- The 8.9.1 daemon job stream file `/SENDMAIL/PUB/JDAEMON` is not modified during the installation of 8.12.1, and it is not compatible with the 8.12.1 distribution. You must use `/SENDMAIL/CURRENT/JDAEMON.sample` as a template for manually creating an 8.12.1-compatible `/SENDMAIL/PUB/JDAEMON` job stream file
- The 8.9.1 `/SENDMAIL/PUB/SENDMAIL` program file is renamed during the 8.12.1 installation to SENDMAIL.bak and replaced by a symbolic link that points to the 8.12.1 `/SENDMAIL/CURRENT/SENDMAIL` program file. Any existing applications that refer to `/SENDMAIL/PUB/SENDMAIL` should continue to work properly without modification.
- All 8.12.1 distribution files live in different HFS directories than the 8.9.1 distribution files. Once you are satisfied that 8.12.1 is working properly, you should purge the old 8.9.1 files to conserve disk space and avoid confusion.
- All 8.12.1 configuration files reside in the `/etc/mail` directory instead of the old 8.9.1 location of `/SENDMAIL/PUB/etc`. The 8.9.1 sendmail.cf file is not compatible with 8.12.1, and so you will either have to use the default 8.12.1 `/etc/mail/sendmail.cf` file or create your own customized configuration file from the 8.12.1 configuration macros in `/SENDMAIL/CURRENT/cf/cf`.
- All 8.9.1 database maps including the aliases file should be rebuilt using the 8.12.1 makemap or newaliases utilities.
- Any undelivered messages still on the 8.9.1 queue will not be delivered by 8.12.1 which now has two separate queues residing at `/var/spool/clientmqueue and /var/spool/mqueue` instead of the previous single 8.9.1 queue location `/SENDMAIL/PUB/mqueue`.
- The implementation of local message submission has changed with 8.12.1. Previously with 8.9.1, the `/SENDMAIL/PUB/SENDMAIL` program file would copy new messages from stdin directly into a queue disk file. With 8.12.1, the SENDMAIL program file will read new messages from stdin and contact the local HP e3000's port 25 to queue the messages using standard SMTP protocol.
- 8.12.1 uses two configuration files æ `/etc/mail/sendmail.cf` for general mail routing, and `/etc/mail/submit.cf` for submitting new e-mail messages from the local host.
- 8.12.1 does not include the Majordomo mailing list software that was bundled with 8.9.1. Majordomo is not supported by HP.

Distribution Highlights

All files reside in the SENDMAIL account in a version-specific group named vuuff (i.e., A0100 at initial release). A symbolic link named CURRENT points to the active version-specific group. If you install a newer version of this distribution on top of an existing installation, a new version-specific group will be created and the CURRENT symbolic link will be adjusted to point to the new group. The old version-specific group will NOT be purged by the installation script, so once you are satisfied the new version is working OK, you will have to manually :PURGEGROUP the old version if you wish to free up its disk space.

Applications that require a specific version of Sendmail should reference files and directories using a pathname prefix of `/SENDMAIL/vuuff`. Applications that don't have any version dependencies should use a pathname prefix of `/SENDMAIL/CURRENT`.

The main files and directories of this distribution are as follows:

- `/SENDMAIL/CURRENT/JDAEMON.sample`

  The sample batch job for running the mail daemon.

- `/SENDMAIL/CURRENT/SENDMAIL`

  The main Sendmail NMPRG.

- `/SENDMAIL/CURRENT/bin/`

  Directory containing various Sendmail utility programs:

dnscheck	Script for validating your DNS configuration.
hoststat	Symlink for displaying host status information. See "man sendmail" for details.
m4	Macro processor used to generate Sendmail configuration files.
mailq	Symlink for displaying the mail queue. Requires SM capability or being logged on to the SENDMAIL account. See "man mailq" for details.
newaliases	Symlink for rebuilding the aliases database map. Requires being logged on as SERVER.SENDMAIL. See "man newaliases" for details.
purgestat	Symlink for purging host status information. See "man sendmail" for details.
vacation	Autoresponder program for vacations. See "man vacation" for details.

- `/SENDMAIL/CURRENT/cf/`

  Directory tree for building Sendmail configuration files:

README	Comprehensive instructions for configuring Sendmail. READ THIS FILE BEFORE ATTEMPTING TO CONFIGURE SENDMAIL!
`cf/generic-mpeix.cf.sample`	Sample MPE/iX Sendmail configuration output file used by the mail daemon.
`cf/generic-mpeix.mc.sample`	Sample MPE/iX Sendmail configuration macro file used to create `generic-mpeix.cf.sample`.
`cf/submit-mpeix.cf.sample`	Sample MPE/iX mail submission configuration output file used when submitting new messages.
`cf/submit-mpeix.mc.sample`	Sample MPE/iX mail submission configuration macro file used to create `submit-mpeix.cf.sample`.

- `/SENDMAIL/CURRENT/doc/op/op.ps`

  Postscript copy of the *Sendmail Installation and Operation Guide*. READING THIS FILE IS HIGHLY RECOMMENDED!

- `/SENDMAIL/CURRENT/etc/profile`

  POSIX shell profile used when logged onto the SENDMAIL account.

- `/SENDMAIL/CURRENT/etc/mail.sample/`

  Directory containing many sample configuration files that will be automatically copied to `/etc/mail` at installation time if files of the same name do not already exist in the target directory.

- `/SENDMAIL/CURRENT/man/`

  Directory containing man page documentation, suitable for adding to your MANPATH environment variable, i.e., export `MANPATH=/SENDMAIL/CURRENT/man:$MANPATH`.

- `/SENDMAIL/CURRENT/sbin/`

  Directory containing various Sendmail utility programs:

editmap	Program for editing Sendmail database maps. See “man editmap” for details.
mailstats	Program for displaying Sendmail traffic statistics. See “man mailstats” for details.
makemap	Program for creating Sendmail database maps. See “man makemap” for details.
praliases	Program for printing the contents of the aliases database map. See “man praliases” for details.
sendmail	Symlink for `/SENDMAIL/CURRENT/SENDMAIL`. See “man sendmail” for details.
smrsh	The Sendmail restricted shell, optionally used to control what external programs Sendmail is allowed to deliver mail to. See “man smrsh” for details.

The following symbolic links are created at installation time in order to provide compatibility with the HPUX Sendmail file layout:

- /usr/bin/m4
- /usr/bin/mailq
- /usr/bin/mailstats
- /usr/bin/newaliases
- /usr/bin/praliases
- /usr/bin/vacation
- /usr/lib/sendmail
- /usr/sbin/editmap
- /usr/sbin/hoststat
- /usr/sbin/mailstats
- /usr/sbin/makemap
- /usr/sbin/newaliases
- /usr/sbin/purgestat
- /usr/sbin/sendmail

• /usr/sbin/smrsh

All Sendmail runtime configuration files reside in the `/etc/mail` directory which is populated at installation time from `/SENDMAIL/CURRENT/etc/mail.sample` for any files that do not already exist. The `/etc/mail` directory contains the following files which must only be altered by the user SERVER.SENDMAIL:

access	The ASCII access database map used to accept or reject mail from selected domains. This map is initially empty, which accepts mail from all domains.
access.db	The compiled access database map created by makemap.
aliases	The ASCII aliases database map used to create local mailbox names that do not necessarily correspond one-to-one with local users. Aliases can be defined to deliver mail to multiple users, to files, or to programs. This map initially defines aliases postmaster as SERVER.SENDMAIL and MAILER-DAEMON as postmaster.
aliases.db	The compiled aliases database map created by newaliases.
domaintable	The ASCII domaintable database map used to remap domain names in mail headers. Because the headers are rewritten, you should only use this for your own domains. This map is initially empty, which does no header rewriting.
domaintable.db	The compiled domaintable database map created by makemap.
genericstable	The ASCII genericstable database map used to remap the user and hostname portion of outgoing header addresses. This map is initially empty, which does no reader rewriting.
genericstable.db	The compiled genericstable database map created by makemap.
helpfile	The documentation returned by the SMTP protocol **HELP** command.
local-host-names	The ASCII file containing hostname aliases (one per line) for the local machine. This file is initially empty, and so incoming e-mail will only be accepted if it is addressed using the true host name of the local machine.
mailertable	The ASCII mailertable database map used to override mail routing for selected domains. This map is initially empty, and so all mail routing is controlled by `sendmail.cf`.
mailertable.db	The compiled mailertable database map created by makemap.
sendmail.cf	The m4-created configuration file for the mail daemon.
sendmail.pid	The POSIX PID of the currently running mail daemon.
statistics	The binary file used to collect Sendmail traffic statistics.
submit.cf	The m4-created configuration file for new mail submission by the local host.
virtusertable	The ASCII virtusertable database map used to perform domain-specific aliasing and hosting of multiple virtual domains on one machine. This map is initially empty, and so no virtual domain aliases will be recognized.
virtusertable.db	The compiled virtusertable database map created by makemap.

Configuring Sendmail

The syslog daemon must be configured to log mail events before you attempt to run Sendmail. The FOS syslog daemon configuration file is `/SYSLOG/PUB/syslog.conf`, and the syslog daemon is started by streaming `/SYSLOG/PUB/JSYSLOGD`. The default `syslog.conf` file will log Sendmail messages to `/tmp/syslog.log`.

Sendmail uses two configuration files æ `/etc/mail/submit.cf` when a user on the local machine is submitting a new e-mail message, and `/etc/mail/sendmail.cf` for all other functions including the mail daemon. These *.cf configuration files are generated from several *.mc macro files which are expanded by the m4 macro processor program.

If you only need to make simple configuration changes such as uncommenting a statement or changing an existing statement parameter, you can edit the *.cf files directly. But if you are adding major new functionality, you will need to regenerate the *.cf files from the *.mc files. It is good Sendmail practice to ALWAYS make configuration changes by editing the *.mc files and then expanding them into their *.cf form.

To regenerate `/etc/mail/submit.cf`:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`
3. `shell/iX> cd /SENDMAIL/CURRENT/cf/cf`
4. `shell/iX> cp submit-mpeix.mc.sample submit-mpeix.mc`
5. Edit `submit-mpeix.mc` with the bytestream file editor (i.e., vi) of your choice to make your changes.
6. `shell/iX> m4 ../m4/cf.m4 submit-mpeix.mc >submit-mpeix.cf`
7. `shell/iX> cp submit-mpeix.cf /etc/mail/submit.cf`

To regenerate `/etc/mail/sendmail.cf`:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`
3. `shell/iX> cd /SENDMAIL/CURRENT/cf/cf`
4. `shell/iX> cp generic-mpeix.mc.sample generic-mpeix.mc`
5. Edit `generic-mpeix.mc` with the bytestream file editor (i.e., vi) of your choice to make your changes.
6. `shell/iX> m4 ../m4/cf.m4 generic-mpeix.mc >generic-mpeix.cf`
7. `shell/iX> cp generic-mpeix.cf /etc/mail/sendmail.cf`

The default copy of `/etc/mail/sendmail.cf` assumes that your local machine will be delivering e-mail directly to the recipient's mail server. If you instead need to relay all of your outbound e-mail through a central relay server, you can simply edit `/etc/mail/sendmail.cf` to specify the relay host name, i.e.,:

```
# "Smart" relay host (may be null)
DSmy.relay.host.name
```

Alternatively you can modify the `generic-mpeix.mc` file as shown below and then rebuild the sendmail.cf file as explained previously:

```
define(‘SMART_HOST’, ‘my.relay.host.name’)
```

In addition to the *.cf configuration files, some Sendmail features require the use of additional configuration files known as database maps. Database maps consist of ASCII key/value pairs that have been compiled into a binary database format. Maps are created by the **makemap** command, and can be modified by the **editmap** command. For example:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`

3.
   ```
   shell/iX> /bin/cat - >/etc/mail/access
   imaspammer.com   REJECT
   :EOD
   ```
4. `shell/iX> makemap hash /etc/mail/access </etc/mail/access`

An ASCII file called `/etc/mail/access` is created with an entry that tells Sendmail to reject all e-mail sent from the `imaspammer.com` domain. The **makemap** command is then used to read this ASCII file from stdin via I/O redirection. The first parameter of makemap describes the database format to be used (Berkeley DB hash or btree), and the second parameter is the name of the binary output file that will be created after ".db" is appended to the name.

It is important to note that while `/etc/mail/sendmail.cf` will refer to the ASCII database file name (i.e., `/etc/mail/access`), Sendmail will actually be reading the data from the binary database filename (i.e., `/etc/mail/access.db`). So whenever you make a change to ASCII database map file data, you must run makemap to create the binary database *.db file, and then restart Sendmail for the changes to be visible.

For more details about database maps, please see "man makemap" and "man editmap".

Starting the Mail Daemon

Make sure that a syslog daemon is running before you start the mail daemon. To start the FOS syslog daemon, `:STREAM JSYSLOGD.PUB.SYSLOG`.

Simply `:STREAM JDAEMON.PUB.SENDMAIL` to start the mail daemon.

Stopping the Mail Daemon

The following command performed in the POSIX shell while logged on to SERVER.SENDMAIL or any SM user will stop the mail daemon job:

```
kill $(head -n 1 /etc/mail/sendmail.pid)
```

Sending E-mail

The POSIX **mailx** command can be used to send simple e-mail messages via Sendmail. **Mailx** reads the file `/etc/mailx.rc` to determine which mail delivery program to use, and the Sendmail installation script modifies this file to specify that Sendmail shall be used. For more information about **mailx**, please see "man mailx" or the *MPE/iX Shell & Utilities Reference Manual Vol. 1*.

To send a message interactively:

1. `:XEQ SH.HPBIN.SYS -L`

2.
   ```
   shell/iX> mailx someuser@some.host
   Subject: hello world
   Hi,

   How are you doing?
   :EOD
   EOT
   ```

To send a message from a pipe:

1. `:XEQ SH.HPBIN.SYS -L`

2.
   ```
   shell/iX> echo "Hi,\n\nHow are you doing?" |\
              mailx -s "hello world" someuser@some.host
   ```

To send a message from a disk file:

1. `:XEQ SH.HPBIN.SYS -L`

2.
   ```
   shell/iX> /bin/cat - >/diskfile/containing/message/body
   Hi,

   How are you doing?
   :EOD
   ```

3.
   ```
   shell/iX> mailx -s "hello world" someuser@some.host \
   </diskfile/containing/message/body
   ```

Mailx only gives you limited control over message headers and does not allow you to send attachments. For total control over message formatting and content, you will need to invoke Sendmail directly.

Sendmail expects you to pass it a fully formatted message via stdin that consists of both header data and body text. Note that an empty line is used to delimit where the headers end and the body text begins.

To send a message interactively:

1. `:XEQ SH.HPBIN.SYS -L`

2.
   ```
   shell/iX> /bin/cat - | /SENDMAIL/CURRENT/SENDMAIL someuser@some.host
   Subject: hello world

   Hi,

   How are you doing?
   :EOD
   ```

To send a message with Sendmail reading the headers to determine the recipient addresses:

1. `:XEQ SH.HPBIN.SYS -L`

2. `shell/iX> /bin/cat - >message.txt`

   ```
   To: someuser@some.host
   Cc: otheruser@other.host
   Bcc: secretuser@another.host
   Subject: hello world

   Hi,

   How is everybody doing?
   :EOD
   ```

3. `shell/iX> /SENDMAIL/CURRENT/SENDMAIL -t <message.txt`

Note that Sendmail is merely a passive Mail Transport Agent and doesn't give you any message composition functionality to create things such as attachments. If you want to create attachments, you must manually create all of the necessary message headers yourself. These Multipurpose Internet Mail Extensions (MIME) headers are described in RFCs 2045-2049. RFCs are available from many places on the Internet; the official central repository is `http://www.rfc-editor.org/`. Some scripting languages contain tools to make MIME content generation easier -- for a Perl example, please see `http://search.cpan.org/search?module=MIME::Lite` (Perl is not supported by HP).

If the mail daemon isn't running when a local user submits a new e-mail message, the message will be queued in the `/var/spool/clientmqueue` directory which will be processed the next time the mail daemon job is started. Otherwise, the new message is sent to the mail daemon via TCP port 25, and the daemon queues the message in the `/var/spool/mqueue` directory and then attempts immediate delivery.

Receiving E-mail

By default, Sendmail delivers to local mailboxes by appending new messages to the file `/usr/mail/USER.ACCOUNT`. Mailbox files will automatically be created if they do not already exist. Each user has direct filesystem read/write access to their own mailbox file. MPE usernames *must* be specified in uppercase when addressing e-mail.

When the **mailx** program is run without any parameters, it checks to see if there is any new mail in your local mailbox file. A summary of the mailbox contents will be presented, and then you can interact with your messages using a simplistic user interface:

1. `:HELLO USER.ACCOUNT`
2. `:XEQ SH.HPBIN.SYS -L`
3.
```
shell/iX> mailx
mailx version MPE/iX Shell and Utilities (A.01.01) May  9 1997 05:04:05  Type ?  for
help.
"/usr/mail/USER.ACCOUNT": 1 message 1 new
>N  1 sender@some.host     Mon Oct 29 16:48   22/908   test message
```
4.
```
? help
                mailx commands
type [msglist]              print messages
next                        goto and type next message
edit [message]              edit message
from [msglist]              print header summary of messages
delete [msglist]            delete messages
save [msglist] file         save messages by appending to "file"
undelete [msglist]          remove deletion mark from messages
reply [msglist]             reply to messages
preserve [msglist]          prevent messages from going into MBOX
unread [msglist]            mark messages as unread
mail [user ...]             mail to specified users
quit                        quit, updating MAILBOX and MBOX
xit                         quit, no updates
headers                     print page of headers summary
!command                    escape to shell with "command"
cd [directory]              change current directory
list                     complete set of command names

The shortest non-ambiguous abbreviation is allowed for commands [msglist] or [message]
are optional specifiers for message by subject, author, number, or type. When
unspecified, the current message is assumed.
```
5.
```
? type 1
Message  1:
From sender@some.host Mon Oct 29 16:48:18 2001
Received: from some.host (IDENT:root@some.host [12.34.56.78])
        by my.host (8.12.1/8.12.1) with ESMTP id f9U0mGPr46792874
        for <USER.ACCOUNT@my.host>; Mon, 29 Oct 2001 16:48:17 -0800
Received: from some.host (some.host [12.34.56.78])
        by some.host (8.11.6/8.11.6) with ESMTP id f9U0m8O06413
        for <USER.ACCOUNT@my.host>; Mon, 29 Oct 2001 16:48:08 -0800
```

```
Message-ID: <3BDDF8C8.15625C@some.host>
Date: Mon, 29 Oct 2001 16:48:08 -0800
From: John Doe <sender@some.host>
X-Mailer: Mozilla 4.77 [en] (Win98; U)
X-Accept-Language: en,pdf
MIME-Version: 1.0
To: Jane Doe <USER.ACCOUNT@my.host>
Subject: test message
Content-Type: text/plain; charset=us-ascii
Content-Transfer-Encoding: 7bit

Hi there!
```

6. `? delete 1`

7. `? quit`

The Aliases Database Map and .forward Files

The aliases database map `/etc/mail/aliases` describes user ID aliases used by Sendmail and is formatted as a series of lines of the form

```
name: addr_1, addr_2, addr_3, . . .
```

The name is the name to alias, and the `addr_n` are the aliases for that name. `addr_n` can be another alias, a local username, a local filename, a command, an include file, or an external e-mail address.

Local Username

`username`	The username must be available via getpwnam(3). Note that names specified here will be subject to recursive alias lookups; to suppress further alias lookups against this name, prefix the name with a backslash (\) character. MPE usernames have the format USER.ACCOUNT.

Local Filename

`/path/name`	Messages are appended to the file specified by the full absolute pathname (starting with a slash (/))

Command

`|command`	A command starts with a pipe symbol (|), it receives messages via standard input. To execute a command with parameters, enclose the entire expression in quotes, i.e., `"|command parm1 parm2 parm3"`.

Include File

`:include: /path/name` The aliases in pathname are added to the aliases for name.

External E-Mail Address

`user@domain`	An e-mail address in RFC 822 format.

Lines beginning with white space are continuation lines. Another way to continue lines is by placing a backslash directly before a newline. Lines beginning with # are comments.

Aliasing occurs only on local names. Loops cannot occur, since no message will be sent to any person more than once.

After aliasing has been done, local and valid recipients who have a “.forward” file in their home directory have messages forwarded to the list of users defined in that file.

This is only the raw data file; the actual aliasing information is placed into a binary format in the file `/etc/mail/aliases.db` using the program newaliases(1). A **newaliases** command must be executed each time the aliases file is changed for the change to take effect:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`
3. `shell/iX> newaliases`

Each local user can create a .forward file to alter the delivery of their own mail. When delivering mail to local users, Sendmail looks for a file called `/ACCOUNT/GROUP/.forward` where ACCOUNT is the user’s MPE account and GROUP is the user’s MPE home group. If this file is found, the contents are parsed as if they were the right-hand side of an aliases file entry. Consider the following example .forward file:

```
\USER.ACCOUNT, "|/SENDMAIL/CURRENT/bin/vacation USER.ACCOUNT"
```

This will cause Sendmail to deliver one copy of an email message to the user's normal mailbox (`\USER.ACCOUNT`), and another copy of an email message will be piped to the Sendmail vacation autoresponder program.

Access_db Feature

The access database map allows you to accept or reject e-mail based on the message envelope and connecting mail server host name. For example:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`

3.
   ```
   shell/iX> /bin/cat - >/etc/mail/access
   imaspammer.com   REJECT
   :EOD
   ```
4. `shell/iX> makemap hash /etc/mail/access </etc/mail/access`

This will reject all e-mail originating from the domain `imaspammer.com`.

For more information about the access_db feature, please see `/SENDMAIL/CURRENT/cf/README`.

Domaintable Feature

The domaintable database map is used to rewrite domain names in e-mail headers. You might find this useful if your company was acquired by a different company and you were forced to change your email domain names. For example:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`

3.
   ```
   shell/iX> /bin/cat - >/etc/mail/domaintable
   oldcompany.com   newcompany.com
   :EOD
   ```
4. `shell/iX> makemap hash /etc/mail/domaintable </etc/mail/domaintable`

All occurrences of `oldcompany.com` in e-mail headers would be rewritten to `newcompany.com`.

For more information about the domaintable feature, please see `/SENDMAIL/CURRENT/cf/README`.

Genericstable Feature

The genericstable database map is used to rewrite both the user and domain portions of e-mail addresses in outgoing e-mail headers. For example:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`

3.
   ```
   shell/iX> /bin/cat - >/etc/mail/genericstable
   USER.ACCOUNT@my.local.host   customer_servce@company.com
   :EOD
   ```
4. `shell/iX> makemap hash /etc/mail/genericstable </etc/mail/genericstable`

All e-mail sent by USER.ACCOUNT on the local host `my.local.host` would have the sender address(es) rewritten as `customer_service@company.com`. Note that domains being modified by genericstable must be added to `/etc/mail/sendmail.cf` class {G}.

For more information about the genericstable feature, please see /SENDMAIL/CURRENT/cf/README.

Mailertable Feature

The mailertable database map is used to override the default mail routing behavior in `/etc/mail/sendmail.cf`. You might find this useful if you needed to route e-mail for certain domains through specific e-mail relays. For example:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`

3.
   ```
   shell/iX> /bin/cat - >/etc/mail/mailertable
   .bitnet   smtp:relay.bit.net
   :EOD
   ```
4. `shell/iX> makemap hash /etc/mail/mailertable </etc/mail/mailertable`

All mail addressed to hostnames ending in “.bitnet” would be relayed via the host `relay.bit.net`.

For more information about the mailertable feature, please see /SENDMAIL/CURRENT/cf/README.

Virtusertable Feature

The virtusertable database map is used to remap incoming e-mail addresses in order to facilitate multiple virtual e-mail domains on the same machine. This is very similar to how aliasing works, except that you can also specify domain names in addition to user names. For example:

1. `:HELLO SERVER.SENDMAIL`
2. `:XEQ SH.HPBIN.SYS -L`

3.
   ```
   shell/iX> /bin/cat - >/etc/mail/virtusertable
   info@bar.com   INFO.BAR
   info@foo.com   INFO.FOO
   :EOD
   ```
4. `shell/iX> makemap hash /etc/mail/virtusertable </etc/mail/virtusertable`

All e-mail addressed to `info@bar.com` will be delivered to user INFO.BAR, and all e-mail addressed to `info@foo.com` will be delivered to user INFO.FOO. Note that all domains used in the map keys must also be present in /etc/mail/local-host-names and that your DNS server(s) have been configured with MX entries that route e-mail for those domains to your local machine.

For more information about the virtusertable feature, please see /SENDMAIL/CURRENT/cf/README.

MPE/iX Implementation Issues

The following Sendmail features have not been implemented on MPE/iX:

- LDAP support
- TLS/SSL encrypted e-mail transport
- SASL secure authentication
- Mail filtering
- Optional chroot()-based security features
- Optional nice()-based dispatching priority adjustments

The following Sendmail features work a bit differently on MPE/iX than they do on other operating systems:

- Sendmail programs that read terminal input by using stdin will echo one character per line and not recognize CR characters or :EOD properly. The workaround is to redirect stdin to either a pipe or a disk file, i.e.,:

  ```
  shell/iX> /bin/cat - | makemap hash mymap
  or
  shell/iX> makemap hash mymap <diskfile
  ```

- Sendmail's "background" DeliveryMode on MPE/iX is actually a hybrid between "background" and "interactive". A background process will be started to deliver the mail, but if it has not finished by the time the parent process is ready to terminate, the parent process will wait for the background process to finish.
- Symlinks such as `/SENDMAIL/CURRENT/bin/mailq` that point to the main Sendmail NMPRG must be invoked from the POSIX shell in order to work properly because invoking them from the CI doesn't initialize ARGV[0] with the name of the symlink. If you need to invoke this symlinked functionality from the CI, you will have to specify the Sendmail parameters that invoked the desired functionality, i.e., `:XEQ /SENDMAIL/CURRENT/SENDMAIL -bp`.
- The newaliases utility will complain that it cannot alter the ownership of `/etc/mail/aliases`, but this warning can be ignored if you are always logged on as SERVER.SENDMAIL when doing maintenance, i.e.,:

  ```
  :HELLO SERVER.SENDMAIL
  :XEQ SH.HPBIN.SYS –L
  shell/iX> newaliases
  no fchown(): cannot change ownership on /etc/mail/aliases
  /etc/mail/aliases: 2 aliases, longest 15 bytes, 48 bytes total
  ```

Troubleshooting

- Always check syslog when you have problems with Sendmail!
- If you don't see any syslog events being logged:
  - If you are running third-party spooling software with an embedded syslog daemon, you must use that embedded daemon instead of Syslog/iX to capture Sendmail logging events.
  - Verify that the syslog daemon is running.
  - Verify that all files used by the syslog daemon have the correct file ownership and permissions.
  - Verify that syslog has been configured to log mail events.
- If syslog or e-mail message headers show strange timestamps, verify that the TZ environment variable is set correctly, preferably in your system logon UDC.
- If syslog shows DNS lookup failures:
  - Run the `/SENDMAIL/CURRENT/bin/dnscheck` script to verify that DNS is configured properly on your local machine.
  - Check with your firewall administrator to make sure your local machine is allowed to talk to your DNS server(s) via port 53.
- If syslog shows connection failures for remote mail servers, check with your firewall administrator to make sure your local machine is allowed to talk to those remote mail servers via port 25. If you are not allowed to talk directly to remote mail servers, you may need to configure a smart host mail relay in `/etc/mail/sendmail.cf` or designate alternate relays for specific domains via the mailertable feature.
- Very long delays when a local user is submitting a new e-mail message are indicative of DNS problems. Check syslog for any errors, and run the `/SENDMAIL/CURRENT/bin/dnscheck` DNS configuration validation script.
- If local users are submitting new messages that aren't being delivered:
  - Verify that the mail daemon job is running. If the mail daemon is not running, newly submitted messages are queued in the `/var/spool/clientmqueue` directory. The mail daemon will process these queued messages the next time it is started.
  - The mail daemon's delivery queue is the `/var/spool/mqueue` directory. Users with proper security can examine the queue files directly, or run `/SENDMAIL/CURRENT/bin/mailq` to get a formatted queue listing.
- If remote users are sending messages to the local machine that aren't being delivered:
  - Check syslog to see if the remote mail server is able to connect to the local machine. If you do not see any connection attempts:
    - Talk to your firewall administrator to determine if remote machines are allowed to send e-mail to your local machine via port 25.
    - Talk to your network administrator to verify that your local machine's DNS entries should be visible to the remote mail server.
  - Verify that the remote users are using valid user addresses (aliases or uppercase USER.ACCOUNT) and hostnames for your local machine.
- If you make a Sendmail configuration change but the new configuration doesn't appear to take effect:

— You must always stop and restart the mail daemon when making *.cf configuration changes.

— If you changed an ASCII database map file, you must run makemap or editmap to create the corresponding *.db binary database file.

— If you changed the ASCII `/etc/mail/aliases` file, you must run newaliases to create the binary `/etc/mail/aliases.db` database file.

Syslog Message Formats

The following examples illustrate the types of syslog messages that Sendmail generates during normal operation.

The MPE user USER.ACCT on the local HP e3000 with a hostname of myhost.mydomain.com has just submitted a new message with 1 recipient consisting of a message body size of 5 bytes:

```
Feb 6 12:14:42 localhost sendmail[65622]: g16HEgik065622: from=USER.ACCT, size=5, class=0, nrcpts=1,
msgid=<200202061714.g16HEgik065622@myhost.mydomain.com>,

relay=USER.ACCT@localhost
```

The new message is being relayed via the local host, i.e., Sendmail is connecting to TCP port 25 (SMTP) on the local host in order to queue the message:

```
Feb 6 12:14:43 localhost sendmail[65623]: g16HEgs9065623: from=<USER.ACCT@myhost.mydomain.com>, size=5,
class=0, nrcpts=1, msgid=<200202061714.g16HEgik065622@myhost.mydomain.com>, proto=ESMTP, daemon=MTA,
relay=localhost [127.0.0.1]
```

The new message has been successfully queued on the local host and will eventually be delivered to `destuser@remhost.mydomain.com`:

```
Feb 6 12:14:43 localhost sendmail[65622]: g16HEgik065622: to=destuser@remhost.mydomain.com,
ctladdr=USER.ACCT (153/126), delay=00:00:01, xdelay=00:00:01, mailer=relay, pri=30091, relay=localhost
[127.0.0.1], dsn=2.0.0, stat=Sent (g16HEgs9065623 Message accepted for delivery)
```

The Sendmail daemon on the local host is now processing the queue for the message being sent from `USER.ACCT@myhost.mydomain.com` to `destuser@remhost.mydomain.com`. The remote mail server's IP address is 192.168.0.1, and the message was successfully sent:

```
Feb 6 12:14:46 localhost sendmail[65625]: g16HEgs9065623: to=<destuser@remhost.mydomain.com>,
ctladdr=<USER.ACCT@myhost.mydomain.com> (153/126), delay=00:00:03, xdelay=00:00:03, mailer=esmtp,
pri=120377, relay=remhost.mydomain.com. [192.168.0.1], dsn=2.0.0, stat=Sent (g16HNwC810485863 Message
accepted for delivery)
```

In this next example, the remote user `destuser@remhost.mydomain.com` is sending an incoming message to some user on the local HP e3000. The remote mail server that has connected to your local HP e3000 is remhost.mydomain.com, and its IP address is 192.168.0.1:

```
Feb 6 12:15:13 localhost sendmail[131160]: g16HFDs9131160: from=<destuser@remhost.mydomain.com>, size=31,
class=0, nrcpts=1, msgid=<200202061724.g16HOMLs065645@remhost.mydomain.com>, proto=ESMTP, daemon=MTA,
relay=remhost.mydomain.com [192.168.0.1]
```

The local Sendmail daemon has successfully delivered the incoming message to the local user USER.ACCT:

```
Feb 6 12:15:14 localhost sendmail[131161]: g16HFDs9131160: to=<USER.ACCT@myhost.mydomain.com>,
delay=00:00:01, xdelay=00:00:01, mailer=local, pri=30042, dsn=2.0.0, stat=Sent
```

For Further Information

- The HP CSY Sendmail web page of `http://jazz.external.hp.com/src/sendmail/`.
- The official Sendmail web site of `http://www.sendmail.org/`.
- Information about unsupported freeware versions of Sendmail for MPE/iX can be found at `http://www.bixby.org/mark/sendmailix.html`.
- Documentation files installed on your local machine with this distribution:
  - `/SENDMAIL/CURRENT/doc/op/op.ps` æ Sendmail Installation and Operation Guide
  - `/SENDMAIL/CURRENT/cf/README` æ Sendmail Configuration Files
  - `/SENDMAIL/CURRENT/man` æ directory tree containing man page documentation, i.e.,:

```
export MANPATH=/SENDMAIL/CURRENT/man:$MANPATH
man sendmail
```

- The HP3000-L mailing list where you can talk with other users of Sendmail on MPE/iX:
  - The official HP3000-L web site of `http://raven.utc.edu/Archives/hp3000-l.html`
  - The gatewayed Usenet newsgroup of `comp.sys.hp.mpe`.

A Samba for MPE/iX Sample Comfiguration File

The following is the sample configuration file `samp-smb.cnf` for Samba for MPE/iX that you can find in the `/usr/local/samba/lib` directory on the HP e3000 system:

```
# Sample config file for Samba for MPE/iX 0.7 and later”

# Copy this file to /usr/local/samba/lib/smb.conf and adjust as needed.
# You must at least adjust the “interfaces” directive to match
# your IP address and subnet mask (if used) as the current version
# of Samba for MPE/iX is unable to retrieve the NMMGR configured values.

# Some of the directives in this sample file are redundant because
# they explicitly specify hardcoded default values that would also
# be in effect if the directives were omitted. They are nevertheless
# included here to document their availability for customization.

# IMPORTANT WARNING: Some of the configuration options do have serious
# security implications and can cause risks or security holes if used
# improperly, especially when you decide to run the SMBD job under a
# user with PM (or even SM) capabilities or even select an SM capable
# user in the “guest account” directive.

# The documentation for smb.conf (available as man page in ../docs as
# well as HTML file in ../html) is thus STRONGLY RECOMMENDED reading!

# Also see the installation and configuration instructions for the
# different ways of running SMBD (i.e. with or without a PM user and
# even without PM program capabilities at all) and the associated
# tradeoffs between feature sets and security issues.
# ----------------------------------------------------------------------
# GLOBAL section (general parms and defaults for other sections)

[global]

# you MUST supply IP address and subnet mask of your 3000 here

 interfaces = 12.34.56.78/255.0.0.0

# config file and log file used by smbd and nmbd are typically
# specified as command line options, unless you are using macros
# like eg %S or %m to get different files for each service or
# client machine, which allows very sophisticated (albeit complex)
# configurations (also see “include” directive and smb.conf doc)

# config file = /usr/local/samba/lib/smb.conf
# log file = /usr/local/samba/var/log.smb

# mapping of incoming usernames is possible and may e.g. be used
# to allow clients using Unix or PC style names like root or lappel
# instead of MPE style names like manager.sys or lars.appel

# multiple alias names are possible e.g. lars.appel = lappel lars

 username map = /usr/local/samba/lib/user.map

# printcap file lists printer names for use by [printers] section

 printcap name = /usr/local/samba/lib/printcap

# how much detail you want in the logfile (try 3 or 5 or higher)

 debug level = 1

# can use a shell script if system does not supply statfs() routine

# dfree command = /usr/local/samba/lib/myfree

# used in conjunction with printcap file and [printers] section
```

```
 load printers = yes

# the workgroup that your server belongs to

 workgroup = SambaIX


# these can be used e.g. to create logon/logoff like console messages

# preexec = callci /usr/local/samba/lib/tellop tcon %S %u %m %I
# postexec = callci /usr/local/samba/lib/tellop tdis %S %u %m %I

# Deal “gracefully” with long file neames

  mangled name =yes

# Do not force downshift of all upper-case filenames to lower case
# else, copying directories fails (looks for upper case names)
   preserve case = yes
# Preserve case, even for 8.3 files
   short preserve case = yes


# shares may be configured to accept connections without a validated
# user id and password (similar to anonymous ftp) and then assume the
# guest logon identity for accessing files and printers

 guest account = mgr.samba
```

```
# ----------------------------------------------------------------------
# PRINTERS section (optional but useful)

# This section work in conjunction with the printcap file and allows
# to configure a large number of printer shares without having to add
# separate detailed sections for each of them. The printer names and
# optional aliases are listed in the printcap file and the config parms
# are defined here. Special printers can still be defined explicitly.

# Directive “load printers” makes all entries available for browsing.
# Directive “auto services” allows a more selective browse offering.

[printers]

# only want printer shares shown, not the [printers] section itself

 browseable = no

# enable this service for printing but not for file access

 print ok = yes
 write ok = no

# current version has problems with printing for non-guest users

 guest ok = yes
 guest only = yes

# the “staging” directory for print requests

 path = /usr/local/samba/spool

# permissions will be more meaningful when non-guest printing works

 create mode = 0700

# the lp family of print command only work as of MPE/iX release 5.5
# the rawlp utility sends file contents to spooler like “lp -oraw”

 print command = /usr/local/samba/lib/rawlp %s %p ; rm %s
```

```
# -----------------------------------------------------------------------
# HOMES section (optional but sometimes useful)

# This section provides access to user’s home directories without
# having to add a separate section for each of them. The share name
# is considered to be a valid user id and the path defaults to that
# user’s home directory. The share is created “on the fly” by using
# attributes from this section.

# Notice that home directories on MPE/iX are currently MPE groups
# and grant CD and TD permissions to every user (not just the user
# who belongs to this home group). This is equivalent to LISTFILE
# ability across the whole system (at least on group levels). Read
# or write access are nevertheless controlled by file system plus
# smb.conf security definitions.

# Notice further that either the connecting user or the user derived
# from the share name may be validated by the appropriate passwords.
# Thus it is possible e.g. for user lars.appel to connect to the home
# directory of manager.sys - with access rights bound by file system.

# Confusing, isn’t it? -- You might want to comment out [homes] thus.

[homes]

# only want home share shown, not the [homes] section itself

 browseable = no

# allowing guest logon is usually not desired for home directories

 guest ok = no

# write access is usually desired for home directories but keep in
# mind that there is also the file system permissions that decide
# if the connecting user (validated by password) may read or write

 write ok = yes

# this one attempts to restrict “cross access” e.g. the user lars.appel
# to the home of manager.sys -- but may cause problems for some clients

 valid users = %S
```

```
# --------------------------------------------------------------------

# OTHER sections (explicit definitions of file or printer shares)

# The writable shares are placed under an MPE group with space limit

[temp]

# multiple users share one server directory but independent file
# ownership is maintained so that they might be able to “see” other
# users’ files but still be unable to get read or write access

comment = Shared temp space for non-guest users

 guest ok = no
 write ok = yes

path = /SAMBA/SHR/temp

# Here is a sample configuration share that only allows the system
# manager like manager.sys to access the entire system files
#
#   comment = share for system manager to access the entire system
#
#    [root]
#
#    path   = /
#    browseable = no
#    guest ok = no
#    read only = no
#    force user = mamager.sys
#    only user = yes

# Here is a samle configuration share to allow the user to
# to access his or her home account
#    comment = share for user to access his or her home account
#
#    [acctname]
#    path = /ACCTNAME
#    guest ok = no
#    read only = no


[public]

# multiple users share one server directory but file ownership is
# forced to the guest logon identity resulting in every user being
# able to “see” as well as read or write the other users’s files

comment = Shared space with all users forced to guest

 guest ok = yes
 guest only = yes
 write ok = yes

path = /SAMBA/SHR/public

[sambadoc]

comment = Samba doc files (readonly but guest allowed)

 guest ok = yes
 write ok = no
 path = /usr/local/samba/docs


[sambahtm]


 comment = Samba HTML files (readonly but guest allowed)
 guest ok = yes
 write ok = no

 path = /usr/local/samba/docs/htmldocs

[sambaman]

 comment = Samba Man pages files (read only but guest allowed)

 guest ok= yes
 write ok = no

 path = /usr/local/samba/man
```

B BIND 8 Configuration File

The following is a dummy configuration file example. This explains in brief what each configuration directive is useful for and its syntax. All the directives are not required for a typical BIND configuration.

```
/*
* This is a worthless, nonrunnable example of a named.conf file that has
* every conceivable syntax element in use. We use it to test the parser.
* It could also be used as a conceptual template for users of new features.
*/

/*
* C-style comments are OK
*/

// So are C++-style comments

# So are shell-style comments

// watch out for “;” -- it’s important!

options {
         directory “.”;                      // use current directory
         named-xfer “/usr/libexec/named-xfer”; // _PATH_XFER
         dump-file “named_dump.db”;          // _PATH_DUMPFILE
         pid-file “/var/run/named.pid”;      // _PATH_PIDFILE
         statistics-file “named.stats”;      // _PATH_STATS
         check-names master fail;
         check-names slave warn;
         check-names response ignore;
         datasize default;
         stacksize default;
         coresize default;
         files unlimited;
         recursion yes;
         fetch-glue yes;
         fake-iquery no;
         notify yes;                    // send NOTIFY messages. You can set
                                        // notify on a zone-by-zone
                                        // basis in the “zone” statement
                                        // see (below)
         auth-nxdomain yes;             // always set AA on NXDOMAIN.
                                        // don’t set this to ‘no’ unless
                                        // you know what you’re doing -- older
                                        // servers won’t like it.
         multiple-cnames no;            // if yes, then a name my have more
                                        // than one CNAME RR. This use
                                        // is non-standard and is not
                                        // recommended, but it is available
                                        // because previous releases supported
                                        // it and it was used by large sites
                                        // for load balancing.
allow-query { any; };
allow-transfer { any; };
transfers-in 10;                        // DEFAULT_XFERS_RUNNING, cannot be
                                        // set > than MAX_XFERS_RUNNING (20)
transfers-per-ns 2;                     // DEFAULT_XFERS_PER_NS
transfers-out 0;                        // not implemented
max-transfer-time-in 120;               // MAX_XFER_TIME; the default number
                                        // of minutes an inbound zone transfer
                                        // may run. May be set on a per-zone
                                        // basis.

/*
 * The “transfer-format” option specifies the way outbound zone
 * transfers (i.e. from us to them) are formatted. Two values are
 * allowed:
 *
 *     one-answer                   Each RR gets its own DNS message.
 *                                  This format is not very efficient,
 *                                  but is widely understood.All
 *                                  versions of BIND prior to 8.1 generate
 *                                  this format for outbound zone
 *                                  and require it on inbound transfers.
 *
 *     many-answers                 As many RRs as will fit are put into
 *                                  each DNS message. This format is
 *                                  the most efficient, but is only known
 *                                  to work with BIND 8. Patches to
 *                                  BIND 4.9.5 named-xfer that enable it
 *                                  to understand 'many-answers' will be
 *                                  available.
 *
 * If you are going to be doing zone transfers to older servers, you
 * shouldn't use 'many-answers'. 'transfer-format' may also be set
 * on a host-by-host basis using the 'server' statement (see below).
 */
transfer-format one-answer;
query-source address * port *;
/*
 * The "forward" option is only meaningful if you've defined
 * forwarders. "first" gives the normal BIND
 * forwarding behavior, i.e. ask the forwarders first, and if that
 * doesn't work then do the full lookup. You can also say
 * "forward only;" which is what used to be specified with
 * "slave" or "options forward-only". "only" will never attempt
 * a full lookup; only the forwarders will be used.
 */
forward first;
forwarders { };                       // default is no forwarders
/*
 * Here's a forwarders example that isn't trivial
 */
/*
forwarders {
          1.2.3.4;
          5.6.7.8;
};
*/
topology { localhost; localnets; };   // prefer local nameservers
/*
 * Here's a more complicated topology example; it's commented out
 * because only one topology block is allowed.
 * topology {
          10/8;                       // prefer network 10.0.0.0
                                      // netmask 255.0.0.0 most
          !1.2.3/24;                  // don't like 1.2.3.0 netmask
                                      // 255.255.255.0 at all
          { 1.2/16; 3/8; };           // like 1.2.0.0 netmask 255.255.0.0
                                      // and 3.0.0.0 netmask 255.0.0.0
                                      // equally well, but less than 10/8
};
*/

listen-on port 53 { any; };         // listen for queries on port 53 on
                                    // any interface on the system
                                    // (i.e. all interfaces). The
                                    // "port 53" is optional; if you
                                    // don't specify a port, port 53
                                    // is assumed.
/*
 * Multiple listen-on statements are allowed. Here's a more
 * complicated example:
 */
/*
listen-on { 5.6.7.8; };              // listen on port 53 on interface
                                     // 5.6.7.8
listen-on port 1234 {                // listen on port 1234 on any
          !1.2.3.4;                  // interface on network 1.2.3
          1.2.3/24;                  // netmask 255.255.255.0, except for
};                                   // interface 1.2.3.4.
*/
```

```
/*
 * Interval Timers
 */
clean-interval 60;                    // clean the cache of expired RRs
                                      // every ‘clean-interval’ minutes
interface-interval 60;                // scan for new or deleted interfaces
                                      // every ‘interface-interval’ minutes
statistics-interval 60;               // log statistics every
                                      // ‘statistics-interval’ minutes
};

zone “master.demo.zone” {
          type master;                // what used to be called “primary”
          file “master.demo.zone”;
check-names fail;
allow-update { none; };
allow-transfer { any; };
allow-query { any; };
// notify yes;                        // send NOTIFY messages for this
                                      // zone? The global option is used
                                      // if “notify” is not specified
                                      // here.
also-notify { };                      // don’t notify any nameservers other
                                      // than those on the NS list for this
                                      // zone
};

zone “slave.demo.zone” {
          type slave;                 // what used to be called “secondary”
          file “slave.demo.zone”;
          masters {
               1.2.3.4;               // where to zone transfer from
               5.6.7.8;
};
          check-names warn;
          allow-update { none; };
          allow-transfer { any; };
          allow-query { any; };
          max-transfer-time-in 120;  // if not set, global option is used. also-notify {
};                      // don’t notify any nameservers other
                                      // than those on the NS list for this
                                      // zone
};

zone “stub.demo.zone” {
          type stub;                    // stub zones are like slave zones,
                                        // except that only the NS records
                                        // are transferred.
          file “stub.demo.zone”;
          masters {
               1.2.3.4;                 // where to zone transfer from
               5.6.7.8;
};
          check-names warn;
          allow-update { none; };
          allow-transfer { any; };
          allow-query { any; };
          max-transfer-time-in 120;    // if not set, global option is used.
};

zone “.” {
          type hint;                    // used to be specified w/ “cache”
          file “cache.db”;
};

acl can_query { !1.2.3/24; any; };      // network 1.2.3.0 mask 255.255.255.0
                                        // is disallowed; rest are OK
acl can_axfr { 1.2.3.4; can_query; };  // host 1.2.3.4 and any host allowed
                                        // by can_query are OK

zone “non-default-acl.demo.zone” {
          type master;
          file “foo”;
          allow-query { can_query; };
          allow-transfer { can_axfr; };
          allow-update {
               1.2.3.4;
               5.6.7.8;servers.
          };
};

key sample_key {                       // for TSIG; supported by parser
          algorithm hmac-md5;          // but not yet implemented in the
          secret “your secret here”;   // rest of the server
};

key key2 {
          algorithm hmac-md5;
          secret “ereh terces rouy”;
};

server 1.2.3.4 {
          bogus no;                    // if yes, we won’t query or listen
                                       // to this server
          transfer-format one-answer;  // set transfer format for this
                                       // server (see the description of
                                       // ‘transfer-format’ above)
                                       // if not specified, the global option
                                       // will be used
          transfers 0;                 // not implemented
          keys { sample_key; key2; };  // for TSIG; supported by the parser
                                       // but not yet implemented in the
                                       // rest of the server
};

logging {
          /*
           * All log output goes to one or more “channels”; you can make as
           * many of them as you want.
           */

          channel syslog_errors {       // this channel will send errors or
                  syslog user;          // or worse to syslog (user facility)
                  severity error;
          };

          /*
           * Channels have a severity level. Messages at severity levels
           * greater than or equal to the channel’s level will be logged on
           * the channel. In order of decreasing severity, the levels are:
           *
           *     critical               a fatal error
           * error
           * warning
           * notice                     a normal, but significant event
           * info                       an informational message
           * debug 1                    the least detailed debugging info
           * ...
           * debug 99                   the most detailed debugging info
           */

          /*
           * Here are the built-in channels:
           *
           *     channel default_syslog {
           *             syslog daemon;
           *             severity info;
           *     };
           *
           *     channel default_debug {
           *             file “named.run”;
           *             severity dynamic;   // this means log debugging
           *                                 // at whatever debugging level
           *                                 // the server is at, and don’t
           *                                 // log anything if not
           *                                 // debugging
```

```
 *     };
 *
 *     channel null {              // this is the bit bucket;
 *             file “/dev/null”    // any logging to this channel
 *                                 // is discarded.
 *
 };
 *
 *     channel default_stderr {    // writes to stderr
 *             file “<stderr>”;    // this is illustrative only;
 *                                 // there’s currently no way
 *                                 // of saying “stderr” in the
 *                                 // configuration language.
 *                                 // i.e. don’t try this at home.
 *             severity info; * };
 *
 *     default_stderr only works before the server daemonizes (i.e.
 *     during initial startup) or when it is running in foreground
 *     mode (-f command line option).
 */

/*
 * There are many categories, so you can send the logs
 * you want to see wherever you want, without seeing logs you
 * don’t want. Right now the categories are
 *
 *     default                 the catch-all. many things still
 *                             aren’t classified into categories, and
 *                             they all end up here. also, if you
 *                             don’t specify any channels for a
 *                             category, the default category is used
 *                             instead.
 *     config                  high-level configuration file
 *                             processing
 *     parser                  low-level configuration file processing
 *     queries                 what used to be called “query logging”
 *     lame-servers            messages like “Lame server on ...”
 *     statistics
 *     panic                   if the server has to shut itself
 *                             down due to an internal problem, it
 *                             logs the problem here (as well as
 *                             in the problem’s native category)
 *     update                  dynamic update
 *     ncache                  negative caching
 *     xfer-in                 zone transfers we’re receiving
 *     xfer-out                zone transfers we’re sending
 *     db                      all database operations
 *     eventlib                debugging info from the event system
 *                             (see below)
 *     packet                  dumps of packets received and sent
 *                             (see below)
 *     notify                  the NOTIFY protocol
 *     cname                   messages like “XX points to a CNAME”
 *     security                approved/unapproved requests
 *     os                      operating system problems
 *     insist                  consistency check failures
 *     maintenance             periodic maintenance
 *     load                    zone loading
 *     response-checks         messages like
 *                             “Malformed response ...”
 *                             “wrong ans. name ...”
 *                             “unrelated additional info ...”
 *                             “invalid RR type ...”
 *                             “bad referral ...”
 */

category parser {
       syslog_errors;            // you can log to as many channels
       default_syslog;           // as you want
};

category lame-servers { null; }; // don’t log these at all
```

```
          channel moderate_debug {
                  severity debug 3;         // level 3 debugging to file
                  file “foo”;               // foo
                  print-time yes;           // timestamp log entries
                  print-category yes;       // print category name
                  print-severity yes;       // print severity level
                  /*
                   * Note that debugging must have been turned on either
                   * on the command line or with a signal to get debugging
                   * output (non-debugging output will still be written to
                   * this channel).
                   */
          };

          /*
           * If you don’t want to see “zone XXXX loaded” messages but do
           * want to see any problems, you could do the following.
           */
          channel no_info_messages {
                  syslog;
                  severity notice;
          };

          category load { no_info_messages; };

          /*
           * You can also define category “default”; it gets used when no
           * “category” statement has been given for a category.
           */
          category default {
                   default_syslog;
                   moderate_debug;
          };

          /*
           * If you don’t define category default yourself, the default
           * default category will be used. It is
           *
           *     category default { default_syslog; default_debug; };
           */

          /*
           * If you don’t define category panic yourself, the default
           * panic category will be used. It is
           *
            *     category panic { default_syslog; default_stderr; };
           */

          /*
           * Two categories, ‘packet’ and ‘eventlib’, are special. Only one
           * channel may be assigned to each of them, and it must be a
           * file channel. If you don’t define them yourself, they default to
           *
           *     category eventlib { default_debug; };
           *
           * category packet { default_debug; };
           */
};

include “filename”;                         // can’t do within a statement
```

C BIND 8.1 Enhanced Features

The following points are explained in this appendix.

1. BIND 8 highlights
2. BIND Configuration File Guide — Logging Statement
3. BIND Configuration File Guide — Zone Statement
4. BIND Configuration File Guide — Option Statement
5. Converting From BIND 4.9.x

BIND 8 Highlights

- DNS Dynamic Updates (RFC 2136)
- DNS Change Notification (RFC 1996)
- Completely new configuration syntax
- Flexible, categorized logging system
- IP-address-based access control for queries, zone transfers, and updates that may be specified on a zone-by-zone basis
- More efficient zone transfers
- Improved performance for servers with thousands of zones
- The server no longer forks for outbound zone transfers
- Many bug fixes

BIND 8 is much more configurable than the previous release of BIND. There are entirely new areas of configuration, such as access control lists and categorized logging. Many options that previously applied to all zones can now be used selectively. These features, plus a consideration of future configuration needs led to the creation of a new configuration file format.

BIND Configuration File Guide — Logging Statement

Syntax

```
logging {
  [ channel channel_name {
     ( file path_name
        [ versions ( number | unlimited ) ]
        [ size size_spec ]
      | syslog ( kern | user | mail | daemon | auth | syslog | lpr |
        news | uucp | cron | authpriv | ftp |
        local0 | local1 | local2 | local3 |
        local4 | local5 | local6 | local7 )
   | null );
[ severity ( critical | error | warning | notice |
             info | debug [ level ] | dynamic ); ]
  [ print-category yes_or_no; ]
  [ print-severity yes_or_no; ]
  [ print-time yes_or_no; ]
  }; ]
[ category category_name {
  channel_name; [ channel_name; ... ]
  }; ]
  ...
};
```

Definition and Usage

The logging statement configures a wide variety of logging options for the nameserver. Its channel phrase associates output methods, format options and severity levels with a name that can then be used with the category phrase to select how various classes of messages are logged.

Only one logging statement is used to define as many channels and categories as are wanted. If there are multiple logging statements in a configuration, the first defined determines the logging, and warnings are issued for the others. If there is no logging statement, the logging configuration will be:

```
logging {
     category default { default_syslog; default_debug; };
     category panic { default_syslog; default_stderr; };
     category packet { default_debug; };
     category eventlib { default_debug; };
};
```

The Channel Phrase

All log output goes to one or more “channels”; make as many of them as you want.

Every channel definition must include a clause that says whether messages selected for the channel go to a file, to a particular syslog facility, or are discarded. It can optionally also limit the message severity level that will be accepted by the channel (default is “info”), and whether to include a named generated time stamp, the category name and/or severity level (default is not to include any).

The word null as the destination option for the channel will cause all messages sent to it to be discarded; other options for the channel are meaningless.

The file clause can include limitations both on how large the file is allowed to become, and how many versions of the file will be saved each time the file is opened.

The size option for files is simply a hard ceiling on log growth. If the file ever exceeds the size, then named will just not write anything more to it until the file is reopened; exceeding the size does not automatically trigger a reopen. The default behavior is to not limit the size of the file.

If you use the version logfile option, then named will retain many backup versions of the file by renaming them when opening. For example, if you choose to keep 3 old versions of the file “`lamers.log`” then just before it is opened `lamers.log.1` is renamed to `lames.log.2`, `lamers.log.0` is renamed to `lamers.log.1`, and `lamers.log` is renamed to `lamers.log.0`. No rolled versions are kept by default. The unlimited keyword is synonymous with 99 in current BIND releases.

The argument for the syslog clause is a syslog facility described earlier in this manual. How syslog will handle messages sent to this facility is described under `syslog.conf` earlier in this manual. If you have a system which uses a very old version of syslog and that only uses two arguments to the openlog() function, then this clause is silently ignored.

The severity clause works like syslog’s “priorities”, except that they can also be used if you are writing straight to a file rather than using syslog. Messages which are not at least of the severity level given will not be selected for the channel; messages of higher severity levels will be accepted.

If you are using syslog, then the `syslog.conf` priorities will also determine what eventually passes through. For example, defining a channel facility and severity as daemon and debug but only logging `daemon.warning` via `syslog.conf` will cause messages of severity information and notice to be dropped. If the situation were reversed, with `named` writing messages of only warning or higher, then syslog would print all messages it received from the channel.

The server can supply extensive debugging information when it is in debugging mode. If the server's global debug level is greater than zero, then debugging mode will be active. The global debug level is set either by starting the server with the "-d" flag followed by a positive integer, or by sending the server the `SIGUSR1` signal (for example, by using "ndc trace"). The global debug level can be set to zero, and debugging mode turned off, by sending the server the `SIGUSR2` signal ("ndc notrace". All debugging messages in the server have a debug level, and higher debug levels give more detailed output. Channels that specify a specific debug severity, for example,

```
      channel specific_debug_level {
          file “foo”;
          severity debug 3;
      };
```

will get debugging output of level 3 or less any time the server is in debugging mode, regardless of the global debugging level. Channels with dynamic severity use the server's global level to determine what messages to print.

If `print-time` has been turned on, then the date and time will be logged. `print-time` may be specified for a syslog channel, but is usually pointless since syslog also prints the date and time. If `print-category` is requested, then the category of the message will be logged as well. Finally, if `print-severity` is on, then the severity level of the message will be logged. The print options may be used in any combination, and will always be printed in the following order: time, category, and severity. Here is an example where all three print options are on:

```
          28-Apr-1997 15:05:32.863 default: notice: Ready to answer queries.
```

There are four predefined channels that are used for `named's` default logging as follows. How they are used is described in the next section, The category phrase.

```
      channel default_syslog {
         syslog daemon;          # send to syslog’s daemon facility
         severity info;          # only send priority info and higher
      };

     channel default_debug {
        file “named.run”;        # write to named.run in the working directory
                                 # Note: stderr is used instead of “named.run”
                                 # if the server is started with the “-f” option.
severity dynamic; # log at the server’s current debug level };

     channel default_stderr {    # writes to stderr
        file “<stderr>”;         # this is illustrative only; there’s currently
                                 # no way of specifying an internal file
                                 # descriptor in the configuration language.
     severity info;              # only send priority info and higher
     };

     channel null {
        null;                    # toss anything sent to this channel
     };
```

Once a channel is defined, it cannot be redefined. Thus you cannot alter the built-in channels directly, but you can modify the default logging by pointing categories at channels you have defined.

The Category Phrase

There are many categories, so you can send the logs you want to see wherever you want, without seeing logs you don't want. If you don't specify a list of channels for a category, then log messages in that category will be sent to the default category instead. If you don't specify a default category, the following "default" is used:

```
     category default { default_syslog; default_debug; };
```

As an example, you want to log security events to a file, but you also want keep the default logging behavior. You'd specify the following:

```
     channel my_security_channel {
         file “my_security_file”;
         severity info
     };
     category security { my_security_channel; default_syslog; default_debug; };
```

To discard all messages in a category, specify the null channel:

```
     category lame-servers { null; };
     category cname { null; };
```

The following categories are available:

`default`	The catch-all. Many things still aren't classified into categories, and they all end up here. Also, if you don't specify any channels for a category, the default category is used instead. If you do not define the default category, the following definition is used: `category default { default_syslog; default_debug; };`
`config`	High-level configuration file processing.
`parser`	Low-level configuration file processing.
`queries`	A short log message is generated for every query the server receives.
`lame-servers`	Messages like “Lame server on ...”
`statistics`	Statistics.
`panic`	If the server has to shut itself down due to an internal problem, it will log the problem in this category as well as in the problem's native category. If you do not define the panic category, the following definition is used: `category panic { default_syslog; default_stderr; };`
`update`	Dynamic updates.
`ncache`	Negative caching.
`xfer-in`	Zone transfers the server is receiving.
`xfer-out`	Zone transfers the server is sending.
`db`	All database operations.
`eventlib`	Debugging info from the event system. Only one channel may be specified for this category, and it must be a file channel. If you do not define the `eventlib` category, the following definition is used: `category eventlib { default_debug; };`
`packet`	Dumps of packets received and sent. Only one channel may be specified for this category, and it must be a file channel. If you do not define the packet category, the following definition is used: `category packet { default_debug; };`
`notify`	The NOTIFY protocol.
`cname`	Messages like “... points to a CNAME”.
`security`	Approved/unapproved requests.
`os`	Operating system problems.

`insist`	Internal consistency check failures.
`maintenance`	Periodic maintenance events.
`load`	Zone loading messages.
`response-checks`	Messages arising from response checking, such as "Malformed response ...", "wrong ans. name ...", "unrelated additional info ...", "invalid RR type ...", and "bad referral ...".

BIND Configuration File Guide—Zone Statement

Syntax

```
zone domain_name [ ( in | hs | hesiod | chaos ) ] {
     type master;
     file path_name;
     [ check-names ( warn | fail | ignore ); ]
     [ allow-update { address_match_list }; ]
     [ allow-query { address_match_list }; ]
     [ allow-transfer { address_match_list }; ]
     [ notify yes_or_no; ] [ also-notify { ip_addr; [ ip_addr; ... ] };
};
```

```
zone domain_name [ ( in | hs | hesiod | chaos ) ]
     { type ( slave | stub );
     [ file path_name; ]
     masters { ip_addr; [ ip_addr; ... ] };
     [ check-names ( warn | fail | ignore ); ]
     [ allow-update { address_match_list }; ]
     [ allow-query { address_match_list }; ]
     [ allow-transfer { address_match_list }; ]
     [ max-transfer-time-in number; ]
     [ notify yes_or_no; ]
     [ also-notify { ip_addr; [ ip_addr; ... ] };
};
```

```
zone "." [ ( in | hs | hesiod | chaos ) ] {
     type hint;
     file path_name;
     [ check-names ( warn | fail | ignore ); ]
};
```

Definition and Usage (Zone Types)

`master`	The master copy of the data in a zone.
`slave`	A slave zone is a replica of a master zone. The masters list specifies one or more IP addresses that the slave contacts to update its copy of the zone. If file is specified, then the replica will be written to the file. Use of file is recommended, since it often speeds server startup and eliminates a needless waste of bandwidth.
`stub`	A stub zone is like a slave zone, except that it replicates only the NS records of a master zone instead of the entire zone.
`hint`	The initial set of root nameservers is specified using a hint zone. When the server starts up, it uses the root hints to find a root nameserver and get the most recent list of root nameservers.

NOTE Previous releases of BIND used the term primary for a master zone, secondary for a slave zone, and cache for a hint zone.

Class

The zone's name may optionally be followed by a class. If a class is not specified, class in is used.

Options

`check-names`	See Name Checking.
`allow-query`	See the description of allow-query in the Access Control section.
`allow-update`	Specifies which hosts are allowed to submit Dynamic DNS updates to the server. The default is to deny updates from all hosts.
`allow- transfer`	See the description of allow-transfer in the Access Control section.
`max-transfer-time-in`	See the description of `max-transfer-time-in` in the Zone Transfers section.
`notify`	See the description of notify in the Boolean Options section.
`also-notify`	`also-notify` is only meaningful if notify is active for this zone. The set of machines that will receive a DNS NOTIFY message for this zone is made up of all the listed nameservers for the zone (other than the primary master) plus any IP addresses specified with `also-notify`. `also-notify` is not meaningful for stub zones. The default is the empty list.

BIND Configuration File Guide — Options Statement

Syntax

```
options {
     [ directory path_name; ]
     [ named-xfer path_name; ]
     [ dump-file path_name; ]
     [ memstatistics-file path_name; ]
     [ pid-file path_name; ]
     [ statistics-file path_name; ]
     [ auth-nxdomain yes_or_no; ]
     [ deallocate-on-exit yes_or_no; ]
     [ fake-iquery yes_or_no; ]
     [ fetch-glue yes_or_no; ]
     [ host-statistics yes_or_no; ]
     [ multiple-cnames yes_or_no; ]
     [ notify yes_or_no; ]
     [ recursion yes_or_no; ]
     [ forward ( only | first ); ]
     [ forwarders { [ in_addr ; [ in_addr ; ... ] ] }; ]
     [ check-names ( master | slave | response ) ( warn | fail | ignore); ]
     [ allow-query { address_match_list }; ]
     [ allow-transfer { address_match_list }; ]
     [ listen-on [ port ip_port ] { address_match_list }; ]
     [ query-source [ address ( ip_addr | * ) ]
     [ port ( ip_port | * ) ] ; ]
     [ max-transfer-time-in number; ]
     [ transfer-format ( one-answer | many-answers ); ]
     [ transfers-in number; ]
     [ transfers-out number; ]
     [ transfers-per-ns number; ]
     [ coresize size_spec ; ]
     [ datasize size_spec ; ]
     [ files size_spec ; ]
     [ stacksize size_spec ; ]
     [ cleaning-interval number; ]
     [ interface-interval number; ]
     [ statistics-interval number; ]
     [ topology { address_match_list }; ]
};
```

Definition and Use

The options statement sets up global options to be used by BIND. This statement may appear at only once in a configuration file; if more than one occurrence is found, the first occurrence determines the actual options used, and a warning will be generated. If there is no options statement, an options block with each option set to its default will be used.

Pathnames

`directory`	The working directory of the server. Any non-absolute pathnames in the configuration file will be taken as relative to this directory. The default location for most server output files, for example, "`named.run`" is this directory. If a directory is not specified, the working directory defaults to ".", the directory from which the server was started. The directory specified should be an absolute path.
`named-xfer`	The pathname to the `named-xfer` program that the server uses for inbound zone transfers. If not specified, the default is system dependent for example, "`/usr/sbin/named-xfer`".
`dump-file`	The pathname of the file the server dumps the database to when it receives `SIGINT` signal (`ndc dumpdb`). If not specified, the default is "`named_dump.db`".
`memstatistics-file`	The pathname of the file the server writes memory usage statistics to on exit, if `deallocate-on-exit` is yes. If not specified, the default is "`named.memstats`".
`pid-file`	The pathname of the file the server writes its process ID in. If not specified, the default is operating system dependent, but is usually "`/var/run/named.pid`" or "`/etc/named.pid`". The pid-file is used by programs like "`ndc`" that want to send signals to the running nameserver.

`statistics-file`	The pathname of the file the server appends statistics to when it receives `SIGILL` signal (ndc stats). If not specified, the default is "`named.stats`".

Boolean Options

`auth-nxdomain`	If yes, then the `AA` bit is always set on `NXDOMAIN` responses, even if the server is not actually authoritative. The default is yes. Do not turn off `auth-nxdomain` unless you are sure you know what you are doing, as some older software won't like it.
`deallocate-on-exit`	If yes, then when the server exits it will painstakingly deallocate every object it allocated, and then write a memory usage report to the `memstatistics-file`. The default is no, because it is faster to let the operating system clean up. `deallocate-on-exit` is handy for detecting memory leaks.
`fake-iquery`	If yes, the server will simulate the obsolete DNS query type `IQUERY`. The default is no.
`fetch-glue`	If yes (the default), the server will fetch "glue" resource records it doesn't have when constructing the additional data section of a response. `fetch-glue no` can be used in conjunction with `recursion no` to prevent the server's cache from growing or becoming corrupted (at the cost of requiring more work from the client).
`host-statistics`	If yes, then statistics are kept for every host that the nameserver interacts with. The default is no.

NOTE Turning on host-statistics can consume huge amounts of memory.

`multiple-cnames`	If yes, then multiple `CNAME` resource records will be allowed for a domain name. The default is no. Allowing multiple `CNAME` records is against standards and is not recommended. Multiple `CNAME` support is available because previous versions of BIND allowed multiple `CNAME` records, and these records have been used for load balancing by a number of sites.
`notify`	If yes (the default), `DNS NOTIFY` messages are sent when a zone the server is authoritative for changes. The use of `NOTIFY` speeds convergence between the master and its slaves. Slave servers that receive a `NOTIFY` message and understand it, will contact the master server for the zone and see if they need to do a zone transfer, and if they do, they will initiate it immediately. The notify option may also be specified in the zone statement, in which case it overrides the options notify statement.
`recursion`	If yes, and a DNS query requests recursion, then the server will attempt to do all the work required to answer the query. If recursion is not on, the server will return a referral to the client if it doesn't know the answer. The default is yes. See also `fetch-glue`.

Forwarding

The forwarding facility can be used to create a large sitewide cache on a few servers, reducing traffic over links to external nameservers. It can also be used to allow queries by servers that do not have direct access to the Internet, but wish to look up exterior names anyway. Forwarding occurs only on those queries for which the server is not authoritative and does not have the answer in its cache.

`forward`	This option is only meaningful if the forwarders list is not empty. A value of first, the default, causes the server to query the forwarders first, and if that doesn't answer the question the server will then look for the answer itself. If only is specified, the server will only query the forwarders.
`forwarders`	Specifies the IP addresses to be used for forwarding. The default is the empty list (no forwarding).

Future versions of BIND 8 will provide a more powerful forwarding system. The syntax described above will continue to be supported.

Name Checking

The server can check domain names based upon their expected client contexts. For example, a domain name used as a hostname can be checked for compliance with the RFCs defining valid hostnames.

Three checking methods are available:

`ignore`	No checking is done.
`warn`	Names are checked against their expected client contexts. Invalid names are logged, but processing continues normally.
`fail`	Names are checked against their expected client contexts. Invalid names are logged, and the offending data is rejected.

The server can check names in three areas; master zone files, slave zone files, and in responses to queries the server has initiated. If `check-names response fail` has been specified, and answering the client's question would require sending an invalid name to the client, the server will send a `REFUSED` response code to the client.

The defaults are:

```
check-names master fail;
check-names slave warn;
check-names response ignore;
```

`check-names` may also be specified in the zone statement, in which case it overrides the options `check-names` statement. When used in a zone statement, the area is not specified (because it can be deduced from the zone type).

Access Control

Access to the server can be restricted based on the IP address of the requesting system. See `address_match_list` for details on how to specify IP address lists.

`allow-query`	Specifies which hosts are allowed to ask ordinary questions. `allow-query` may also be specified in the zone statement, in which case it overrides the options `allow-query` statement. If not specified, the default is to allow queries from all hosts.
`allow-transfer`	Specifies which hosts are allowed to receive zone transfers from the server. `allow-transfer` may also be specified in the zone statement, in which case it overrides the options `allow-transfer` statement. If not specified, the default is to allow transfers from all hosts.

Interfaces

The interfaces and ports that the server will answer queries from may be specified using the `listen-on` option. `listen-on` takes an optional port, and an `address_match_list`. The server will listen on all interfaces allowed by the address match list. If a port is not specified, port 53 will be used.

Multiple `listen-on` statements are allowed. For example:

```
listen-on { 5.6.7.8; };
listen-on port 1234 { !1.2.3.4; 1.2/16; };
```

If no `listen-on` is specified, the server will listen on port 53 on all interfaces.

Query Address

If the server doesn't know the answer to a question, it will query other nameservers. `query-source` specifies the address and port used for such queries. If address is * or is omitted, a wildcard IP address (`INADDR_ANY`) will be used. If port is * or is omitted, a random unprivileged port will be used. The default is

```
query-source address * port *;
```

NOTE Query-source currently applies only to UDP queries; TCP queries always use a wildcard IP address and a random unprivileged port.

Zone Transfers

`max-transfer-time-in`	Inbound zone transfers (`named-xfer` processes) running longer than this many minutes will be terminated. The default is 120 minutes (2 hours).
`transfer-format`	The server supports two zone transfer methods. `one-answer` uses one DNS message per resource record transferred. `many-answers` packs as many resource records as possible into a message. `many-answers` is more efficient, but is only known to be understood by BIND 8.1 and patched versions of BIND 4.9.5. The default is `one-answer`. `transfer-format` may be overridden on a `per-server` basis by using the server statement.
`transfers-in`	The maximum number of inbound zone transfers that can be running concurrently. The default value is 10. Increasing `transfers-in` may speed up the convergence of slave zones, but it also may increase the load on the local system.
`transfers-out`	This option will be used in the future to limit the number of concurrent outbound zone transfers. It is checked for syntax, but is otherwise ignored.
`transfers-per-ns`	The maximum number of inbound zone transfers (`named-xfer` processes) that can be concurrently transferring from a given remote nameserver. The default value is 2. Increasing `transfers-per-ns` may speed up the convergence of slave zones, but it also may increase the load on the remote nameserver. `transfers-per-ns` may be overridden on a `per-server` basis by using the transfers phrase of the server statement.

Resource Limits

The server's usage of many system resources can be limited. Some operating systems don't support some of the limits. On such systems, a warning will be issued if the unsupported limit is used. Some operating systems don't support limiting resources, and on these systems a cannot set resource limits on this system message will be logged.

Scaled values are allowed when specifying resource limits. For example, `1G` can be used instead of `1073741824` to specify a limit of one gigabyte. unlimited requests unlimited use, or the maximum available amount. default uses the limit that was in force when the server was started. See `size_spec` for more details.

`coresize`	The maximum size of a core dump. The default is default.
`datasize`	The maximum amount of data memory the server may use. The default is default.
`files`	The maximum number of files the server may have open concurrently. The default is unlimited.

NOTE	On some operating systems the server cannot set an unlimited value and cannot determine the maximum number of open files the kernel can support. On such systems, choosing unlimited will cause the server to use the larger of the rlim_max for RLIMIT_NOFILE and the value returned by sysconf (_SC_OPEN_MAX). If the actual kernel limit is larger than this value, use limit files to specify the limit explicitly.

`stacksize`	The maximum amount of stack memory the server may use. The default is default.

Periodic Task Intervals

`cleaning-interval`	The server will remove expired resource records from the cache every `cleaning-interval` minutes. The default is 60 minutes. If set to 0, no periodic cleaning will occur.
`interface-interval`	The server will scan the network interface list every `interface-interval` minutes. The default is 60 minutes. If set to 0, interface scanning will only occur when the configuration file is loaded. After the scan, listeners will be started on any new interfaces (provided they are allowed by the `listen-on` configuration). Listeners on interfaces that have gone away will be cleaned up.
`statistics-interval`	Nameserver statistics will be logged every `statistics-interval` minutes. The default is 60. If set to 0, no statistics will be logged.

Topology

All other things being equal, when the server chooses a nameserver to query from a list of nameservers, it prefers the one that is topologically closest to itself. The topology statement takes an `address_match_list` and interprets it in a special way. Each top-level list element is assigned a distance. Non-negated elements get a distance based on their position in the list, where the closer the match is to the start of the list, the shorter the distance is between it and the server. A negated match will be assigned the maximum distance from the server. If there is no match, the address will get a distance which is further than any non-negated list element, and closer than any negated element. For example,

```
topology {
   10/8;
   !1.2.3/24;
   { 1.2/16; 3/8; };
};
```

will prefer servers on network 10 the most, followed by hosts on network `1.2.0.0` (netmask `255.255.0.0`) and network `3`, with the exception of hosts on network 1.2.3 (netmask `255.255.255.0`), which is preferred least of all.

The default topology is

```
topology { localhost; localnets; };
```

Converting From BIND 4.9.x

BIND 4.9.x configuration files can be converted to the new format by using `src/bin/named/named-bootconf.pl`, a perl script that is part of the BIND 8.1 source kit.

D Server Configuration Migration

There is a host of configuration migration utility available now. If you want to convert `4.x named.boo`t files to `8.x named.conf` files, there is a perl script, `named-bootconf.p`l available on the system. This perl script file resides in `/BIND/PUB/bin` directory.

Explanation of configuration migration utilities;

The `named-bootconf.p`l is a perl script. Perl is a scripting language, like a shell script, it runs under an interpreter environment on MPE. The interpreter is a shareware, we require the Perl version 5 as the interpreter. The binary file for Perl version 5 can be downloaded from `http://jazz.external.hp.com`.

“Perl” is packaged as a mover archive. This has to be installed on the MPE machine. “Mover” is a archiving program which is available on `http://jazz.external.hp.com`. “Mover” will unarchive the “perl” package which is in mover formal and install at the correct place. One has to log on as `MANAGER.SYS` to do this. The files are stored in `/usr/local/bin` and `/usr/local/lib/perl5` interpreter.

E Configure and Run Syslog/iX

How to Run Syslog/iX:

1. Log on as `mgr.syslog`.
2. Examine `syslog.conf` and customize for your own environment.
3. :stream `JSYSLOGD.PUB.SYSLOG`.
4. Stop Syslog/iX by issuing the command `:ABORTJOB`.##

```
##
## :TELL @.@
##
*.emerg    *
##
## Write to the :CONSOLE
##
*.alert     /dev/console
##
## :TELL @.SYSLOG
##
*.crit           @.SYSLOG
##
## :TELL MANAGER.SYS
##
*.err       MANAGER.SYS
##
## Forward to syslogd on another host via UDP
##
*.warning    @some.host.running.syslogd
##
## Write to the :CONSOLE
*.info           /dev/console
##
## Write to a file
##
*.debug /tmp/syslog.log
```

The messages coming from a program are classified into **critical, informative**, **alert**, **error**, **emergency** etc. The syslog configuration file tells the syslog daemon how to post these messages. They could be sent to the console or to a log file, a printer, a message sent to an administrator or to another machine. SYSLOG uses UDP to send to another machine.

Explanation of parameters in syslog configuration file:

Syslog has a set of parameters that can be configured. Messages are classified into several levels. These messages can be directed to different outputs like console, logfile and so forth. They can also be sent to another machine which runs a syslog daemon.

They are classified as follows:

debug

info

error

critical

warning

alert

emergency

Now these messages could also be sent to a particular user by using the “tell” option followed by the user name.

They can also be sent to another machine by using `“@machine name”`.

A

address An identifier defined and used by a particular protocol and associated software to distinguish one node from another.

address resolution In NS networks, the mapping of node names to IP addresses and the mapping of IP addresses to subnet addresses. *See also* **probe protocol**, **ARP**.

alias A character string that is used as an alternate name for a protocol or a node.

ARP Address Resolution Protocol. ARP provides IP to LAN station address resolution for Ethernet nodes on a LAN.

ARPA Advanced Research Projects Agency.

ARPANET The computer network of the Advanced Research Projects Agency.

ASCII American National Standard Code for Information Interchange. A character set using 7-bit code used for information interchange among data processing and data communications systems. The American implementation of International Alphabet No. 5.

B

binary mode Data transfer scheme in which no special character processing is performed. All characters are considered to be data and are passed through with no control actions being taken.

bind A system call that assigns a specific name and unique address to a socket, turning a socket (which is one end-point of the connection) into an actual file. Binding allows servers to register well-known addresses with the system and each client to register a specific address for itself. *See also* socket and well-known addresses.

bootp Internet Boot Protocol (BOOTP) used to start, or boot, LAN devices such as routers, printers, X-terminals, and diskless workstations.

BOOTPTAB.NET.SYS The configuration file for the Bootstrap protocol daemon, `bootpd`, that contains client and relay information.

C

client A node on the internetwork that asks to use one of the Internet Services on the host. For example, a Telnet client is the process that uses Telnet protocol to establish a virtual terminal on your system.

D

daemon A process that either waits for the occurrence of an event or waits to perform some specificied task on a periodic basis. Daemons are typically started once, on system startup, and they frequently start other processes to handle service requests. The Internet daemon `inetd` is a good example of such a process.

datagram A message consisting of content *and* all of the information needed to deliver the content between one system and another. Datagrams are sent using the User Datagram Protocol, or UDP. *See also* **UDP**.

datagram service A connectionless service that transmits messages, or datagrams, from one system to another. Because datagrams are transmitted without relying on a pre-established network connection (hence the term *connectionless*), each datagram must contain all the information required for its delivery. The protocol associated with datagram service is UDP, or User Datagram Protocol. *See also* **datagram**, **protocol**, and **UDP**.

DCE Data circuit-terminating equipment. The interfacing equipment required in order to interface to data terminal equipment (DTE) and its transmission circuit. Synonyms: data communications equipment, dataset.

domain name A name designated for a system in ARPANET standard format. This name can be used by other nodes on the network to access the host for which it is configured.

DTC Datacommunications and Terminal Controller. The DTC is a hardware device, configured as a node on a LAN, that enables asynchronous devices to access HP e3000 computers. Terminals can either be directly connected to the DTC, or they can be remotely connected through a Packet Assembler Disassembler (PAD). The DTC can be configured with DTC/X.25 Network Access cards and DTC/X.25

Network Access software. A DTC/X.25 iX Network Link consists of two software modules: the X.25 iX System Access software (on the host) and the DTC/X.25 Network Access software (on the DTC).

DTC Telnet Access An HP product providing Telnet connections from HP 9000 and non-HP systems running ARPA standard Telnet services to the HP e3000. The solution includes a Telnet Access Card (TAC) that resides in the DTC 72MX or DTC 48 and provides protocol conversion between Telnet and Avesta Flow Control Protocol (AFCP). Equivalent functionality is provided by a separate product, the Telnet Express Box (TEB).

DTE Data Terminal Equipment. Equipment that converts user information into data transmission signals or reconverts received data signals into user information. Data terminal equipment operations in conjunction with data circuit-terminating equipment.

E

environment A session that is established on a remote node.

Ethernet A Local Area Network system that uses baseband transmission at 10 Mbps over coaxial cable. Ethernet is a trademark of Xerox Corporation.

F

file equation An assignment statement that is used to associate a file with a specific device or type of device during execution of a program.

flow control A means of regulating the rate at which data transfer takes place between devices to protect against data overruns.

FTP File Transfer Protocol. The Internet Services protocol that facilitates the transfer of files between systems. Originally developed by the Advanced Research Projects Agency (ARPA).

H

host computer A computer on which network communications software resides, and which is currently providing a service to a requesting client.

HOSTS.NET.SYS The host name data base file which associates Internet addresses with official host names and aliases.

I

IEEE 802.3 A standard for a broadcast local area network published by the Institute for Electrical and Electronics Engineers (IEEE). This standard is used for both the ThinLAN and ThickLAN implementations of the Local Area Network (LAN).

inetd The Internet server that allows one daemon to invoke many servers, thus reducing load on the system. Normally started at system boot time, only one `inetd` can run at any given time.

INETDCNF.NET.SYS The configuration file for the Internet daemon `inetd`, which determines which installed Internet Services are available to users.

INETDSEC.NET.SYS The optional security file for `inetd`, which lets you control access to individual services to specific accounts, groups, or users.

internet An aggregation of computer systems and other types of computing equipment that share information according to a set of defined communications protocols. Local networks, such as all computer systems linked together within a company, are typically linked to other local networks via the Internet. Or, individual systems which are not part of a local network, such as a personal computer or a standalone business computing system, can exchange information via the Internet if they are equipped with the appropriate communications software and hardware.

Internet Protocol (IP). A set of rules used to route information between different local networks in an internetwork, as well as among nodes in the same local network. The internet protocol corresponds to layer three, the network layer, of the OSI model. *See also* **IP address**.

IP address Internet Protocol address. An address used by the Internet Protocol to route information. A complete IP address comprises a network portion and a subnet portion to identify a specific network, and a node portion to identify a node within that network.

L

local host The host system you are currently working from.

local node Same as host system.

loopback The routing of messages from a node back to itself.

N

name space The set of possible names allowed in a given environment. The POSIX name space, which follows hierarchical file system syntax (i.e., `\sys\pub\myfile`) is distinct from the MPE/iX name space, which follows MPE naming rules (i.e., `MYFILE.PUB.SYS`).

network address Either the network portion of an IP address (as opposed to the node portion) or a node's X.25 address when referring to X.25 networks.

network directory A file containing information required for one node to communicate with other nodes in 1) an internetwork, 2) an X.25 network, or 3) a network that contains non-HP nodes. The active network directory on a node must be named `NSDIR.NET.SYS`.

NI *See* **Network Interface**.

Network Interface The collection of software that enables data communication between a system and a network. A node possesses one or more network interfaces for each of the networks to which it belongs. Examples of network interfaces include Local Area Networks (LANs), point-to-point (router), X.25, token ring, SNA, loopback, and gateway half. The maximum number of supportable network interfaces is 12, one of which is reserved for loopback.

Network Services Software application products that can be used to access data, initiate processes, and exchange information among nodes in the network. The NS 3000/iX Network Services include RPM, VT, RFA, RDBA, and NFT.

NMCONFIG.PUB.SYS The file that contains all the network configuration data for the HP e3000 computer on which it resides. It includes information about the clients that can access the system as well as information about any Network Services (NS) products running on the system. This is the only file name allowed.

NMMAINT Node Management services MAINTenance utility. A utility that lists the software module version numbers for all HP AdvanceNet products, including NS 3000/iX. It detects missing or invalid software modules.

NMMGR Node Management Services Configuration Manager. A software subsystem that enables you to configure network connectivity and access parameters for an HP e3000 computer.

NMMGRVER Node management services conversion utility. A conversion program that converts configuration files created with NMMGR from an earlier version to the latest format.

node A computer that is part of a network. The DTC, or Datacommunications and Terminal Controller that enables asynchronous devices to access the HP e3000, is also considered to be a node and has its own address.

node address The node portion of an Internet Protocol (IP) address.

Node Management Services Configuration Manager See NMMGR.

node name A character string that uniquely identifies each system in a network or internetwork. Each node name in a network or internetwork must be unique; however, a single node can be identified by more than one node name.

NS See Network Services.

NS 3000/iX Link Software and hardware that provides the connection between nodes on a network. Some of the NS 3000/iX links available are the ThinLAN 3000/iX Link and its ThickLAN option, the DTC/X.25 iX Network Link, and the NS Point-to-Point 3000/iX Link.

NS 3000/iX Network Services Software applications that can be used to access data, initiate processes, and exchange information among nodes in a network. The services are RPM, VT, RFA, RDBA, and NFT.

NSDIR.NET.SYS The name of the active network directory file. See also network directory.

P

packets Encapsulated messages transmitted across a network or an internetwork.

privileged mode A capability assigned to accounts, groups, or users allowing unrestricted memory access, access to privileged CPU instructions, and the ability to call privileged procedures.

probe protocol An HP protocol used by NS 3000/iX IEEE 802.3 networks to get information about other nodes on the network. It resolves names to IP addresses, and resolves IP addresses to IEEE 802.3 addresses.

process A single instance of a program that is being executed by the operating system, also known as a task.

protocol A set of rules that enables two or more data processing entities to exchange information. In networks, protocols are the rules and conventions that govern each layer of network architecture. They define what functions are performed and how messages are exchanged.

protocols file A file that contains a list of protocols known to the system, plus the identification number and one or more aliases for each. *See also* **protocol**.

PROTOCOL.NET.SYS The protocols file, described above.

R

relay Using one node on an internetwork to pass information through to another node or nodes. A relay entry in the `bootpd` configuration file, for example, provides the information necessary to forward, or relay, bootstrap protocol requests to one or more bootp servers.

remote host The host system from which you, as a client, are requesting service.

remote node A node on an internetwork other than the node you are currently using or referring to.

RSLVSAMP.NET.SYS Sample initialization file for the domain name resolver.

RESLVCNF.NET.SYS An initialization file for the domain name resolver. It contains information needed by the network to determine how to resolve a domain name to an IP address.

S

server A node on a network or internetwork that provides on-demand service to requesting clients.

services file The file which associates official service names and aliases with the port number and protocol the services use. In the HFS name space, this file is `/etc/services`.

SERVICES.NET.SYS The services name file, described above.

socket A special kind of file that uniquely identifies one end point of an Internetwork connection. A socket specifies the protocol being used (for example TCP) the Internetwork address (for example `192.44.244.7`) and the integer identifiying the process (for example 377). A socket pair completely specifies the two processes that make up an Internetwork connection.

stream services A type of service that uses Transmission Control Protocol (TCP) to exchange information on an internetwork. Stream services rely on an established, known connection between two systems, client and host, similar to a leased or dedicated phone line between two parties.

stream socket A type of socket that is used to establish stream services between two systems.

subnet Another name for a network, especially if the network is part of an internetwork. The word subnet is also a synonym for intranet.

subnet mask A grouping of bits that determines which bits of the IP address will be used to define a subnetwork. The subnet mask is configured using the NMMGR utility and specified in the same format as an IP address.

T

TAC Telnet Access Card. A board within a DTC 48 or 72MX.

TCP/IP Transmission Control Protocol/Internet Protocol. A set of rules that establishes and maintains connections between nodes on an internetwork. TCP/IP regulates the flow of data, breaks messages into smaller fragments if necessary (and reassembles the fragments at the destination), detects errors, and retransmits messages if errors have been detected.

TEB Telnet Express Box. An HP product consisting of a DTC dedicated to providing protocol conversion between Telnet on TCP/IP and AFCP to allow incoming calls from the Internet Services environment to HP e3000 systems.

Telnet The application protocol offering virtual terminal service in the Internet suite of protocols developed by the Advanced Research Projects Agency (ARPA).

TELNET.ARPA.SYS A file that contains the Telnet client program.

TELNTDOC.ARPA.SYS The readme file for the Telnet client program.

TFTP Trivial File Transfer Protocol, TFTP, a set of rules used to read and write files to or from a remote system.

U

UDP User Datagram Protocol, a set of rules used to send connectionless messages called *datagrams* between systems. UDP requires much less overhead than a protocol such as TCP because it does not require acknowledgement from the recipient that the message reached its destination.

V

Virtual Terminal A network service that allows a user to establish interactive sessions on a node.

W

WAN Wide Area Network. A data communications network of unlimited size, used for connecting localities, cities, and countries.

well-known address The port number that identifies the specific user process of an available and commonly-used Internet Service. For example, the port number for the File Transfer Protocol (FTP) is 21.

X

X.25 Defines the interface between a DTE and a DCE for packet mode operation on a public data network (PDN).

Index