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POSIX
A New Interface for MPE/iX

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HP 3000 Application Note # 97

POSIX - A New Interface for MPE/IX

Introduction

Version 4.5 of MPE/iX includes a new interface called POSIX.

POSIX comprises POSIX.1 and POSIX.2:

- POSIX.1 includes a group of new procedures called up from the command interpreter or from POSIX.2.
- POSIX.2 includes a new SHELL command language meeting IEEE standards, as well as utility programs.

The MPE/iX operating system integrates the basic functions of POSIX.1 (hierarchical directory structures with commands NEWDIR, CHDIR, PURGEDIR).

An RL-type library (relocatable library) adds new INTRINSICS which may be used with the C programming language. When an application is linked to this library, it may be executed in a POSIX environment on an HP 3000 series 900.

The purpose of this article is to present a general overview of these changes.

Hierarchical Directory

When the MPE operating system first came out, it was designed for adaptability to a corporate environment. This is why files were grouped together by departments (ACCOUNT). For example, PAYROLL, PRODUCTION, etc. Finally, within a given account, files were divided up in groups (BRANCH1, FLOORA etc.).

Each group may contain between zero and N files, N being infinite on the MPE/iX. A file is uniquely defined using the following structure:

```
FILE.GROUP.ACCOUNT
```

This arrangement is in fact a three-level hierarchical representation of all files present on the system.

With POSIX, the three-level hierarchy notion is extended to a system with the capability of managing an infinite number of levels. The POSIX DIRECTORY has a root directory, represented by a SLASH (/). The root DIRECTORY contains either files or other DIRECTORIES. The sub-DIRECTORIES are themselves comprised of files and/or DIRECTORIES, and the structure may be repeated ad infinitum.

The implementation of POSIX on MPE/iX integrates two DIRECTORY notions.

In MPE/iX, the root DIRECTORY may contain files and other DIRECTORIES (as we described above), but may also contain accounts. As in the preceding versions, an account may contain groups. With the new version however, a group may contain not only files, but may also contain DIRECTORIES.

In Figure 1-1, the PAYROLL account contains two groups (JANUARY, FEBRUARY), and the February group contains two files (hours and taxes).

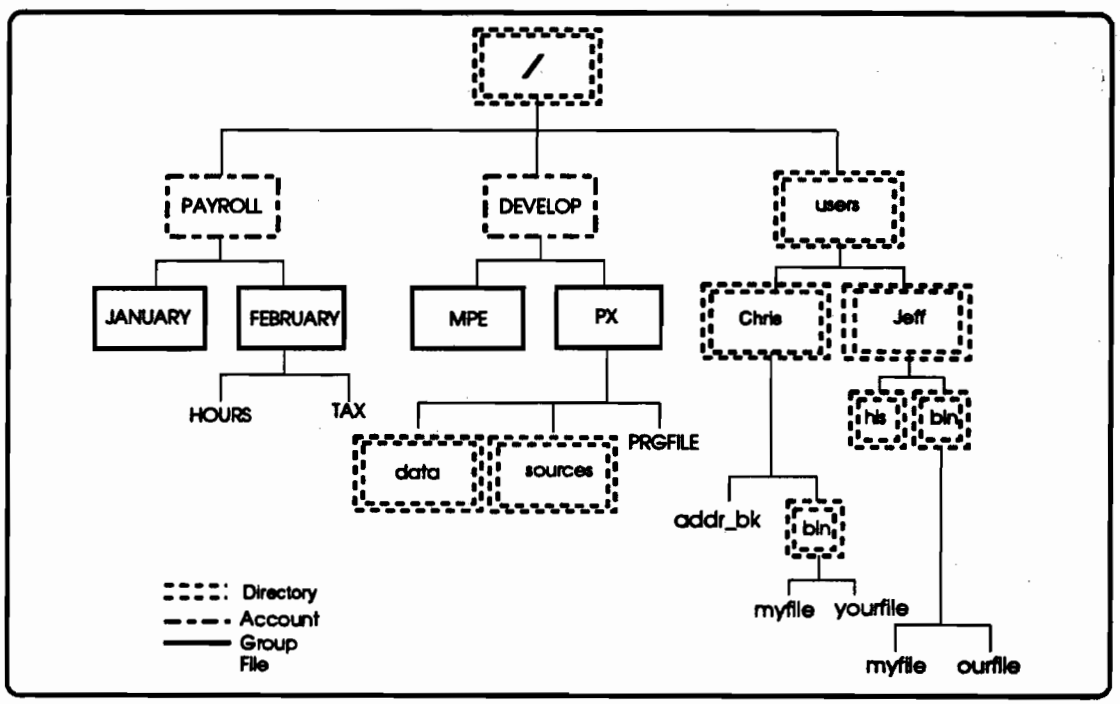

Figure 1-1.

Note These two files have names which may be recognized by a normal MPE system (HOURS.FEBRUARY.PAYROLL).

Note On the right a hierarchical DIRECTORY also exists on the system. The "users" DIRECTORY contains two sub-DIRECTORIES:

"chris" and "jeff".

The "chris" DIRECTORY contains a file called "addr_bk" and a sub-DIRECTORY called "bin" which in turn contains two files:

"myfile" and "ourfile".

This brings to light the strong points of the new MPE/iX DIRECTORY structure:

- The root DIRECTORY, represented by a SLASH, may contain accounts, files and other DIRECTORIES.
- The accounts contain groups.

Note In version 4.5 of MPE/iX, accounts may not contain files or directories. This restriction is likely to be dropped in subsequent versions.

- All groups may have DIRECTORIES or files.
- All DIRECTORIES may contain files or other DIRECTORIES.
- All accounts and groups must have valid names in the traditional MPE sense of the term, i.e., eight alphanumerical characters, in capital letters, and starting with a letter. All other POSIX objects (DIRECTORIES and files), may be comprised of alphabetical characters (either upper or lower case), of numerical characters or even the following special characters "." and "_". There is, however, one restriction: no object name may start by an underline mark "_".
- All names directly under the root may not exceed 16 characters in length (the names of accounts and groups must meet MPE requirements and are limited to 8 characters).
- With version 4.5, only program names residing in MPE groups and having a valid MPE name may be executed. This restriction will probably disappear in future versions.

In MPE/iX all JOBS and SESSIONS have a work group by default (HOME GROUP) which is used to qualify incomplete filenames. For POSIX filenames, MPE/iX uses two new references: the current working DIRECTORY or CWD, and the ROOT DIRECTORY.

Note These references are defined for each PROCESS. In this way, two PROCESSES during the same session may have two distinct CWD's.

If the access path to a file starts with a SLASH, this implies that the first element of the access path is directly attached to the root DIRECTORY. Such access paths are termed "absolute". For example, "/users/chris/bin/myfile" is an absolute access path since it defines the file myfile without any possible ambiguity.

If a filename does not start with a SLASH, a relative reference is assumed.

In Figure 1-1, "bin/myfile" could be either the file in the "chris" DIRECTORY, or in the "jeff" DIRECTORY. This ambiguity will be resolved by referring to the current working directory in which the file is referenced.

MPE/iX was designed so that the existing interfaces (INTRINSICS, command interpreter) may access all types of objects, without altering the operating characteristics of "classical" MPE. In the same way, existing interfaces in POSIX (POSIX.1 library functions and commands of the POSIX.2 shell) integrate in the MPE objects such as accounts, groups, etc.

This integration is made possible through the use of three name servers:

```
MPE NAME SERVER
MPE-ESCAPE NAME SERVER
POSIX NAME SERVER
```

"Classical" filenames are always given the following form:

```
FILE,
FILE.GROUP
FILE.GROUP.ACCOUNT
```

These three possible constructions are managed by the MPE NAME SERVER.

They must use valid object names under MPE (maximum eight characters). The MPE NAME SERVER will automatically convert letters to upper case. If a filename is not qualified, the MPE NAME SERVER references the file with respect to the current working DIRECTORY (CWD).

This current working DIRECTORY may be different from LOGON GROUP. In the second case (FILE.GROUP), the FILE is referenced in the group GROUP of the account to which the user is connected or to the CWD.

Finally, if the name is totally qualified (FILE.GROUP.ACCOUNT) the user can access the specific FILE, GROUP, and ACCOUNT, irrespective of the CWD and the account to which the user are currently connected.

To access the file "yourfile" in Figure 1-1, the MPE NAME SERVER may not be used, since the file "yourfile" is not in a group but in a DIRECTORY ("bin").

A transition must be made from MPE NAME SERVER to POSIX NAME SERVER; this is accomplished through use of MPE-ESCAPE NAME SERVER.

To implement this concept, the filename starts with a dot (".") or with a slash ("/"), the MPE-ESCAPE NAME SERVER does not interpret this filename, but sends it directly to the POSIX NAME SERVER.

For example `/users/chris/bin/myfile` is a valid filename.

In the same way, if the CWD is "/users/chris", then "./bin/myfile" is also valid.

However, "bin/myfile" may not be used since the name does not start either by a SLASH "/" nor by a dot (."). In this case, the MPE ESCAPE NAME SERVER will not make a transition to POSIX NAME SERVER and "bin/myfile" will be interpreted as a file named "bin" associated to its LOCKWORD "myfile".

If the CWD is `/DEVELOP/PX/sources`, the name "main.c" does not reference the file MAIN in the group C in the account to which the user is connected, but simply the file "main.c" in the CWD.

The MPE file named FILE.GROUP.ACCOUNT may also be named `/ACCOUNT/GROUP/FILE`.

Note The POSIX NAME SERVER does not convert lower to upper case, which means that the above files may not be referenced using `/account/group/file`.

At present, the POSIX name server is not directly accessible from the command interpreter and usual INTRINSICS (except in the case of HPFOPEN).

The use of name servers makes it possible to integrate the new directory organization while maintaining compatibility with existing systems. Most MPE commands and INTRINSICS were modified so as to invoke the MPE-ESCAPE NAME SERVER. Old applications will continue to run, since an MPE filename may not start either by a SLASH or a dot.

Use of the Hierarchical Directory

With version 4.5 of MPE/iX, use of a hierarchical DIRECTORY does not require that a POSIX SHELL be used. This means that the new DIRECTORY structure is directly accessible from the MPE/iX command interpreter (the colon ":").

For this reason, several new commands were added.

Creating a DIRECTORY

DIRECTORIES may be created directly from the root, from another DIRECTORY, or in a group. In version 4.5 of MPE/iX, a DIRECTORY may not be created in an account. In order to create a directory in a node (ROOT, DIRECTORY or group), the user must have CD access (CREATE DIRECTORY) to the node.

The NEWDIR command makes it possible to add a directory. If we are connected as follows:

```
:hello CJ,CHRIS.DEVELOP,PX
```

It will be possible to create the "my_src" DIRECTORY:

```
:NEWDIR /DEVELOP/PX/my_src
```

Note DEVELOP and PX must be entered in upper case.

Here is another way of proceeding:

```
:NEWDIR ./my_src
```

This allows the CWD to be referenced by using the symbols "./".

The CWD systematically becomes the logon group after the HELLO command. In our example, the CWD is "PX.DEVELOP".

The following command, despite its correct appearance, will not create DIRECTORY "my_src" in the CWD:

```
:NEWDIR my_src
```

Here `my_src` does not start with a slash ("/"), or with a dot ("."), resulting in, the MPE NAME SERVER being invoked.

As shown above, this server automatically converts lower case to upper case and an upper case "MY_SRC" DIRECTORY will be created instead of a lower case "my_src" DIRECTORY.

Finally, the following command generates an error:

```
:NEWDIR ./a_slightly_long_name
```

Normally, the POSIX object names may have up to 255 characters, but as in this case we are creating a DIRECTORY under a group, the system limits the user to 16 characters.

Only filenames or DIRECTORY names under a DIRECTORY may have more than 16 characters (in fact up to 255 characters).

Changing the CURRENT WORKING DIRECTORY (CWD)

The above user, "CHRIS.DEVELOP", is connected to group PX, and his CWD is "PX.DEVELOP".

If the user wants CWD to be "my_src", the user must enter the following command:

```
:CHDIR ./my_src
```

The new CHDIR command allows users to change the CWD of their command interpreter (CI). For this reason, all "son" PROCESSES created by the CI will have the same CWD as the "father" PROCESS.

Here is an additional means of changing the current directory:

```
:CHDIR /DEVELOP/PX/my_src
```

It is possible to change the CWD to any CWD on the system as long as access rights permit this. If user "CHRIS.DEVELOP" has Traverse Directory (TD) access to the ROOT DIRECTORY ("/") and to the users DIRECTORIES, he can connect to the "/users/jeff" DIRECTORY by entering the following command:

```
:CHDIR /users/jeff
```

Erasing a DIRECTORY

A DIRECTORY may be erased by using the PURGEDIR command, so long as the directory is empty. The ";TREE" option under the PURGEDIR command makes it possible to erase not only the specified DIRECTORY, but also all objects underneath.

Note PURGEDIR may not be used to erase accounts or groups.

List of DIRECTORY Contents

LISTFILE is one of the many commands that were modified in order to make it possible to both handle hierarchical DIRECTORIES, without affecting compatibility with a traditional MPE DIRECTORY structure.

The following examples concern the new functions of this command.

```
:LISTFILE @.@.@,2
```

In version 4.5 of MPE/iX, this command lists all objects which are valid in the MPE sense of the term, currently located in groups and accounts.

If you wish to extend this list to all objects (accounts, groups, files and DIRECTORIES) currently on the system, the command becomes:

```
:LISTFILE /,2;TREE
```
(See Figure 1-2)

```
:listfile /,2;tree

PATH= /

CODE  ----------LOGICAL RECORD----------  ----SPACE----  FILENAME
       SIZE  TYP        EOF      LIMIT R/B  SECTORS #I MX

         0W  DBR          0          0   0       64  2  * */

PATH= /

CODE  ----------LOGICAL RECORD----------  ----SPACE----  FILENAME
       SIZE  TYP        EOF      LIMIT R/B  SECTORS #I MX

         0W  DBA          0          0   0       32  1  *  3000devs/
         0W  DBA          0          0   0       32  1  *  CI/
                                  .
                                  .
                                  .
         0W  DBA          0          0   0       96  3  * *SYS/
         0W  DBA          0          0   0       32  1  *  TELESUP/
         0W  DBA          0          0   0       32  1  *  TESTB/
         0W  DBA          0          0   0       32  1  *  VESOFT/
         0W  DBA          0          0   0       32  1  *  XLSERVER/
        32B  DBH          4   67107839   1       32  1  *  cAmit/
        16W  DBH          4   67107839   1       32  1  *  etc/

PATH= /3000devs/

CODE  ----------LOGICAL RECORD----------  ----SPACE----  FILENAME
       SIZE  TYP        EOF      LIMIT R/B  SECTORS #I MX

         0W  DBG          0          0   0       32  1  *  CLASSES/
         0W  DBG          0          0   0       32  1  *  DEVICES/

PATH= /3000devs/CLASSES/

CODE  ----------LOGICAL RECORD----------  ----SPACE----  FILENAME
       SIZE  TYP        EOF      LIMIT R/B  SECTORS #I MX

       128W  FB           0    8388607   1        0  0  *  00000000
       128W  FB           0    8388607   1        0  0  *  00000001
       128W  FB           0    8388607   1        0  0  *  00000002
       128W  FB           0    8388607   1        0  0  *  DISC
       128W  FB           0    8388607   1        0  0  *  SPOOL
       128W  FB           0    8388607   1        0  0  *  TAPE
       128W  FB           0    8388607   1        0  0  *  TAPE1
       128W  FB           0    8388607   1        0  0  *  TAPED
       128W  FB           0    8388607   1        0  0  *  TERM
```

Figure 1-2.

LISTFILE lists all objects starting with the ROOT DIRECTORY. Since the description of the files to be listed starts with a SLASH ("/"), the POSIX NAME SERVER will be used.

The ";TREE" option indicates that LISTFILE should list all object under the ROOT DIRECTORY ("/").

Note This syntax would have the same result without the ";TREE" option, since a filename terminating in a SLASH ("/") indicates "and all below".

In order to enable taking into account any object names which are longer than 8 characters, the "LISTFILE ,1" or "LISTFILE ,2" commands display filenames to the right of their characteristics, whereas these are usually displayed in the left-hand column. This is one of the rare exceptions to compatibility with previous versions.

Note This concerns only the LISTFILE command and not the LISTF command.

If the user is only interested in files on the system (not the DIRECTORIES, or groups or accounts), the following command may be used:

```
:LISTFILE /SYS/,2; SELEQ=[OBJECT=FILE];TREE
```
(See Figure 1-3)

```
:listfile /SYS/,2 ;seleq=[object=file];tree

PATH= /SYS/ALINE925/

CODE  ------------LOGICAL RECORD-----------  ----SPACE----  FILENAME
        SIZE  TYP        EOF      LIMIT R/B  SECTORS #X MX

          8W  FB           1          1  16       16  1  *  IDP
         20W  FB           9          9   6       16  1  *  IOCLASSP
         92W  FB          40         40   1       32  1  *  IOLDEVP
         78W  FB          22         22   1       16  1  *  IOPATHP
        162W  FB           1          1   1       16  1  *  IOVOLP
          7W  FB           1          1  18       16  1  *  LOGP
        298W  FB           3          3   1       16  1  *  MISCP
         26W  FB         200        200   4       48  1  *  SPUINFOP
         40W  FB         124        124   3       48  1  *  SYSFILEP

PATH= /SYS/ALINX925/

CODE  ------------LOGICAL RECORD-----------  ----SPACE----  FILENAME
        SIZE  TYP        EOF      LIMIT R/B  SECTORS #X MX

          8W  FB           1          1  16       16  1  *  IDP
         20W  FB           9          9   6       16  1  *  IOCLASSP
         92W  FB          30         30   1       32  1  *  IOLDEVP
         78W  FB          14         14   1       16  1  *  IOPATHP
        162W  FB           1          1   1       16  1  *  IOVOLP
          7W  FB           1          1  18       16  1  *  LOGP
        298W  FB           3          3   1       16  1  *  MISCP
         26W  FB         200        200   4       48  1  *  SPUINFOP
         40W  FB         124        124   3       48  1  *  SYSFILEP
```

Figure 1-3.

The SELEQ option of the list file command was modified in order to interpret the new key word "OBJECT".

The objects which may be selected in this way, are files (FILE), accounts (ACCOUNT), groups (GROUP) or DIRECTORIES (DIR).

"DIR" includes all accounts and groups in addition to the hierarchical DIRECTORIES.

In the following example only the accounts on the system are displayed:

`:LISTFILE /@,2; SELECT=[OBJECT=ACCOUNT];TREE` (See Figure 1-4)

```
:listfile /@/,2 ;seleq=[object=account];tree

  PATH= /

  CODE  ------------LOGICAL RECORD-----------  ----SPACE----  FILENAME
          SIZE  TYP        EOF      LIMIT R/B  SECTORS #X MX

            OW  DBA          0          0   0       32  1  *  3000devs
            OW  DBA          0          0   0       32  1  *  ACCIAL2/
            OW  DBA          0          0   0       32  1  *  APPIC/
            OW  DBA          0          0   0       32  1  *  AUDITCRC
            OW  DBA          0          0   0       32  1  *  BIZAC/
            OW  DBA          0          0   0       32  1  *  CONV/
            OW  DBA          0          0   0       32  1  *  EASY/
            OW  DBA          0          0   0       32  1  *  HPLANMGR
            OW  DBA          0          0   0       32  1  *  HPNCS/
            OW  DBA          0          0   0       64  2  *  HPOFFICE
            OW  DBA          0          0   0       32  1  *  HPOPTMGT
            OW  DBA          0          0   0       32  1  *  HPPL85/
            OW  DBA          0          0   0       32  1  *  HPPL87/
            OW  DBA          0          0   0       32  1  *  HPPL89/
            OW  DBA          0          0   0       32  1  *  HPSKTS/
            OW  DBA          0          0   0       32  1  * *HPSPOOL/
            OW  DBA          0          0   0       32  1  *  HPWORD/
            OW  DBA          0          0   0       32  1  *  HPX11/
            OW  DBA          0          0   0       32  1  *  INDHPE/
            OW  DBA          0          0   0       32  1  *  INTEGRAL
            OW  DBA          0          0   0       32  1  *  ITF3000/
            OW  DBA          0          0   0       32  1  *  NETWARE/
            OW  DBA          0          0   0       32  1  *  NMCEACTI
            OW  DBA          0          0   0       32  1  *  PATCH/
            OW  DBA          0          0   0       32  1  *  RJE/
            OW  DBA          0          0   0       32  1  *  ROLAND/
            OW  DBA          0          0   0       32  1  *  SNADS/
            OW  DBA          0          0   0       32  1  *  SUPPORT/
            OW  DBA          0          0   0       64  2  * *SYS/
            OW  DBA          0          0   0       32  1  *  SYSMGR/
            OW  DBA          0          0   0       32  1  *  TELESUP/
            OW  DBA          0          0   0       32  1  *  TESTB/
```

Figure 1-4.

This command would not display the "users" DIRECTORY even though it is part of "/@", since "users" is a DIRECTORY and not an account.

Finally, it is possible to locate a file on the system. If the file name to be located contains the word "_load", the following command would be used:

```
:LISTFILE /,6; NAME=@_load@;TREE
```

The new "NAME" option makes it possible to restrict file display to those which correspond to the criteria selected.

MPE/iX 4.5 users now have the choice of using the new functions described above, or not. Some users have hierarchical DIRECTORIES, and in this case they will have to modify their STORE/RESTORE procedures in order to take these DIRECTORIES into account. For this reason, the TURBOSTORE/iX program was modified to operate with hierarchical DIRECTORIES. In addition, the DISKUSE utility was added, providing an indication of the disk space used by an object (DIRECTORY, group or account).

Management of User Identifiers and Groups

On systems adhering to the POSIX norm, each user is identified by his USER ID (UID). This UID is a unique whole number, which is attributed to each user by the system.

In order to facilitate file sharing among various users, the POSIX norm defines user groups. Each user is a member of at least one group, and each group is identified by a GROUP ID (GID). On MPE/iX, the UID and GID are saved in two files: "MPUID.PUB.SYS" and "HPGID.PUB.SYS".

The management of these files is totally transparent to the user who may use the following commands: NEWUSER, ALTUSER, PURGEUSER, NEWACCT and PURGEACCT.

The "PXUTIL.PUB.SYS" utility makes it possible to synchronize the "HPUID.PUB.SYS" and "HPGID.PUB.SYS" files if necessary.

This utility may only be executed by a user with SM CAPABILITY.

Management of File and DIRECTORY Backups

Let us consider a system with the DIRECTORY structure illustrated in Figure 1-1.

What will happen if we back up the system files using the command given below?

```
:STORE @.@.@;*t;SHOW;DIRECTORY
```

As was the case for the LISTFILE command above, the STORE command will save only valid MPE names which are located in group and account structures. This means that only HOURS, TAXES and PRGFILE files will be saved. The DIRECTORY structure will also be saved since the ";DIRECTORY" option was specified. If we wish to save all POSIX objects present on the system, the following command must be used:

```
:STORE / ;*t; SHOW;DIRECTORY;TREE
```

The STORE/RESTORE program will in this case use the POSIX NAME SERVER because of the SLASH heading the description of all the files to be saved. The ";TREE" option indicates that all objects under the object specified should be taken into account (in our case, below "/").

Use of a minus sign (-) indicates that a sub-group of files should be excluded from the list of objects to be backed up. For example:

```
:STORE / - /users/chris/;*t; SHOW;DIRECTORY;TREE
```

This command backs up all objects except those in the "chris" DIRECTORY.

Note Since the (-) character is an authorized character for a POSIX filename, when used independently, it must be preceded and followed by a space.

The following command will restore all files to the system except those in the "bin" DIRECTORY. The "bin" DIRECTORY itself will be restored, though empty.

```
:RESTORE *t ; / - /user/chris/bin/@;SHOW;CREATE
```

Monitoring Disk Use

With version 4.5 of MPE/iX, the DISKUSE command was introduced in order to provide information concerning the use of disk space:

```
:DISKUSE /
```

This command displays the space occupied by the root DIRECTORY and everything below it. If we do not wish to have the details for every directory, but only the general total, the following command may be used:

```
:DISKUSE /@;NOTREE
```
(See Figure 1-5)

```
------------------------------------------------------------------

          SECTORS
      TREE       LEVEL   DIRECTORY
                 BELOW
       608 +       64    /3000devs/
        96 +       64    /ACCIAL2/
       160 +      128    /APPIC/
     18896 +      128    /AUDITCRC/
       256 +      224    /BIZAC/
        64 +        0    /CAMIF/
        64 +       32    /CONV/
        96 +       64    /EASY/
       128 +       96    /HPLANMGR/
     12208 +      192    /HPNCS/
      2016 +     1952    /HPOFFICE/
        96 +       64    /HPOPTMGT/
      1472 +     1440    /HPPL85/
        64 +       32    /HPPL87/
      4944 +      160    /HPPL89/
       416 +      384    /HPSKTS/
    180416 +      448    /HPSPOOL/
        64 +       32    /HPWORD/
       224 +      192    /HPX11/
       160 +      128    /INDHPE/
       352 +      320    /INTEGRAL/
       192 +      160    /ITF3000/
       448 +      416    /NETWARE/
       512 +      480    /NMCEACTI/
        64 +       32    /PATCH/
        96 +       64    /RJE/
       320 +       64    /ROLAND/
        96 +       64    /SNADS/
      7264 +      448    /SUPPORT/
   2547904 +     2848    /SYS/
       192 +      160    /SYSMGR/
    389920 +     1152    /TELESUP/
       384 +      352    /TESTB/
     93008 +      640    /VESOFT/
        64 +       32    /XLSERVER/
        64 +        0    /camif/
      8768 +     8704    /etc/
      8064 +     4416    /hpshell-examples/
       320 +      256    /lib/
       320 +      256    /tmp/
    167200 +      320    /usr/
   3448000               /@
------------------------------------------------------------------
```

Figure 1-5.

Finally, if the user requires information only concerning a particular object in the DIRECTORY (for example "HPSPOOL"), the user should enter:

`:DISKUSE /HPSPOOL/;TREE` (See Figure 1-6)

```
-----------------------------------------------------------------

        SECTORS
     TREE        LEVEL   DIRECTORY
                 BELOW
       64 +         32   /HPSPOOL/D0000006/
       32 +          0   /HPSPOOL/D0000025/
       32 +          0   /HPSPOOL/D0000027/
       32 +          0   /HPSPOOL/D0000031/
       32 +          0   /HPSPOOL/D0000068/
       32 +          0   /HPSPOOL/D0000069/
       32 +          0   /HPSPOOL/D0000080/
       32 +          0   /HPSPOOL/D0000083/
       32 +          0   /HPSPOOL/D0000084/
       48 +         16   /HPSPOOL/D0000100/
       32 +          0   /HPSPOOL/D0000101/
       32 +          0   /HPSPOOL/IN/
   179920 +     179888   /HPSPOOL/OUT/
       32 +          0   /HPSPOOL/PUB/
   180416          448   /HPSPOOL/ (32 +)
-----------------------------------------------------------------
```

Figure 1-6.

Conclusion

The purpose of this article was to clarify the new functions offered by the POSIX norm in measurement of hierarchical DIRECTORIES. We have noted how this new implementation is completely compatible with DIRECTORY structures which already exist on your systems. Hierarchical DIRECTORIES are only a small part of the many new functions afforded by the POSIX norm on MPE/iX.

Published Application Notes

HP 3000

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Note #	Part Number	Topic
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2	5960-2841	Terminal types for HP 3000 HPIB Computers - Version 1
3	5960-2842	Plotter Configuration Guide
4	5960-2843	Printer Configuration Guide - Version 2
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22	5960-2861	Asynchronous Modems

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24	5960-2863	Private Volumes
25	5960-2864	TurboIMAGE: Transaction Logging
26	5960-2865	HP 2680A 2688A Error Trailers
27	5960-2866	HP Trend: An Installation and Problem Solving Guide
28	5960-2867	The Startup State Configurator
29	5960-2868	A Programmer's Guide to VPLUS 3000
30	5960-2869	Disc Cache
31	5960-2870	Calling the CREATEPROCESS Intrinsic
32	5960-2871	Configuring Terminal Buffers
33	5960-2871	Printer Configuration Guide - Version 3
34A	5960-2873	RIN Management (Using COBOLII Examples) (A)
34B	5960-2874	Process Handling (Using COBOLII Examples) (B)
34C	5960-2876	Extra Data Segments (Using COBOLII Examples) (C)
35	5960-2875	HPDESK IV (Script files, FSC, and Installation Considerations)
36	5960-2877	Tips for the DESK IV Administrators
37	5960-2878	AUTOINST: Trouble-free Updates
38	5960-2879	Store/Restore Errors
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48	5959-9215	Printer Configuration - Version 4
49	5959-9227	Configuring DATACOMM Products Into MPE
50	5959-9228	VFC's for Serial Printers

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52	5959-9242	Configuring MRJE
53	5959-9245	Using Special Characters on the 700/9x Series Terminals
54	5959-9251	Improving Database Performance
55	5959-9258	Customized Message Catalogs and Help Facilities
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59	5959-9289	HP 2334A and HP 2334A Configuration Recipes
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62	5959-7803	Setting Up a System Dictionary
63	5959-7834	Configuring Telesupport Modems for MPE V/E Systems
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65	5960-1817	Using the Electronic Call Feature of HP SupportLine
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67	5960-1819	Printing Documents from HP SupportLine
68	5960-1820	HP SupportLine Commands
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70	5960-2907	Modem Links for Remote Console and Standard DTC Connections on Commercial XL HPPA Systems
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72	5960-2919	BRW Tips and Tricks
73	5960-2998	SNA NRJE Configuration
74	5960-2999	SNA IMF Configuration
75	5060-3000	XL NRJE Configuration

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76	5960-4301	XL IMF Configuration
77	5960-4302	Calling the BRW Intrinsics
78	5960-4303	PUB.SYS What Is Behind It?
79	5960-4625	Conquest of Disc Space
80	5960-4633	Looking Behind the Scenes of Resource Sharing
81	5960-4637	MPE/XL System Interrupt Recovery Procedures
82	5960-4347	Private Volumes
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84	5960-4334	How to Migrate FORTRAN Programs to Newer Compilers and XL Hardware
85	5960-4335	The Optimization of Programs in MPE/XL
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89	5960-4673	AUTOINST/XL Questions and Answers
90	5960-4701	The New Spooler
91	5960-6659	Using the Port Structure Under MPE/XL
92	5960-6696	SUBNET 3000
93	5960-6697	Native Mode Spooler Questions and Answers Version 2
94	5960-8223	RPG/XL Intrisic Interface
95	5961-1689	LaserRx Questions and Answers
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