HPSS User’s Guide
High Performance Storage System, Version 7.5
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• File Transfer Protocol (FTP)

• Parallel FTP (PFTP)

• HPSS Virtual File System (VFS)

Note: It is not the intent of this document to define the standard commands and subcommands provided by standard FTP and POSIX compliant file systems. Only interface extensions provided by HPSS are defined within the HPSS User’s Guide.

Refer to the HPSS Installation Guide and the HPSS Management Guide for descriptions of the interfaces provided to HPSS administrators. Refer to the HPSS Programmer’s Reference for programming interfaces provided to the end user. Refer to the HPSS Error Messages Manual for a list of all HPSS error and advisory messages which are output by the HPSS software.

The HPSS User’s Guide is structured as follows:

• Chapter 1: Overview - Provides an overview of each type of user interface, a summary of key storage concepts, and recommendations on usage.

• Chapter 2: File Transfer Protocol (FTP) - Defines the extensions to the standard FTP interface.

• Chapter 3: Parallel File Transfer Protocol (PFTP) - Defines the Parallel FTP (PFTP) interface.

• Appendix A: Glossary of Terms and Acronyms

• Appendix B: References - Lists documents cited in the text as well as other reference materials.

• Appendix C: Developer Acknowledgments

Typographic and Keying Conventions. This document uses the following typographic conventions:

Example commands that should be typed at a command line will be proceeded by a percent sign (“%”) and be presented in a boldface courier font:

```
% sample command
```

Any text preceded by a pound sign (“#”) should be considered comment lines:

```
# This is a comment
```

Italics. Italic words or characters represent variable values to be supplied.

Brackets enclose optional items in syntax and format descriptions.

Braces enclose a list of items to select in syntax and format descriptions.
Chapter 1. Overview

The High Performance Storage System (HPSS) has been designed to meet the high end of archival storage system and data management requirements. These requirements have led to a scalable design which uses network attached storage devices to transfer data at rates up to multiple gigabytes per second into data stores of many petabytes.

Listed below are the user interfaces available for accessing data in the HPSS.

1.1. User Interfaces

1.1.1. File Transfer Protocol (FTP)

HPSS provides an industry-standard FTP user interface. Because FTP is a serial interface, data sent to a user is received serially. This does not mean that the data within HPSS is not stored and retrieved in parallel. It simply means that the FTP daemon within HPSS must consolidate its internal parallel transfers into a serial data transfer to the user. HPSS FTP performance in many cases will be limited not by the speed of a single storage device, as in most other storage systems, but by the speed of the data path between the HPSS FTP daemon and the user’s FTP client.

All FTP commands are supported or properly rejected if the HPSS Parallel FTP Daemon does not implement a specific feature. In addition, the ability to specify Class of Service is provided via the quote site or site commands. Additional site command options are provided for chgrp, chgid, chmod, chown, chuid, stage, wait, and symlink. The HPSS PFTP Daemon supports access from any FTP client that conforms to RFC-0959. In addition, the quote allo64 command is supported. Additional "site" commands are available as described in Site (and Quote) Commands Section 2.1, “Site (and Quote) Commands” below.

Proxy (third-party) transfers are not supported. Also, to maximize performance, the user should explicitly change the data transfer type to binary. ASCII transfers are very inefficient as the daemon must scan the entire file to determine how many carriage returns to insert so that it can compute the actual amount of date to transfer. It may also cause incorrect results if a file is stored as binary and retrieved as ASCII, or vice versa.

Refer to the HPSS Installation Guide for information on configuring PFTP.

1.1.2. Parallel FTP (PFTP)

PFTP supports normal FTP plus extensions. It is built to optimize FTP performance for storing and retrieving files from HPSS by allowing the data to be transferred in parallel to the client. The interface presented to the user has syntax similar to FTP but with some extensions to allow the user to transfer data to and from HPSS across parallel communication interfaces. PFTP supports transfers via TCP/IP and communicates directly with HPSS Movers to transfer data.

The following constraints are imposed by PFTP.
• Outbound "Pipes" may be configured and supported. Inbound "Pipes" (pgets) are NOT supported. The use of "Pipes" should be discouraged.

• Proxy (third-party) transfers are not supported.

• ASCII transfers are not supported over the parallel interface. Since extra characters are inserted in the stream by the ASCII translation, there is no way to resolve data placement in a parallel stream. Note that some standard FTP implementations default to ASCII or to "Auto". If either of these are the case, it will be necessary to specify binary by entering the bin command.

• PFTP client access is supported only from nodes which support the HPSS PFTP client software.

1.1.3. HPSS Virtual File System (VFS) Interface

Support for HPSS VFS has been deprecated in favor of an analogous application called HPSSFS-FUSE. Refer to HPSSFS-FUSE documentation for its usage documentation.

1.1.4. User Utilities hacl and lshpss

The purpose of these HPSS user utilities is to provide the end user with information such as Access Control List (ACL) definitions and Class of Service definitions. In addition, the ability for a user to change ACL definitions is provided.

• hacl - edit HPSS Access Control Lists.

• lshpss - list information concerning the HPSS configuration (Class of Service list, hierarchy list, storage class list, physical volumes, devices and drives, servers, Movers, and other metadata)

Refer to the man pages for details on use of these utilities.

1.2. Storage Concepts

This section defines key HPSS storage concepts which have a significant impact on the usability of HPSS. Configuration of the HPSS storage objects and policies is the responsibility of your HPSS administrator.

1.2.1. Class of Service (COS)

A COS is an abstraction of storage system characteristics that allows HPSS users to select a particular type of service based on performance, space, and functionality requirements. Each COS describes a desired service in terms of characteristics such as minimum and maximum file size, transfer rate, access frequency, latency, and valid read or write operations. The desired COS is selected when the file is created. Underlying a COS is a Storage Hierarchy that describes a progression of storage media that may be used to store the file.

For the FTP and PFTP interfaces, the COS ID may be explicitly specified by using the site setcos command. If not specified, a default COS is used. Contact your HPSS administrator to determine the COSs which have been defined and available for your use.

PFTP provides a feature to automatically store the local file size in the minimum and maximum file size fields of the COS. This feature is also provided for FTP clients which support the ALLO
command. This allows the COS selection to be made according to file size. The HPSS administrator should ensure that COS definitions contain proper minimum and maximum file sizes in order for PFTP (FTP clients which support **ALLO**) to optimize storage utilization when transferring files to HPSS. Note: If the COS ID is explicitly set by using the **site setcos** command, that COS will be used regardless of file size.

A COS is implemented by a Storage Hierarchy of one to five Storage Classes. Storage Hierarchies and Storage Classes are not directly visible to the user, but are described in the following sections.

### 1.2.2. Storage Class

An HPSS Storage Class is used to group various storage media together to provide them with uniform characteristics. The attributes associated with a Storage Class are both physical and logical. Physical storage media in HPSS are called Physical Volumes. Physical characteristics associated with Physical Volumes are the media type, block size, the estimated amount of storage space on volumes in this class, and how often to write tape marks on tape volumes.

Physical Volumes are organized into logical Virtual Volumes. Virtual Volumes can be striped by aggregating two or more Physical Volumes in the Virtual Volume. Some of the Virtual Volume attributes associated with the Storage Class are virtual volume block size, stripe width, data transfer rate, latency associated with devices supporting the physical media in this class, and disk storage segment size. In addition, the Storage Class has attributes that associate it with a particular migration policy and purge policy to help in managing the usage of media in the Storage Class.

RAIT volume characteristics are described in Storage Classes. When a tape storage class is defined to have three or more physical volumes in a stripe, and a non-zero value for the ParityStripeWidth, then that Storage Class defines RAIT volumes. Virtual volumes created in such a Storage Class will have RAIT characteristics.

### 1.2.3. Storage Hierarchy

An HPSS Storage Hierarchy consists of one to five Storage Classes in a fixed order. Files are moved up and down the Storage Hierarchy via stage and migrate operations, based upon storage policy, usage patterns, storage availability, and user request. For example, a Storage Hierarchy might consist of a fast disk Storage Class, followed by a fast data transfer and medium storage capacity robot tape system Storage Class, which in turn is followed by a large data storage capacity, but relatively slow data transfer tape robot system Storage Class. Files are placed on a particular level in the hierarchy depending on the migration policy and staging operations. Multiple copies of a file may also be specified in the migration policy. If data is duplicated for a file at multiple levels in the hierarchy, the more recent data is at the higher level (lowest level number) in the hierarchy. Typically, files are first recorded at the top level of the Storage Hierarchy, then migrate to lower levels over time, following the rules laid down in the migration policy associated with the Storage Hierarchy. The purge policy determines when a file migrated to a lower level is purged from an upper level. When the file is read, it is usually first staged back to a higher level following the rules of the migration policy.

### 1.2.4. File Family

A file family is an attribute of an HPSS file that is used to group files on tape virtual volumes. When a file is migrated from disk to tape, it is migrated to a tape virtual volume assigned to the
family associated with the file. If no tape is associated with the family, the file is migrated to the
next available tape not associated with a family, then that tape is assigned to the family. The family
affiliation is preserved when tapes are repacked. Configuring file families is a HPSS administrator
function.

1.3. Interface Usage Considerations

Guidance on when to use a particular HPSS interface is provided below. In general, PFTP provides
the best data transfer performance.

1.3.1. Possible Reasons For Using FTP

• Utilizes standard FTP interface - Users and applications familiar with FTP can access HPSS with
  the standard command set.

• Supports standard FTP client on most platforms - FTP commands may be issued from any vendor
  nodes with an FTP interface. *NOTE: Some GUI-based FTP clients may NOT function properly.* No
  specialized code is required.

1.3.2. Possible Reasons for Using PFTP

• Provides faster file transfers than FTP - PFTP is a better performer than FTP (for large files) since it
  provides the capability to stripe data across multiple client data ports.

• Supports files greater than 2 gigabytes - PFTP supports file sizes up to $2^{64}$ bytes.

• Supports partial file transfer - PFTP provides options on the pget and pput commands to perform
  partial file transfers. This is beneficial to users who want to extract pieces of large files.

1.4. User IDs

After the HPSS system is configured, the necessary accounts must be created for HPSS users. Contact
your HPSS administrator to add an account.

For FTP / PFTP access, an FTP account must be created. Contact your HPSS administrator to set up
your account.

Users calling the utilities described in this document may need to be properly logged in with valid
credentials. If the site is using Kerberos authentication, this will require the user to issue the `kinit`
function call to acquire credentials. If Unix authentication is being used, some of the utilities will
require the user to provide the user password in order to use the utility. The `hpssuser` utility with
proper parameters should be used by the HPSS administrator to create the Kerberos or UNIX
accounts.

1.5. User Accounts

As mentioned in the previous section, the user utilities may require the user to have obtained valid
Kerberos or UNIX credentials. The HPSS administrator should use the `hpssuser` utility to create the
proper user accounts.
In order to create the credentials, the proper command must be issued. For example, if you are using Kerberos authentication, the following should be issued:

```bash
% kinit <principal name>
```

When this command is entered, the principal’s identity is validated, and the network credentials are obtained. The user will be prompted for the password.

If UNIX authentication is being used, the **HPSS** utility will prompt for the user password. An example of this is running the **scrub** utility.

If using Kerberos authentication and the login context is no longer required, the following command may be used to destroy the login context and associated credentials:

```bash
% kdestroy
```

Another command which might be of interest to the user is:

- **klist** - list the primary principal and tickets held in the Kerberos credentials cache.
This chapter describes the HPSS FTP interface. FTP is supported from any FTP client platform.

HPSS supports the FTP command set for transferring files to and from HPSS. To use FTP, use the following syntax:

```
ftp <host> [port_number]
```

where,

- **host** is the name of the node where the HPSS PFTP Daemon process resides
- **port_number** is the port number for HPSS, as set up in `/etc/services`

At this point, any standard FTP command may be entered. Note: If the message "451 Local resource failure: audit info." is received, contact your HPSS administrator. This message generally implies that either HPSS is not correctly configured, or some HPSS components may not be executing.

### 2.1. Site (and Quote) Commands

HPSS also supports the site commands listed below (e.g., "site setcos 300" or "quote site setcos 300"). **NOTE:** site commands supported only by the HPSS PFTP clients are listed and described in Chapter 3, Parallel File Transfer Protocol (PFTP).

Note: On some platforms, it may be necessary to specify **quote site** instead of **site**.

- allo64
- chgid
- chgrp
- chmod
- chown (valid only for "root" account)
- chuid (valid only formatting "root" account)
- getfam
- idle
- newer
- setcos
- setfam
- stage
2.1.1. Allocating space for files - quote allo64

The quote allo64 command is used to specify the size of a file for space allocation.

\[ \text{quote allo64 } \text{<size>} \]

where,

\textit{size} is a string representing the size of the file. The size may be a decimal number less than \(2^{64}\) or may be in the form of a decimal number followed by a magnitude representation string. No spaces are allowed between the decimal number and the magnitude representation string. Accepted magnitude representation strings are:

- \text{KB} (kilobyte = 1024),
- \text{MB} (megabyte = 1048576),
- \text{GB} (gigabyte = 1073741824),
- \text{TB} (terabyte = 1099511627776),
- \text{PB} (petabyte = 1125899906842624).

The magnitude representation string is case independent. The decimal component may contain up to two decimal points of precision.

1005.03 will truncate to 1005 if no magnitude representation string is specified. Similar truncations will occur for excess precision specifications.

This command provides a 64-bit extension to the standard \textit{quote allo size} command. NOTE: the \textit{quote allo size} command only accepts decimal values for \textit{size}. Both these commands are helpful for providing hints for non-parallel "put" commands.

Example: The following may be entered to specify the file size of 8 gigabytes.

\[ \text{ftp> quote allo64 8GB} \]

\[ \text{2.1.2. Changing a File’s Group by ID - chgid} \]

chgid is used to change the group ID of a file and has the following format:

\[ \text{quote site chgid } \text{<gid> } \text{<file>} \]

where,
*gid* is the new group ID of the file

*file* is the name of the file.

The user must belong to the specified group and be the owner of the file, or be the root user.

Example: The following may be entered to change the group ID of *myfile* to group ID 210.

```plaintext
ftp> quote site chgid 210 myfile
```

### 2.1.3. Changing a File’s Group by Name - chgrp

chgrp is used to change the group name of a file and has the following format:

```plaintext
quote site chgrp <group> <file>
```

where,

*group* is the new group name of the file

*file* is the name of the file.

The user must belong to the specified group and be the owner of the file, or be the root user.

Example: The following may be entered to change the group of *myfile* to group *mygroup*.

```plaintext
ftp> quote site chgrp mygroup myfile
```

### 2.1.4. Changing a File’s Permissions - chmod

chmod is used to change the mode of a file and has the following format:

```plaintext
quote site chmod <mode> <file>
```

where,

*mode* is the new octal mode number of the file

*file* is the name of the file.

Mode is constructed from the bitwise OR of the following modes:

- **0400** read by owner
- **0200** write by owner
- **0100** execute (search in a directory) by owner
- **0040** read by group
- **0020** write by group
- **0010** execute (search in a directory) by group
- **0004** read by others
0002 write by others

0001 execute (search in a directory) by others

Note: The following mode values are ONLY supported by issuing the command using the symbolic
formats:

4000 set user ID on execution (u+s)

2000 set group ID on execution (g+s)

1000 sticky bit (o+t)

NOTE: the setuid bit and sticky bits have no meaning in HPSS; but may be set/unset. The setgid bit is
ON by default (although it is NOT printed by default) and sets "inheritance" when on.

Only the owner of the file or root user can change its mode.

Example: The following may be entered to change the mode of myfile to read, write by owner and
group.

> quote site chmod 0660 myfile

Example: The following may be entered to change the mode of myfile to read, write by owner and
group and also set the gidbit. All other mode bits are left unchanged.

> quote site chmod u+rw,g+rws myfile

2.1.5. Changing a File’s Owner by Name - chown

chown is used to change the owner of a file and has the following format:

quote site chown <owner> <file>

where,

owner is the new owner of the file

file is the name of the file.

Only the root user can change the owner of a file.

Example: The following may be entered to change the owner of /home/smith/myfile to jones.

> quote site chown jones /home/smith/myfile

2.1.6. Changing a File’s Owner by ID - chuid

chuid is used to change the uid of a file and has the following format:

quote site chuid <uid> <file>

where,

uid is the new uid of the owner of the file
File Transfer Protocol (FTP)

file is the name of the file.

Only the root user can change the uid of a file.

Example: The following may be entered to change the uid of /home/smith/myfile to 201.

```plaintext
ftp> quote site chuid 201 /home/smith/myfile
```

2.1.7. Getting the File Family of a File - getfam

Used to get the file family of a file

```plaintext
quote site getfam [filename]
```

where,

filename is the name of the file for which the file family is desired

Example: The following will display the file family of myfile

```plaintext
ftp> quote site getfam myfile
200 myfile file family set to 8
```

If no filename is specified, the command returns the current file family setting. Example:

```plaintext
ftp> quote site getfam
200 Current file family is 8.
```

2.1.8. Listing/Setting Idle Time

Used to determine / change the Default Idle Time (in seconds)

```plaintext
quote idle time
```

where,

`time` is a number in seconds less than the Maximum Idle time.

Example: The following may be entered to set the idle time to 1000 seconds.

```plaintext
ftp> quote site idle 1000
200 Maximum IDLE time set to 1000 seconds
```

Without a size specifier, the current idle time is returned:

```plaintext
ftp> quote site idle
200 Current IDLE time limit is 1000 seconds; max 7200
```

2.1.9. File Listings for files Newer than a Specified Date

Newer is used to determine which files in a directory are newer than a specified date. Newer provides a recursive short listing of files newer than the specified date.
quote site newer date path

where,

date refers to the date in the format YYYYMMDDHHMMSS and

path refers to the pathname.

Example: The following may be entered to determine the files newer than March 03, 2005 13:51:22 in the path specified by mypath.

```bash
ftp> quote site newer 20050301135122 mypath
mypath/scrub_tests/file87
mypath/scrub_tests/file88
mypath/scrub_tests/file89
```

### 2.1.10. Specifying a File’s Class of Service - setcos

setcos is used to specify a class of service and has the following format:

```bash
quote site setcos <cos_id>
```

where,

cos_id is the Class of Service identifier (used when creating a new HPSS file during a put operation.)

Class of Service is used as a means for specifying the amount of parallelism or media stripe width for a file. See your HPSS administrator for the Class of Service identifiers defined for your site. If a Class of Service is not specified, a default is used. **NOTE: Parallel and Striped transfers are NOT supported by the non-Parallel FTP Clients.**

In the example below, the following commands might be entered to put a large file to HPSS with a Class of Service identifier of 4.

```bash
ftp> quote site setcos 4
```

### 2.1.11. Specifying a File’s File Family - setfam

setfam is used to specify a file family and has the following format:

```bash
quote site setfam [fam_id]
```

where,

fam_id is the File Family identifier (used when creating a new HPSS file during a put operation.)

Example: the following command might be entered to put a large file to HPSS with a File Family of 8.

```bash
ftp> quote site setfam 8
200 Family set to 8.
```

If no fam_id is specified, the command returns the current file family setting. Example:

```bash
ftp> quote site setfam
200 Current file family is 8.
```
In order to clear the current file family, call this command with \textit{fam\_id} set to 0. Example:

\begin{verbatim}
ftp> quote site setfam 0
200 File family is now cleared
\end{verbatim}

\subsection*{2.1.12. Staging a File - stage}

\textit{stage} is used to initiate a stage of a migrated file (e.g. from tape to disk). The user can initiate the stage and then return at a later time to initiate the file transfer using the FTP \texttt{get} or PFTP \texttt{pget} commands.

\begin{verbatim}
quote site stage <file>
\end{verbatim}

where,

- \textit{file} is the name of the file.

Example: The following may be entered to stage file \texttt{/home/smith/myfile}.

\begin{verbatim}
ftp> quote site stage /home/smith/myfile
\end{verbatim}

\subsection*{2.1.13. Creating a Symbolic Link - symlink}

\textit{symlink} is used to create a symbolic link.

\begin{verbatim}
quote site symlink <path/file> <link>
\end{verbatim}

where,

- \textit{path/file} refers to the destination
- \textit{link} refers to the local filename.

Example: The following may be entered to create a link named \texttt{sys\_passwd} in the local directory pointing to \texttt{/etc/passwd}.

\begin{verbatim}
ftp> quote site symlink /etc/passwd sys_passwd
\end{verbatim}

A \texttt{dir} command will show \texttt{sys\_passwd -> /etc/passwd}.

\subsection*{2.1.14. Setting the Desire Wait Options (for Migrated Files) - wait}

\textit{wait} is used to notify the HPSS PFTP Daemon.

\begin{verbatim}
quote site wait <option>
\end{verbatim}

where,

- \textit{option} is one of the following values:

  - \texttt{-1} or \texttt{inf(inite)} - wait forever for the file to be staged. Do not return from the \texttt{get / pget} command to complete until the file has been transferred or a transfer error has occurred.
0 - do not wait for the file to be staged. If the file has been migrated, return the appropriate message and initiate the stage. The user will return later to reissue the `get / pget` command.

n (where n is an integer) - wait the specified period (in seconds) for the file requested by a `get / pget` command to complete. Either transfer the file if the file is staged within the specified period or return a reply to notify the user to try again later.

Example: The following may be entered to wait for files to be staged.

```plaintext
ftp> quote site wait -1
```

The following table describes the behavior the customer should expect from FTP when issuing the stage/wait commands. Only Classes of Service utilizing the "Stage on Open Background" option will exhibit predictable results. Refer to the Class of Service section in the HPSS Installation Guide for more information.

### Table 2.1. Stage / Wait Behavior

<table>
<thead>
<tr>
<th>Wait Time</th>
<th>File Condition</th>
<th>Command</th>
<th>Behavior/Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Wait</td>
<td>Archived</td>
<td><code>quote site stage xyz</code></td>
<td>&quot;File xyz is being retrieved from archive.&quot;</td>
</tr>
<tr>
<td>No Wait</td>
<td>Not Archived</td>
<td><code>quote site stage xyz</code></td>
<td>&quot;File xyz is currently ready for other processing.&quot;</td>
</tr>
<tr>
<td>Wait #</td>
<td>Archived</td>
<td><code>quote site stage xyz</code></td>
<td>Wait for period then receive message: &quot;File xyz is currently ready for other processing.&quot; or &quot;File xyz is currently ready for other processing.&quot; if the file is staged in the time frame allowed</td>
</tr>
<tr>
<td>Wait #</td>
<td>Not Archived</td>
<td><code>quote site stage xyz</code></td>
<td>&quot;File xyz is currently ready for other processing.&quot;</td>
</tr>
<tr>
<td>No Wait</td>
<td>Archived</td>
<td><code>get xyz</code></td>
<td>&quot;File xyz is being retrieved from archive.&quot;</td>
</tr>
<tr>
<td>No Wait</td>
<td>Not Archived</td>
<td><code>get xyz</code></td>
<td>Transfers Data as expected.</td>
</tr>
<tr>
<td>Wait #</td>
<td>Archived</td>
<td><code>get xyz</code></td>
<td>Wait for period then receive message: &quot;File xyz is being retrieved from archive.&quot; or transfers data as expected if file is staged in the time allowed.</td>
</tr>
<tr>
<td>Wait #</td>
<td>Not Archived</td>
<td><code>get xyz</code></td>
<td>Transfers file as expected.</td>
</tr>
</tbody>
</table>

### 2.1.15. Changing the Default UMASK

`umask` is used to change the default umask.

```plaintext
quote site umask octal-mask
```

where,
octal-mask refers to the octal mask to be applied.

Example: The following may be entered to change the default umask to 2.

```
ftp> quote site umask 0002
```

When issued without an octal value, the active umask is displayed.

### 2.2. List Directory Extensions

FTP supports the `ls` command to list the contents of a directory. Standard options supported are: `ls`, `ls -l`, `ls -a`, and `ls -F`. In addition to the standard `ls` options generally provided, HPSS also provides a `-lh` option. If `-lh` is specified, then a long directory listing is generated. However, in place of the owner field (field #3) and group field (field #4) listed for the `-l` option, the Class of Service identifier and Account Code are listed.

**Example:**

```
ftp> ls -lh
-rw-rw---- 1 1  198 157286400 May 13 1996  TEST
-rw-r--r-- 1 1  160  32768 May 16 1996  prod1
-rw-r--r-- 1 1  160  32768 May 16 1996  prod10
-rw-r--r-- 1 1  160  32768 May 16 1996  prod11
-rw-r--r-- 1 1  160  32768 May 16 1996  prod12
-rw-r--r-- 1 1  160  32768 May 16 1996  prod13
-rw-r--r-- 1 1  160  32768 May 16 1996  prod14
-rw-r--r-- 1 1  160  32768 May 16 1996  prod15
-rw-r--r-- 1 1  160  32768 May 16 1996  prod151
-rw-r--r-- 1 1  160  32768 May 16 1996  prod152
-rw-r--r-- 1 1  160  32768 May 16 1996  prod153
-rw-r--r-- 1 1  160  32768 May 16 1996  prod154
-rw-r--r-- 1 1  160  32768 May 16 1996  prod155
-rw-r--r-- 1 1  160  32768 May 16 1996  prod156
-rw-r--r-- 1 1  160  32768 May 16 1996  prod157
-rw-r--r-- 1 1  160  32768 May 16 1996  prod158
-rw-r--r-- 1 1  160  32768 May 16 1996  prod159
```
Chapter 3. Parallel File Transfer Protocol (PFTP)

This chapter specifies the HPSS PFTP interface. In order to use PFTP, the PFTP client code must be compiled and supported on the client platform. Contact your Support Representative for more guidance. PFTP supports the FTP command set plus some additional commands. Refer to Section 3.3, “Additional PFTP Commands” for more information. To use PFTP, the user enters one of the following commands:

```
```

where,

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-b</td>
<td>Sets the PDATA protocol Blocksize. StringSize is the size specification in the format: Digit(s)Magnitude; e.g. 1MB.</td>
</tr>
<tr>
<td>-c</td>
<td>Sets &quot;Child&quot; mode. This provides the ability to &quot;emulate&quot; a tty and interactive mode when executing the client in a &quot;batch&quot; mode.</td>
</tr>
<tr>
<td>-d</td>
<td>The standard FTP debug specification.</td>
</tr>
<tr>
<td>-e</td>
<td>Sets &quot;Echo&quot; mode. When running the client in batch mode, this causes the client to echo each command into the output file providing a helpful record of commands interleaved with the return messages.</td>
</tr>
<tr>
<td>-g</td>
<td>Disables the expansion of metacharacters in file names. Interpreting metacharacters can be referred to as expanding (sometimes called globbing) a file name. See the <code>glob</code> subcommand.</td>
</tr>
<tr>
<td>-h</td>
<td>Specifies to use the original HPSS protocol, PDATA_AND_MOVER, regardless of the default specified in the HPSS.conf file.</td>
</tr>
<tr>
<td>-i</td>
<td>Turns off interactive prompting during multiple file transfers. See the <code>prompt</code>, <code>mget</code>, <code>mput</code>, and <code>mdel</code> subcommands for descriptions of prompting during multiple file transfers.</td>
</tr>
<tr>
<td>-k</td>
<td>Kerberos ONLY option to specify an alternate Kerberos Realm for the PFTP Daemon.</td>
</tr>
<tr>
<td>-m</td>
<td>This argument will enable multinode processing. By default, multinode processing is disabled. Multinode will be ignored if NO multinode specification for this client / daemon pair is specified in the HPSS.conf file.</td>
</tr>
<tr>
<td>-n</td>
<td>Prevents an automatic login on the initial connection. Otherwise, the <code>ftp</code> command searches for a SHOME/.netrc entry that describes the login and initialization process for the remote host. See the <code>user</code> subcommand.</td>
</tr>
</tbody>
</table>
### Option Description

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>-p</td>
<td>Specifies to use the HPSS protocol (PDATA_ONLY) for parallel transfers regardless of the default in the HPSS.conf file.</td>
</tr>
<tr>
<td>-t</td>
<td>The standard FTP trace specification.</td>
</tr>
<tr>
<td>-v</td>
<td>Displays all the responses from the remote server and provides data transfer statistics. This display mode is the default when the output of the ftp command is to a terminal, such as the console or a display.</td>
</tr>
<tr>
<td>-w</td>
<td>This argument will set the pwidth. The pwidth value must be specified immediately following this argument.</td>
</tr>
</tbody>
</table>
| -A     | Specify the user authentication mechanism.  
Values: GSS, USER_PASS |
| -B     | Sets the Parallel Blocksize for parallel transfers. StringSize is the size specification in the format: Digit(s)Magnitude; e.g. 1MB. |
| -C     | Sets the default Class of Service (COS) for the session. The argument is a valid string representation of a decimal COS. COS names are NOT accepted. |
| -P     | Specifies to use the PDATA_PUSH protocol. This will be overridden if another protocol is specified in the .netrc file or if an explicit specification of another protocol is made by the user. |
| -R     | Used to specify the valid ports for parallel transfers. This is useful in instances where network filters are invoked which provide port ranges for TCP traffic. The syntax is "start_range-end_range". |
| -S     | Sets the maximum open / close socket size for HPSS parallel transfers. An artificial maximum of 250GB (subject to change) is compiled in. Results may be smaller than the specified value based on a number of external HPSS constraints. The default is 1.5GB. StringSize is the size specification in the format: Digit(s)Magnitude; e.g., 200GB. |
| -T     | Terminate session on error. Useful for batch processing. |
| Host   | The node where the HPSS PFTP Daemon process resides. |
| Port   | The port number for the HPSS PFTP Daemon, as set in /etc/services. |

The local administrator may opt to define a pftp program link that points to pftp_client.

The HPSS 7.5 pftp_client provides both username/password authentication and the GSS facilities previously provided by the krb5_gss_pftp_client binary in previous versions of HPSS. Contact your site representative for details. These clients utilize either standard username/password authentication or the MIT Kerberos GSS facilities for authentication and reply processing. The GSS-based clients provide credential authentication facilities (password-less authentication) between the client and the HPSS Parallel FTP Daemon using Kerberos credentials for authentication.

The pftp_client does NOT obtain the end user’s initial Kerberos Credentials. The end user should obtain these credentials prior to initiating a pftp_client session by doing the...
appropriate Kerberos kinit command. MIT Kerberos is available from MIT and will NOT be supplied by the HPSS project for non-HPSS platforms.

Incompatibilities may exist between the HPSS (GSS) Parallel FTP Client and Daemon and the Kerberos-based FTP features provided by IBM with AIX 4.x and/or AIX 5.x. This has been reported in the past and was outside the jurisdiction of the HPSS project. The HPSS Parallel FTP Clients and Daemon are compatible with the MIT GSS-based FTP processes.

As a courtesy to HPSS customers, the Parallel FTP Client code is available for compilation at customer sites upon request on non-HPSS platforms, subject to any legal/licensing restrictions. This explicitly denies any support requirement on IBM or the HPSS Development/Support personnel for any modifications made by the customer. Contact your site representative for details.

The HPSS PFTP Client has been successfully compiled on: Cray UNICOS [discontinued], Hewlett-Packard HP-UX [discontinued], Silicon Graphics IRIX [discontinued], Sun Solaris (Sparc and Intel), Intel Teraflop[discontinued], NEC[discontinued], IA64 Linux, Linux Intel (RHEL 4.0 & 5.0), SUSE 9.x for AMD64, Compaq Alpha[discontinued], and IBM AIX 5.3 and 6.1. All current ports may be compiled in either 32-bit or 64-bit mode.

Ports to other hardware/software components are the responsibility of the remote site. These sites will be asked to share their ports with the HPSS development team (and other HPSS facilities); however, neither IBM nor the HPSS Development Team accepts any obligation to incorporate any hardware/software ports into the distribution source. No site specific features (local mods) added to the Parallel FTP client by customer sites will be incorporated into the PFTP client without the appropriate modification to the HPSS license agreement.

Note: If the message "Local resource failure: audit info." is received, contact your HPSS Administrator. This message generally implies that either HPSS is not correctly configured, or some HPSS components may not be executing.

### 3.1. Parallel FTP Client Transfers

Parallel transfers involve the creation of child processes to transfer the data between the source and the destination. This process may be either locally spawned PFTP client children, remotely initiated PFTP "children", or the combination of both. When the pwidth value is set and a valid multinode configuration file does not exist or multinode has not been activated, the PFTP client will provide parallel data paths to the Movers by spawning multiple processes on the same client node using one or more network interfaces (NICs).
Parallel File Transfer Protocol (PFTP)

Figure 3.1. Local File Transfer Probable Configuration for Parallel FTP

The multinode option supports spawning the client processes across multiple machines / nodes and/or multiple interfaces on the remote machines / nodes. This Multinode option may be beneficial on processors which support shared file systems, such as GPFS on the IBM SP. **NOTE: if multinode is used in a non-shared file system, the multinode file transfer to the client will be spread across multiple, separate files, which is not the desired behavior and can result in data integrity problems.** The client nodes which participate in a multinode transfer are selected from the HPSS.conf configuration file (see discussion below) which contains entries with control, and optionally, data interface names or addresses. The number of nodes selected from the configuration file is based on the pwidth value. The starting node is selected using an offset of which is maintained by the PFTP client.

### 3.1.1. Parallel FTP Client / Server Configuration

The PFTP client can read configuration information from the HPSS.conf file to provide optimal performance characteristics. This file is configurable by HPSS Administrators to provide performance enhancement. Performance enhancements require considerable expertise. Contact your site representative if you need these features. The PFTP Server also reads this file and the file should be present in the directory /var/hpss/etc along with other HPSS configuration files. It should be marked as readable by the everybody and writable by root ONLY for security reasons.

**HPSS.conf File**

This configuration file is used to specify performance optimization parameters for the PFTP components, the HPSS Movers, and potentially Site specific applications. For details of the implementation of the HPSS.conf file, contact your HPSS Administrator. This file is constantly being updated with additional features/enhancements.
Local File Functions

The Local File Functions represent performance enhancements using the HPSS parallel protocols where both the HPSS file and the Unix source/destination file are "globally available" to the Mover(s) and the PFTP client processes (e.g., GPFS file systems.) The local file path must be specified in the file: `/var/hpss/etc/hpss_mvr_localfilepath.conf`. The specified path must exist for each PFTP Client/Mover machine.

Configuration Criteria:

**Figure 3.2. Local File Transfer Optimal Configuration for Parallel FTP**

Local File Transfer Optimal Configuration for Parallel FTP

- **PFIP Client, PFTP, Mover Machine**
- **Mover Process**
- **Unix Filesystem**
- `/hpss_home`
- Tape(s) [Migration]
3.2. PFTP Site (and Quote) Commands

Several additional site commands are available with PFTP.

Note: On some platforms, it may be necessary to specify `quote site` instead of `site`.

- acl
- bufsize
- gettun
- minfo
- rdrmt
- wtrmt

These commands are described in the following subparagraphs.

3.2.1. Listing/Setting HPSS ACLs

acl is used to list/set the acls for HPSS files and directories

```
quote site acl command object
```

where,
command refers to an acl command from the following list:

- clear
- help
- remove
- replace
- show
- update

object refers to a file or directory.

Example: The following list the ACLs for a directory, st_data_mgmt_01.

```
ftp> quote site acl show st_data_mgmt_01
200 PORT command successful.
150 Opening ASCII mode data connection for acl list.
  user_obj:rwxcid
  group_obj:rw+x-id
  other_obj:r-x---
226 Transfer complete.
56 bytes received in 0.0006 seconds (0.093 Mbytes/sec)
```

### 3.2.2. Determining/Setting Buffer Sizes [Grid FTP]

bufsize is used to determine/set the buffer size to be used for parallel transfers.

```
quote site bufsize size
```

where,

size refers to the desired buffer size.

Example: The following may be entered to set the buffer size to 1 MB.

```
ftp> quote site bufsize 1048576
200 Current TCP Buffer size is 1048576
```

Without a size specifier, the current buffer size is returned (-1 means use the default).

### 3.2.3. Reading Configuration Options for the PFTP Server

The quote gettun command is used to determine characteristics that the Parallel FTP Server uses to transfer files to the Client. NOT implemented at this time.

```
quote gettun
```

Example: The following lists the default characteristics of the PFTP Server.

```
ftp> quote gettun
```
3.2.4. File Listings for Files Newer than a Specified Date

Minfo is used to determine which files in a directory are newer than a specified date. Minfo provides a recursive long listing of files and directories in the specified path.

```
quote site minfo date path
```

where,

`date` refers to the date in the format YYYYMMDDHHMMSS and

`path` refers to the pathname.

Example: The following may be entered to determine the files newer than March 03, 2005 13:51:22 in the path specified by mypath.

```
ftp> quote site minfo 20050301135122 mypath
F Mon Mar 21 16:43:16 2005 mypath/scrub_tests/file87
F Mon Mar 21 16:43:33 2005 mypath/scrub_tests/file89
```

3.2.5. Perform Media Timing (Eliminating the Network Transfer Time)

The quote rdrmt command is used to time the reading of data from media by the Mover(s). Similarly, the quote wtrmt command is used to time the performance of writing data to the HPSS media. **NOT implemented for HPSS PFTP Server!**

```
quote rdrmt filename Media_read_size Quantity
quote wtrmt filename Media_write_size Quantity
```

**NOTE:** These functions are for obtaining performance information ONLY and are **NOT** for use by users.

3.3. Additional PFTP Commands

All FTP extensions described in Chapter 2 are supported by PFTP. In addition, the following commands (abbreviations) are supported by PFTP:

- `pappend (papp)`
- `pput, mpput (ppu, mpp)`
- `pget, mpget (pge, mpg)`
- `lfappend (lfa)`
- `lfput, mlfput (lfp, mlfp)`
- `lfget, mlfget (lfg, mlf)`
• recursive (recu)
• setwidth (setpw)
• setblocksize (setpb)
• multimode (multi)
• autoparallel (autop)
• getprot (getp)
• gettuningparms (gettun)
• pdata
• pdatapush (pdatap)
• pmover (pmov)
• setsockbufsize (sets)
• setxferbufsize (setx)

Pipes are supported by the `pput` and `pget` commands if appropriate configuration is performed. The pipes facility uses temporary files. Configuration of the pipe temporary file path in the PFTP Client section of `HPSS.conf` is strongly advised.

### 3.3.1. General Login Messages (Examples)

**Without valid Kerberos Credentials:**

```
my_prompt> pftp_client fire 4021
Parallel block size set to 1048576.
Connected to fire.clearlake.ibm.com.
220-#
#    HPSS 7.5 Parallel FTP Daemon on fire
#        coming from fire.clearlake.ibm.com
#
220 fire FTP server (HPSS 7.5 PFTPD V1.1.1 Mon Apr 4 06:36:09 CDT 2005) ready.
334 Using authentication type GSSAPI; ADAT must follow
GSSAPI accepted as authentication type
init_sec_context: (krb5) Miscellaneous failure: No credentials cache found
init_sec_context: (krb5) Miscellaneous failure: No credentials cache found
GSSAPI authentication failed
Name (fire:whrahe): hpss
331 GSSAPI user hpss is not authorized as hpss - Password required.
Password: {abcdefgh}
230 User hpss logged in as hpss.
Remote system type is UNIX.
```
Parallel File Transfer Protocol (PFTP)

Using binary mode to transfer files.
**** NOTE: FTP Daemon supports feature discovery ****
**** NOTE: Server supports Parallel Features ****
**** Auto-Parallel Substitution Enabled. ****
**** NOTE: Protocol set to PDATA_AND_MOVER ****
**** NOTE: Daemon does NOT support Transfer Agent
Pwidth set to default(1).
Multinode is Disabled.
ftp>

With appropriate Kerberos Credentials (as HPSS)

my_prompt> pftp_client fire 4021
Parallel block size set to 1048576.
Connected to fire.clearlake.ibm.com.
220-
#   HPSS 7.5 Parallel FTP Daemon on fire
#   coming from fire.clearlake.ibm.com
#
220 fire FTP server (HPSS 7.5 PFTPD V1.1.1 Mon Apr 4 06:36:09
CDT 2005) ready.
334 Using authentication type GSSAPI; ADAT must follow
GSSAPI accepted as authentication type
GSSAPI authentication succeeded
Preauthenticated FTP to fire as whrahe:
232 GSSAPI user hpss@FIRE.CLEARLAKE.IBM.COM is authorized as hpss
230 User hpss@FIRE.CLEARLAKE.IBM.COM logged in as hpss.
Remote system type is UNIX.
Using binary mode to transfer files.
**** NOTE: FTP Daemon supports feature discovery ****
**** NOTE: Server supports Parallel Features ****
**** Auto-Parallel Substitution Enabled. ****
**** NOTE: Protocol set to PDATA_AND_MOVER ****
**** NOTE: Daemon does NOT support Transfer Agent
Pwidth set to default(1).
Multinode is Disabled.
ftp>

3.3.2. Parallel append - pappend

Synopsis

   pappend local_file [remote_file]

Description

The pappend command transfers a file from the local machine to HPSS. The transfer starts at the end of the remote file and continues until the entire file is moved or until an error occurs.

Parameters

   local_file - Identification of the file to transfer on the local machine.

   remote_file - Optional file name to the remote file. If not supplied, then the remote (HPSS) file name defaults to be the same as the local file name.

Return strings

   Output shows the amount of data transferred and any error conditions.
**Error conditions**

Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error codes are:

- -5 - an I/O error occurred.
- -28 - no space remaining in the associated storage class.

**See also**

RFC-0959.

**Notes**

none.

**Examples**

1. Append local file testfile to the same file name in the user’s HPSS home directory.
   
   ftp> pappend testfile

2. Append local file testfile to HPSS file prod1 in the current working directory.
   
   ftp> pappend testfile prod1

**3.3.3. Parallel file store - pput**

**Synopsis**

```
pput [-l local_offset] [-r remote_offset] [-s size] local_file [remote_file]
```

**Description**

The `pput` command transfers a file from the local machine to HPSS. If offsets and size of transfer are not specified, the transfer starts at the beginning of the local file and continues until the entire file is moved or until an error occurs. However, flexibility is provided to perform partial file transfers by specifying local file offset, remote file offset, and size of transfer. The `local_offset`, `remote_offset`, and `size` may be specified using a decimal and magnitude representation string.

The normal `pput` command functions just like the standard `ftp put` command and transfers an entire file.

**Parameters**

- `-l local_offset` - Optional byte offset into the local file where the transfer is to begin.
- `-r remote_offset` - Optional byte offset into the remote file where the data is to be placed.
- `-s size` - Optional byte size of the amount of data to transfer.

`local_file` - Identification of the file to transfer on the local machine.

`remote_file` - Optional file name to the remote (HPSS) file. If not supplied then the remote file name defaults to be the same as the local file name.
Return strings

Output shows amount of data transferred and any error conditions.

Error conditions

Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Error conditions may also be returned from HPSS. The most common error codes are:

- -5 - an I/O error occurred.
- -28 - no space remaining in the associated storage class.

See also

RFC-0959.

Notes

none.

Examples

1. Transfer local file testfile to the user’s HPSS home directory.
   ftp> pput testfile

2. Transfer local file testfile to HPSS file prod1 in the current working directory.
   ftp> pput testfile prod1

3. Transfer 1MB from offset 1MB of local file testfile to offset 0 of HPSS file /home/bob/prod1.
   ftp> pput -l 1048576 -r 0 -s 1048576 testfile /home/bob/prod1.

4. Transfer all local files which begin with "test" to the user's HPSS home directory using a pipe and tar (bundling).
   ftp> pput " | tar cf - ./test*" my_test.tar

   The pipe facility uses temporary files. It is strongly advised to configure a location for temporary files used by the pipe facility.

3.3.4. Multiple Parallel file store - mpput

Synopsis

mpput local_files

Description

The mpput command expands the files specified in the local_files parameter at the local host and copies the indicated files to HPSS. The mpput command functions just like the standard ftp mput command.

Parameters

local_files - Identification of the files to transfer on the local machine.
Return strings
Output shows the amount of data transferred and any error conditions.

Error conditions
Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error codes are:
• -5 - an I/O error occurred.
• -28 - no space remaining in the associated storage class.

See also
RFC-0959.

Notes
none.

Examples
1. Transfer all local files in the current directory to the user’s HPSS home directory.
   ftp> mpput *

2. Transfer all local files which begin with test in directory /usr/bob to the user’s HPSS home directory.
   ftp> lcd /usr/bob
   ftp> mpput test*  

3.3.5. Parallel file retrieval - pget

Synopsis
pget [-r remote_offset] [-l local_offset] [-s size] remote_file [local_file]

Description
The pget command transfers a file to the local machine from HPSS. If offsets and size of transfer are not specified, the transfer starts at the beginning of the remote file and continues until the entire file is moved or until an error occurs. However, flexibility is provided to perform partial file transfers by specifying remote file offset, local file offset, and size of transfer. The local_offset, remote_offset, and size may be specified using a decimal and magnitude representation string. See Section 2.1.1, “Allocating space for files - quote allo64” for use of this notation.

The standard pget command transfers entire files similar to the standard ftp get command.

Parameters
-r remote_offset - Optional byte offset where transfer is to begin in the remote file.
-l local_offset - Optional parameter where the data is transferred in the local file.
-s size - Optional number of bytes to transfer.

remote_file - Identification of the file to transfer from the remote (HPSS) host.

local_file - Optional file name to the local file. If not supplied, then the local file name defaults to be the same as the remote file name.

**Return strings**
Output shows the amount of data transferred and any error conditions.

**Error conditions**
Connection Failures - data transfer connection malfunction.
Network Failures - data transfer malfunction.
Allocation Failures - no space on local machine for file.

Error codes may also be returned from HPSS. The most common error code is:
- -5 - an I/O error occurred.

**See also**
RFC-0959.

**Notes**
none.

**Examples**

1. Transfer HPSS file /home/bob/prod1 to the user’s local directory.
   
   ftp> pget /home/bob/prod1

2. Transfer HPSS file prod1 in the current working directory to local file testfile1.
   
   ftp> pget prod1 testfile1

3. Transfer 1MB from offset 0 of HPSS file /home/bob/prod1 to offset 1048576 of local file testfile.
   
   ftp> pget -r 0 -l 1048576 -s 1048576 /home/bob/testfile1 testfile

4. Transfer and untar a tar file into the user’s current working directory using a pipe and tar (unbundling)
   
   ftp> pget my_test.tar " | tar xf -"

   *The pipe facility uses temporary files. It is strongly advised to configure a location for temporary files used by the pipe facility.*

### 3.3.6. Multiple Parallel file retrieval - mpget

**Synopsis**

mpget remote_files
Description
The mpget command expands the remote_files parameter at the remote (HPSS) host and copies the indicated HPSS files to the current directory on the local host. The mpget command functions just like the standard ftp mget command.

Parameters
remote_files - Identification of the files to transfer from the remote (HPSS) host.

Return strings
Output shows the amount of data transferred and any error conditions.

Error conditions
Connection Failures - data transfer connection malfunction.
Network Failures - data transfer malfunction.
Allocation Failures - no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error code is:
• -5 - an I/O error occurred.

See also
RFC-0959.

Notes
 none.

Examples
1. Transfer all files in HPSS directory /home/bob to the user’s local directory.
   ftp> cd /home/bob
   ftp> mpget *

2. Transfer all HPSS files which begin with test in directory /home/bob to the user’s local directory.
   ftp> cd /home/bob
   ftp> mpget test*

3.3.7. Local File append - lfappend

Synopsis
lfappend local_file [remote_file]

Description
The lfappend is a performance optimized Parallel FTP Client command used to append a "globally available" file into HPSS using the "parallel" protocols. IF the input file is not available to the Mover(s) machine (NOT "globally available"), the transfer will fail because the Mover(s) will NOT be able to locate the desired file. The difference between lfappend and pappend is that the Mover(s) involved in the transfer will not use the network to move the data, thus providing improved performance. The Mover(s) machine MUST be correctly configured. The file: /var/hpss/etc/hpss_mvr_localfilepath.conf MUST exist on each "local file"-aware Mover.
machine and MUST contain entries specifying which directories are eligible for "local file" transport.

The `lfappend` command transfers a file from the local machine to HPSS. The transfer starts at the end of the remote file and continues until the entire file is moved or until an error occurs.

**Parameters**

- `local_file` - Identification of the "globally available" file to transfer.
- `remote_file` - Optional file name to the remote file. If not supplied, then the remote (HPSS) file name defaults to be the same as the "globally available" file name.

**Return strings**

Output shows the amount of data transferred and any error conditions.

**Error conditions**

- Connection Failures: data transfer connection malfunction.
- Network Failures: data transfer malfunction.
- Allocation Failures: no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error codes are:

- -5 - an I/O error occurred.
- -28 - no space remaining in the associated storage class.

**See also**

RFC-0959.

**Notes**

none

**Examples**

1. Append "globally available" file `testfile` to the same file name in the user’s HPSS home directory.
   
   ```
   ftp> lfappend testfile
   ```

2. . . . (Information returned by the PFTP Daemon)
   
   ```
   ftp>
   ```

3. Append "globally available" file `testfile` to HPSS file `prod1` in the current working directory.
   
   ```
   ftp> lfappend testfile prod1
   ```

4. . . . (Information returned by the PFTP Daemon)
   
   ```
   ftp>
   ```

### 3.3.8. Local File store - `lfput`

**Synopsis:**

```bash
lfput [-l local_offset] [-r remote_offset] [-s size] local_file [remote_file]
```
Description
The `lfput` is a performance optimized Parallel FTP Client command used to transfer a "globally available" file into HPSS using the "parallel" protocols. If the file is not available to the Mover(s) machine (NOT "globally available"), the transfer will fail because the Mover(s) will NOT be able to locate the desired file. The difference between `lfput` and `pput` is that the Mover(s) involved in the transfer will not use the network to move the data, thus providing improved performance. The Mover(s) machine MUST be correctly configured. The file `/var/hpss/etc/hpss_mvr_localfilepath.conf` MUST exist on each "local file"-aware Mover machine and MUST contain entries specifying which directories are eligible for "local file" transport.

If offsets and size of transfer are not specified, the transfer starts at the beginning of the local file and continues until the entire file is moved or until an error occurs. However, flexibility is provided to perform partial file transfers by specifying local file offset, remote file offset, and size of transfer. The `local_offset`, `remote_offset`, and `size` may be specified using a decimal and magnitude representation string. See Section 2.1.1, "Allocating space for files - quote allo64" for use of this notation. The normal `lfput` command functions just like the standard `ftp put` command and transfers an entire file.

Parameters
- `-l local_offset` - Optional byte offset into the "globally available" file where the transfer is to begin.
- `-r remote_offset` - Optional byte offset into the remote file where the data is to be placed.
- `-s size` - Optional byte size of the amount of data to transfer.

`local_file` - Identification of the "globally available" file to transfer. (MUST be available to Mover(s) machines)

`remote_file` - Optional file name to the remote (HPSS) file. If not supplied then the remote file name defaults to be the same as the "globally available" file name.

Return strings
Output shows amount of data transferred and any error conditions.

Error conditions
Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error codes are:
- `-5` - an I/O error occurred.
- `-28` - no space remaining in the associated storage class.

See also
RFC-0959.

Notes
none.
Examples

1. Transfer local file testfile in the current working directory of the client to the user’s HPSS home directory.
   
   ftp> cd ~

2. . . . (Information returned by the PFTP Daemon)
   
   ftp> lfput testfile

3. . . . (Information returned by the PFTP Daemon)
   
   ftp>

4. Transfer local file testfile in the current working directory of the client to HPSS file prod1 in the current working directory.
   
   ftp> lfput testfile prod1

5. . . . (Information returned by the PFTP Daemon)
   
   ftp>

6. Transfer 1MB from offset 1MB of local file testfile in the current working directory of the client to offset 0 of HPSS file /home/bob/prod1 with a new name testfile2.
   
   ftp> lfput -l 1048576 -r 0 -s 1048576 testfile /home/bob/prod1/testfile2

7. . . . (Information returned by the PFTP Daemon)
   
   ftp>

3.3.9. Local file retrieval - lfget

Synopsis

   lfget [-r remote_offset] [-l local_offset] [-s size] remote_file [local_file]

Description

The lfget is a performance optimized Parallel FTP Client command used to transfer an HPSS file into a "globally available" file using the "parallel" protocols. IF the current working directory or the specified directory is not available to the Mover(s) machine (NOT "globally available"), the transfer will fail because the Mover(s) will NOT be able to locate the desired file. The difference between lfget and pget is that the Mover(s) involved in the transfer will not use the network to move the data, thus providing improved performance. The Mover(s) machine MUST be correctly configured. The file: /var/hpss/etc/hpss_mvr_localfilepath.conf MUST exist on each "local file"-aware Mover machine and MUST contain entries specifying which directories are eligible for "local file" transport.

The lfget command transfers a file from HPSS to a "globally available" directory on the Mover machine(s). If offsets and size of transfer are not specified, the transfer starts at the beginning of the remote file and continues until the entire file is moved or until an error occurs. However, flexibility is provided to perform partial file transfers by specifying remote file offset, local file offset, and size of transfer. The local_offset, remote_offset, and size may be specified using a decimal and magnitude representation string. See Section 3.3.10, “Multiple Local file store - mlfput” for use of this notation.
The standard `lfget` command transfers entire files similar to the standard ftp `get` command.

**Parameters**

- `-r remote_offset` - Optional byte offset where transfer is to begin in the remote file.

- `-l local_offset` - Optional parameter where the data is transferred in the local file.

- `-s size` - Optional number of bytes to transfer.

- `remote_file` - Identification of the file to transfer from the remote (HPSS) host.

- `local_file` - Optional file name to the local file. If not supplied, then the local file name defaults to be the same as the remote file name.

**Return strings**

Output shows the amount of data transferred and any error conditions.

**Error conditions**

- Connection Failures - data transfer connection malfunction.

- Network Failures - data transfer malfunction.

- Allocation Failures - no space on local machine for file.

Error codes may also be returned from HPSS. The most common error code is:

- `-5` - an I/O error occurred.

**See also**

RFC-0959.

**Notes**

none.

**Examples**

1. Transfer HPSS file `/home/bob/prod1` to the user’s local directory.
   
   ```
   ftp> lfget /home/bob/prod1
   ```

2. . . . (Information returned by the PFTP Daemon)
   
   ```
   ftp>
   ```

3. Transfer the HPSS file `prod1` in the current working directory to local file `testfile1`.
   
   ```
   ftp> lfget prod1 testfile1
   ```

4. . . . (Information returned by the PFTP Daemon)
   
   ```
   ftp>
   ```

5. Transfer the HPSS file `testfile` into the "globally available" directory `/home/bob` renaming the file to `testfile`.
   
   ```
   ftp> lfget prod1 /home/bob/testfile1 testfile
   ```

6. . . . (Information returned by the PFTP Daemon)
   
   ```
   ftp>
   ```
Parallel File Transfer
Protocol (PFTP)

7. Transfer 1MB from offset 0 of HPSS file /home/bob/prod1 to offset 1048576 of local file testfile.
   ftp> lfget -r 0 -l 1048576 -s 1048576 /home/bob/testfile1 testfile

8. . . . (Information returned by the PFTP Daemon)
   ftp>

3.3.10. Multiple Local file store - mlfput

**Synopsis**
mlfput local_files

**Description**
The mlfput is a performance optimized Parallel FTP Client command used to transfer multiple "globally available" files into HPSS using the "parallel" protocols. If the file(s) is not available to the Mover(s) machine (NOT "globally available"), the transfer will fail because the Mover(s) will NOT be able to locate the desired file. The difference between mlfput and mpput is that the Mover(s) involved in the transfer will not use the network to move the data, thus providing improved performance. The Mover(s) machine MUST be correctly configured. The file: /var/hpss/etc/hpss_mvr_localfilepath.conf MUST exist on each "local file"-aware Mover machine and MUST contain entries specifying which directories are eligible for "local file" transport.

The mlfput command expands the files specified in the local_files parameter at the local host and copies the indicated files to HPSS. The mlfput command functions just like the standard ftp mput command.

**Parameters**
local_files - Identification of the files to transfer on the local machine.

**Return strings**
Output shows the amount of data transferred and any error conditions.

**Error conditions**
Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error codes are:

- -5 - an I/O error occurred.
- -28 - no space remaining in the associated storage class.

**See also**
RFC-0959.

**Notes**
none.
Examples

1. Transfer all "globally available" files in the current directory to the user’s HPSS home directory.
   
   ftp> cd ~

2. . . . (Information returned by the PFTP Daemon)
   
   ftp> prompt(<== Toggles File Prompting)

3. . . .
   
   ftp> mlfput *

4. . . . (Information returned by the PFTP Daemon)
   
   ftp>

5. Transfer all "globally available" files which begin with test in directory /usr/bob to the user’s HPSS home directory.
   
   ftp> cd ~

6. . . . (Information returned by the PFTP Daemon)
   
   ftp> mlfput /usr/bob/test*

7. . . . (Information returned by the PFTP Daemon)
   
   ftp>

3.3.11. Multiple Local file retrieval - mlfget

Synopsis

mlfget remote_files

Description

The mlfget is a performance optimized Parallel FTP Client command used to transfer an HPSS file into a "globally available" file using the "parallel" protocols. IF the current working directory or the specified directory is not available to the Mover(s) machine (NOT "globally available"), the transfer will fail because the Mover(s) will NOT be able to locate the desired file. The difference between mlfget and mpget is that the Mover(s) involved in the transfer will not use the network to move the data, thus providing improved performance. The Mover(s) machine MUST be correctly configured. The file: /var/hpss/etc/hpss_mvr_localfilepath.conf MUST exist on each "local file"-aware Mover machine and MUST contain entries specifying which directories are eligible for "local file" transport.

The mlfget command expands the remote_files parameter at the remote (HPSS) host and copies the indicated HPSS files to the current directory on the local host. The mlfget command functions just like the standard ftp mget command.

Parameters

remote_files - Identification of the files to transfer from the remote (HPSS) host.

Return strings

Output shows the amount of data transferred and any error conditions.
Parallel File Transfer
Protocol (PFTP)

**Error conditions**

Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Error codes may also be returned from HPSS. The most common error code is:

- -5 - an I/O error occurred.

**See also**

RFC-0959.

**Notes**

none.

**Examples**

1. Transfer all files in HPSS directory `/home/bob` to the "globally available" current working directory
   
   `ftp> mlfget /home/bob/*`

2. . . . (Information returned by the PFTP Daemon)
   
   `ftp>

3. Transfer all HPSS files which begin with test in directory `/home/bob` to the "globally available" current working directory.
   
   `ftp> mlfget /home/bob/test*`

4. . . . (Information returned by the PFTP Daemon)
   
   `ftp>

### 3.3.12. Recursive commands - recursive

**Synopsis**

`recursive mget|mput|mdelete dir_name`

**Description**

The **recursive** command is used to recursively mget, mput, or mdelete a directory.

**Parameters**

`mget|mput|mdelete` - The recursive command to be performed. The commands perform similarly to regular mget, mput, and mdelete, except they perform recursively on all the contained files and subdirectories contained in the specified directory.

`dir_name` - The directory on which to perform the recursive action. For mget or mdelete, this will be the remote directory to get or delete. For mput, this is the local directory to put.

**Return strings**

Output shows the amount of data transferred and any error conditions.
Error conditions
Connection Failures - data transfer connection malfunction.

Network Failures - data transfer malfunction.

Allocation Failures - no space on remote machine for file.

Not Found Failures - Specified dir_name does not exist or is not a directory

Error codes may also be returned from HPSS. The most common error code is:

• -5 - an I/O error occurred.

See also
RFC-3659.
RFC-0959.

Notes
none.

Examples
1. Transfer local directory my_dir1 and all of its contents to the user’s HPSS home directory
   ftp> recursive mput my_dir1

2. Transfer directory my_dir1 and all of its contents from the user’s HPSS home directory to the
   local file system
   ftp> recursive mget my_dir1

3. Delete directory my_dir1 and all of its contents from the user’s HPSS home directory
   ftp> recursive mdelete my_dir1

3.3.13. Specify transfer stripe width - setpwidth

Synopsis
   setpwidth stripe_width

Description
   The setpwidth command is used to specify the size of the client side stripe to the FTP client code.

Parameters
   stripe_width - The width of the PFTP client-side stripe. The width can have a value of 1 through
   16. The default width is 1. The stripe width from the PFTP client perspective is the number of
   client processes spawned to handle the data transfers. Stripe width from the server perspective is
   the number of volumes the file is striped across.

   A general guideline would be to set stripe_width to an even divisor of the number of volumes the
   file is striped across. For example, if the Class of Service for a file were set up for a 4-way stripe,
   suggested values for stripe_width might be 2 or 4.

   If the stripe width of the file is unknown, consult your HPSS administrator or follow the following
   steps to determine the stripe width:
Enter the `lshpss -cos` command to list Class of Service information. From the entry with the `CID` value equal to your Class of Service ID, locate the `HID` (hierarchy ID) field.

Enter the `lshpss -hier` command to list hierarchy information. From the entry matching the `HID` value above, locate the `StorageClassID` field.

Enter the `lshpss -sc` command to list the storage class information. From the entry matching the `StorageClassID` value above, locate the `W` field. This is the stripe width for the storage class of the file.

**Return strings**

"Parallel stripe width set to \[stripe width\]."

**Error conditions**

"Bad width value \[stripe width\]."

**See also**

RFC-0959.

**Notes**

none.

**Example**

1. Set the stripe width to 4.

   `ftp> setpwidth 4`

---

### 3.3.14. Specify transfer block size - `setpblocksize`**

**Synopsis**

`setpblocksize block_size`

**Description**

The `setpblocksize` command is used to specify the block size to be used for parallel transfers. The `block_size` may be specified using a decimal or magnitude representation string. See *Section 2.1.1, “Allocating space for files - quote allo64”* for use of this notation. The maximum blocksize is 16MB.

**Parameters**

`block_size` - The number of bytes to be transferred to each element of the stripe before data is sent to the next element. The current allowable transfer sizes range from 1 through 16MB. The default block size is 256KB.

A general guideline would be to set `block_size` to the virtual volume block size. Consult your HPSS administrator or follow the following steps to determine the virtual volume blocksize:

1. Enter the `lshpss -cos` command to list Class of Service information. From the entry with the `CID` value equal to your Class of Service ID, locate the `HID` (hierarchy ID) field.

2. Enter the `lshpss -hier` command to list hierarchy information. From the entry matching the `HID` value above, locate the `StorageClassID` field.
3. Enter the `lshpss -sc` command to list the storage class information. From the entry matching the `StorageClassID` value above, locate the `VVBlk` field. This is the virtual volume block size.

Return strings
"Parallel block size set to [block size]."

Error conditions
"Bad block size value [block size]."

See also
RFC-0959.

Notes
none.

Example
Set the transfer block size to 8 MB.

1. ftp> setpblocksize 8388608

or

2. ftp> setpblocksize 8MB

### 3.3.15. Multinode Enable/Disable - multinode

**Synopsis**
```
multinode
```

**Description**
The `multinode` command is used to enable/disable the ability to perform a parallel file transfer using multiple nodes. When multinode is enabled, the `pftp_client` will process the multinode configuration file. If the process cannot obtain a single node to perform the parallel transfer, then the transfer will occur using non-multinode parallel method.

**Parameters**
None.

**Return strings**
"Processing the multinode list, please wait....."

"Multinode is on."

or

"Multinode is off."

**Error conditions**
"Configuration File I/O Problems: Without nodes, files cannot be transferred using the multiple node capability."

**See also**
None
3.3.16. Autoparallel Enable/Disable - autoparallel

Synopsis

autoparallel

Description
The *autoparallel* command is used to enable/disable the automatic mapping of non-parallel commands to parallel commands; e.g., `get` maps to `pget`. In autoparallel mode (enabled), transfers involving files smaller than the "Auto Parallel Size" specification in the `HPSS.conf` will NOT be auto-mapped.

Parameters
None.

Return string
Automatic Substitution of Parallel Commands Disabled

Daemon supports Parallel Features - Auto-Parallel Substitution Enabled

Error conditions
?Invalid command

See also
HPSS.conf(7)

Examples
ftp> autop
Automatic Substitution of Parallel Commands Disabled

or

Daemon supports Parallel Features - Auto-Parallel Substitution Enabled

3.3.17. Get Current Protocol Mode - getprot

Synopsis

getprot

Description
Display the current parallel protocol mode.

Parameters
None.

Return strings
Current Parallel Protocol is PDATA and MOVER to MOVER

Current Parallel Protocol is PDATA ONLY

Current Parallel Protocol is PDATA PUSH
Error conditions

?Invalid command ==> Older Client?

See also

None.

Examples

ftp> getprot
Current Parallel Protocol is PDATA and MOVER to MOVER
Current Parallel Protocol is PDATA ONLY
Current Parallel Protocol is PDATA PUSH

3.3.18. Get Tuning Parameters - gettun

Synopsis

gettun hostname/IP Addr

Description

Display the (transfer) parameters between the client and other hosts (default is the PFTP Daemon host.)

Parameters

None.

Return strings

See Example below.

Error conditions

Warning Preceding without HPSS.conf (-2) (Observed at Login Time)

HPSS.conf parsing errors.

See also

None.

Example

ftp> gettun
Effective Tuning parameters from saux22 to sair031
   Using PDATA_AND_MOVER protocol
   Using 4.1 Protocol
Parallel Transfer Size = 2147483647
Transfer Buffer Size = 16777216
Parallel Block Size = 262144

Parallel Network Width = 1
No Interfaces Found (ret_code = -2)
Using Default Interface for 1 stripes(s)
Multinode is disabled

or
Multinode Enabled:
Processing the multinode list, please wait…..
Using 1 remote node(s) from the following:
Control Interface ==> Data Interface:
water ==> water

Using Network Options
Using "Default" destination characteristics
PdataSockBufSize = 1048576 based on user input
recv_socksize = send_socksize = 1048576 based on
PdataSockBufSize
Writsize = 524288

or
recv_socksize = 262144 based on Network Options
send_socksize = 262144 based on Network Options
PdataSockBufSize = 262144 based on send_socksize

RFC1323 is turned on
TCPNoDelay is turned on

NOTE: The use of "Parallel Pipes" should be discouraged; however, you may observe
either of the following two scenarios:
PipeFileSize TOO Large reset to 2147483647
Pipe Files NOT supported on this machine- Open Failed 2
or
Pipe Files are supported on this machine
Pipe File = /copylvol/pftp_pipes26404
Pipe File Size = 1073741824

3.3.19. Set the PDATA_ONLY protocol - pdata

Synopsis
pdata

Description
Explicitly request the PDATA_ONLY protocol.

Parameters
None.

Return strings
**** NOTE: Protocol set to PDATA_ONLY **** (At logon time)
215 Parallel protocol is PDATA_ONLY

Error conditions
?Invalid command ==> Older Client?

See also
None.
Parallel File Transfer Protocol (PFTP)

Examples

1. Set protocol to PDATA_ONLY (Failure)
   ftp> pdata
   Server does NOT support command ==> Older Server?
   ?Invalid command ==> Older Client?
   ftp>

3.3.20. Set the PDATA_PUSH protocol - pdatapush

Synopsis
   pdatapush

Description
   Explicitly request the PDATA_PUSH protocol.

Parameters
   None.

Return strings
   **** NOTE: Protocol set to PDATA_PUSH **** (At logon time)
   215 Parallel protocol is PDATA_PUSH

Error conditions
   ?Invalid command ==> Older Client?

See also
   None.

Examples

1. Set protocol to PDATA_PUSH (Failure)
   ftp> pdatapush
   Server does NOT support command ==> Older Server?
   ?Invalid command ==> Older Client?
   ftp>

3.3.21. Set the PDATA_AND_MOVER protocol - pmover

Synopsis
   pmover

Description
   Explicitly specify parallel transfers to use the PDATA_AND_MOVER protocol regardless of what is specified in the HPSS.conf file.

Parameters
   None.
Return strings
215 Parallel protocol is PDATA_AND_MOVER

Error conditions
ftp> pmover
Server does NOT support command ==> Older Server?
?Invalid command ==> Older Client?

See also
HPSS.conf(7)

Examples
1. Set PDATA_AND_MOVER protocol
   ftp> pmover
   215 Parallel protocol is PDATA_AND_MOVER
   ftp>

3.3.22. Set the Socket Buffer Size - setsock

Synopsis
setsock SizeString

Description
Set the desired socket buffer size. Useful when no HPSS.conf file exists or the client/Mover combination is NOT in the HPSS.conf file. When entered without a SizeString, the command returns the Socket Buffer Size in effect.

Parameters
SizeString; e.g., "1MB"

Return strings
Socket Buffer Size = 1048576.

Error conditions
PdataSockBufSize reset equal or below sb_max (1048576)

See also
None.

Example
1. Set Socket Buffer Size
   ftp> setsock 4mb (Above system max)
   PdataSockBufSize reset equal or below sb_max (1048576)
   ftp>

2. Set Socket Buffer Size
   ftp> setsock 512kb
   ftp>

3. Set Socket Buffer Size (no argument)
3.3.23. Set the Transfer Buffer Size - setxfer

Synopsis
setxferbufsize SizeString

Description
Set the desired transfer buffer sizes. Useful when no HPSS.conf file exists or the client/daemon combination is NOT in the HPSS.conf file. When entered without a SizeString, the command returns the Transfer Buffer Size in effect.

Parameters
SizeString; e.g., "4MB"

Return strings
PdataBufferSize = 4194304

Error conditions
?Invalid command ==> Old Client?

See also
None.

Example

1. Set Transfer Buffer Size
   ftp> setxfer 40MB (Max is 32MB)
   ftp>

2. Display effective Transfer Buffer Size (no argument)
   ftp> setxfer
   Socket Buffer Size = 33554432.
   ftp>
Appendix A. Glossary of Terms and Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACL</td>
<td>Access Control List</td>
</tr>
<tr>
<td>ACSLS</td>
<td>Automated Cartridge System Library Software (Oracle StorageTek)</td>
</tr>
<tr>
<td>ADIC</td>
<td>Advanced Digital Information Corporation</td>
</tr>
<tr>
<td>accounting</td>
<td>The process of tracking system usage per user, possibly for the purposes of charging for that usage. Also, a log record type used to log accounting information.</td>
</tr>
<tr>
<td>AIX</td>
<td>Advanced Interactive Executive. An operating system provided on many IBM machines.</td>
</tr>
<tr>
<td>alarm</td>
<td>A log record type used to report situations that require administrator investigation or intervention.</td>
</tr>
<tr>
<td>AML</td>
<td>Automated Media Library. A tape robot.</td>
</tr>
<tr>
<td>AMS</td>
<td>Archive Management Unit</td>
</tr>
<tr>
<td>ANSI</td>
<td>American National Standards Institute</td>
</tr>
<tr>
<td>API</td>
<td>Application Program Interface</td>
</tr>
<tr>
<td>archive</td>
<td>One or more interconnected storage systems of the same architecture.</td>
</tr>
<tr>
<td>attribute</td>
<td>When referring to a managed object, an attribute is one discrete piece of information, or set of related information, within that object.</td>
</tr>
<tr>
<td>attribute change</td>
<td>When referring to a managed object, an attribute change is the modification of an object attribute. This event may result in a notification being sent to SSM, if SSM is currently registered for that attribute.</td>
</tr>
<tr>
<td>audit</td>
<td>An operation that produces lists of HPSS log messages whose record type is SECURITY. A security audit is used to provide a trail of security-relevant activity in HPSS.</td>
</tr>
<tr>
<td>bar code</td>
<td>An array of rectangular bars and spaces in a predetermined pattern which represent alphanumeric information in a machine readable format (e.g., UPC symbol)</td>
</tr>
<tr>
<td>BFS</td>
<td>HPSS Bitfile Service.</td>
</tr>
<tr>
<td>bitfile</td>
<td>A file stored in HPSS, represented as a logical string of bits unrestricted in size or internal structure. HPSS imposes a size limitation in 8-bit bytes based upon the maximum size in bytes that can be represented by a 64-bit unsigned integer.</td>
</tr>
<tr>
<td>bitfile segment</td>
<td>An internal metadata structure, not normally visible, used by the Core Server to map contiguous pieces of a bitfile to underlying storage.</td>
</tr>
<tr>
<td>Bitfile Service</td>
<td>Portion of the HPSS Core Server that provides a logical abstraction of bitfiles to its clients.</td>
</tr>
<tr>
<td>BBTM</td>
<td>Blocks Between Tape Marks. The number of data blocks that are written to a tape virtual volume before a tape mark is required on the physical media.</td>
</tr>
<tr>
<td>CAP</td>
<td>Cartridge Access Port</td>
</tr>
<tr>
<td>cartridge</td>
<td>A physical media container, such as a tape reel or cassette, capable of being mounted on and dismounted from a drive. A fixed disk is technically considered to be</td>
</tr>
</tbody>
</table>
a cartridge because it meets this definition and can be logically mounted and
dismounted.

**central log**
The main repository of logged messages from all HPSS servers enabled to send
messages to the Log Client. The Log Client forwards messages to the Log Daemon
for recording in the central log.

**class**
A type definition in Java. It defines a template on which objects with similar
characteristics can be built, and includes variables and methods specific to the class.

**Class of Service**
A set of storage system characteristics used to group bitfiles with similar logical
characteristics and performance requirements together. A Class of Service is
supported by an underlying hierarchy of storage classes.

**cluster**
The unit of storage space allocation on HPSS disks. The smallest amount of disk
space that can be allocated from a virtual volume is a cluster. The size of the cluster
on any given disk volume is determined by the size of the smallest storage segment
that will be allocated on the volume, and other factors.

**configuration**
The process of initializing or modifying various parameters affecting the behavior of
an HPSS server or infrastructure service.

**COS**
Class of Service

**Core Server**
An HPSS server which manages the namespace and storage for an HPSS system.
The Core Server manages the Name Space in which files are defined, the attributes
of the files, and the storage media on which the files are stored. The Core Server is
the central server of an HPSS system. Each storage sub-system uses exactly one Core
Server.

**daemon**
A UNIX program that runs continuously in the background.

**DB2**
A relational database system, a product of IBM Corporation, used by HPSS to store
and manage HPSS system metadata.

**debug**
A log record type used to report internal events that can be helpful in troubleshooting
the system.

**delog**
The process of extracting, formatting, and outputting HPSS central log records. This
process is obsolete in 7.4 and later versions of HPSS. The central log is now recorded
as flat text.

**deregistration**
The process of disabling notification to SSM for a particular attribute change.

**descriptive name**
A human-readable name for an HPSS server.

**device**
A physical piece of hardware, usually associated with a drive, that is capable of
reading or writing data.

**directory**
An HPSS object that can contain files, symbolic links, hard links, and other
directories.

**dismount**
An operation in which a cartridge is either physically or logically removed from
a device, rendering it unreadable and unwritable. In the case of tape cartridges, a
dismount operation is a physical operation. In the case of a fixed disk unit, a dismount
is a logical operation.

**DNS**
Domain Name Service

**DOE**
Department of Energy
drive  A physical piece of hardware capable of reading and/or writing mounted cartridges. The terms device and drive are often used interchangeably.

EB  Exabyte \( (2^{60}) \)

ESCON  Enterprise System Connection

event  A log record type used to report informational messages (e.g., subsystem starting, subsystem terminating).

export  An operation in which a cartridge and its associated storage space are removed from the HPSS system Physical Volume Library. It may or may not include an eject, which is the removal of the cartridge from its Physical Volume Repository.

FIFO  First in first out

file  An object than can be written to, read from, or both, with attributes including access permissions and type, as defined by POSIX (P1003.1-1990). HPSS supports only regular files.

file family  An attribute of an HPSS file that is used to group a set of files on a common set of tape virtual volumes.

fileset  A collection of related files that are organized into a single easily managed unit. A fileset is a disjoint directory tree that can be mounted in some other directory tree to make it accessible to users.

fileset ID  A 64-bit number that uniquely identifies a fileset.

fileset name  A name that uniquely identifies a fileset.

file system ID  A 32-bit number that uniquely identifies an aggregate.

FTP  File Transfer Protocol

Gatekeeper  An HPSS server that provides two main services: the ability to schedule the use of HPSS resources referred to as the Gatekeeping Service, and the ability to validate user accounts referred to as the Account Validation Service.

Gatekeeping Service  A registered interface in the Gatekeeper that provides a site the mechanism to create local policy on how to throttle or deny create, open and stage requests and which of these request types to monitor.

Gatekeeping Site Interface  The APIs of the gatekeeping site policy code.

Gatekeeping Site Policy  The gatekeeping shared library code written by the site to monitor and throttle create, open, and/or stage requests.

GB  Gigabyte \( (2^{30}) \)

GECOS  The comment field in a UNIX password entry that can contain general information about a user, such as office or phone number.

GID  Group Identifier

GK  Gatekeeper

GUI  Graphical User Interface

HA  High Availability

HACMP  High Availability Clustered Multi-Processing - A software package used to implement high availability systems.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>HADR</td>
<td>DB2 High Availability Disaster Recovery</td>
</tr>
<tr>
<td>halt</td>
<td>A forced shutdown of an HPSS server.</td>
</tr>
<tr>
<td>HDM</td>
<td>Shorthand for HPSS/DMAP.</td>
</tr>
<tr>
<td>HDP</td>
<td>High Density Passthrough</td>
</tr>
<tr>
<td>hierarchy</td>
<td>See Storage Hierarchy.</td>
</tr>
<tr>
<td>HPSS</td>
<td>High Performance Storage System</td>
</tr>
<tr>
<td>HPSS-only fileset</td>
<td>An HPSS fileset that is not linked to an external filesystem (e.g., XFS).</td>
</tr>
<tr>
<td>IBM</td>
<td>International Business Machines Corporation</td>
</tr>
<tr>
<td>ID</td>
<td>Identifier</td>
</tr>
<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
</tr>
<tr>
<td>import</td>
<td>An operation in which a cartridge and its associated storage space are made available to the HPSS system. An import requires that the cartridge has been physically introduced into a Physical Volume Repository (injected). Importing the cartridge makes it known to the Physical Volume Library.</td>
</tr>
<tr>
<td>I/O</td>
<td>Input/Output</td>
</tr>
<tr>
<td>IOD/IOR</td>
<td>Input/Output Descriptor / Input/Output Reply. Structures used to send control information about data movement requests in HPSS and about the success or failure of the requests.</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>IRIX</td>
<td>SGI’s implementation of UNIX</td>
</tr>
<tr>
<td>junction</td>
<td>A mount point for an HPSS fileset.</td>
</tr>
<tr>
<td>KB</td>
<td>Kilobyte ((2^{10}))</td>
</tr>
<tr>
<td>KDC</td>
<td>Key Distribution Center</td>
</tr>
<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LANL</td>
<td>Los Alamos National Laboratory</td>
</tr>
<tr>
<td>latency</td>
<td>For tape media, the average time in seconds between the start of a read or write request and the time when the drive actually begins reading or writing the tape.</td>
</tr>
<tr>
<td>LBP</td>
<td>Logical Block Protection</td>
</tr>
<tr>
<td>LDAP</td>
<td>Lightweight Directory Access Protocol</td>
</tr>
<tr>
<td>LLNL</td>
<td>Lawrence Livermore National Laboratory</td>
</tr>
<tr>
<td>local log</td>
<td>An optional log file maintained by a Log Client. The local log contains formatted messages sent by HPSS servers running on the same node as the Log Client.</td>
</tr>
<tr>
<td>Location Server</td>
<td>An HPSS server that is used to help clients locate the appropriate Core Server and/or other HPSS server to use for a particular request.</td>
</tr>
<tr>
<td>Log Client</td>
<td>An HPSS server required on non-Mover nodes. The Log Client is responsible for delivering log messages to the local log file, the Log Daemon, SSM, and the syslog system as configured.</td>
</tr>
<tr>
<td>Log Daemon</td>
<td>An HPSS server responsible for writing log messages to the central log. There is one Log Daemon per HPSS installation.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
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<tr>
<td>----------------------</td>
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</tr>
<tr>
<td>log record</td>
<td>A message generated by an HPSS application and handled and recorded by the HPSS logging subsystem.</td>
</tr>
<tr>
<td>log record type</td>
<td>A log record may be of type alarm, event, status, debug, request, security, trace, or accounting.</td>
</tr>
<tr>
<td>logging service</td>
<td>An HPSS infrastructure service consisting of a central Log Daemon, one or more Log Clients, and one or more logging policies. A default logging policy can be specified, which will apply to all servers, or server-specific logging policies may be defined.</td>
</tr>
<tr>
<td>logging service</td>
<td>The Log Client and Log Daemon.</td>
</tr>
<tr>
<td>LS</td>
<td>Location Server</td>
</tr>
<tr>
<td>LTO</td>
<td>Linear Tape-Open. A half-inch open tape technology developed by IBM, HP and Seagate.</td>
</tr>
<tr>
<td>MAC</td>
<td>Mandatory Access Control</td>
</tr>
<tr>
<td>managed object</td>
<td>A programming data structure that represents an HPSS system resource. The resource can be monitored and controlled by operations on the managed object. Managed objects in HPSS are used to represent servers, drives, storage media, jobs, and other resources.</td>
</tr>
<tr>
<td>MB</td>
<td>Megabyte ($2^{20}$)</td>
</tr>
<tr>
<td>metadata</td>
<td>Control information about the data stored under HPSS, such as location, access times, permissions, and storage policies. Most HPSS metadata is stored in a DB2 relational database.</td>
</tr>
<tr>
<td>method</td>
<td>A Java function or subroutine</td>
</tr>
<tr>
<td>migrate</td>
<td>To copy file data from a level in the file’s hierarchy onto the next lower level in the hierarchy.</td>
</tr>
<tr>
<td>Migration/Purge Server</td>
<td>An HPSS server responsible for supervising the placement of data in the storage hierarchies based upon site-defined migration and purge policies.</td>
</tr>
<tr>
<td>MM</td>
<td>Metadata Manager. A software library that provides a programming API to interface HPSS servers with the DB2 programming environment.</td>
</tr>
<tr>
<td>mount</td>
<td>An operation in which a cartridge is either physically or logically made readable and/or writable on a drive. In the case of tape cartridges, a mount operation is a physical operation. In the case of a fixed disk unit, a mount is a logical operation.</td>
</tr>
<tr>
<td>mount point</td>
<td>A place where a fileset is mounted in the XFS and/or HPSS namespaces.</td>
</tr>
<tr>
<td>Mover</td>
<td>An HPSS server that provides control of storage devices and data transfers within HPSS.</td>
</tr>
<tr>
<td>MPS</td>
<td>Migration/Purge Server</td>
</tr>
<tr>
<td>MVR</td>
<td>Mover</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics and Space Administration</td>
</tr>
<tr>
<td>Name Service</td>
<td>The portion of the Core Server that provides a mapping between names and machine oriented identifiers. In addition, the Name Service performs access verification and provides the Portable Operating System Interface (POSIX).</td>
</tr>
<tr>
<td>name space</td>
<td>The set of name-object pairs managed by the HPSS Core Server.</td>
</tr>
<tr>
<td>NERSC</td>
<td>National Energy Research Supercomputer Center</td>
</tr>
</tbody>
</table>
**Glossary of Terms and Acronyms**

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIS</td>
<td>Network Information Service</td>
</tr>
<tr>
<td>NLS</td>
<td>National Language Support</td>
</tr>
<tr>
<td><strong>notification</strong></td>
<td>A notice from one server to another about a noteworthy occurrence. HPSS notifications include notices sent from other servers to SSM of changes in managed object attributes, changes in tape mount information, and log messages of type alarm, event, or status.</td>
</tr>
<tr>
<td>NS</td>
<td>HPSS Name Service</td>
</tr>
<tr>
<td>NSL</td>
<td>National Storage Laboratory</td>
</tr>
<tr>
<td>object</td>
<td>See Managed Object</td>
</tr>
<tr>
<td>ORNL</td>
<td>Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
</tr>
<tr>
<td>OS/2</td>
<td>Operating System (multi-tasking, single user) used on the AMU controller PC</td>
</tr>
<tr>
<td>PB</td>
<td>Petabyte ($2^{50}$)</td>
</tr>
<tr>
<td>PFTP</td>
<td>Parallel File Transfer Protocol</td>
</tr>
<tr>
<td><strong>physical volume</strong></td>
<td>An HPSS object managed jointly by the Core Server and the Physical Volume Library that represents the portion of a virtual volume. A virtual volume may be composed of one or more physical volumes, but a physical volume may contain data from no more than one virtual volume.</td>
</tr>
<tr>
<td>Physical Volume Library</td>
<td>An HPSS server that manages mounts and dismounts of HPSS physical volumes.</td>
</tr>
<tr>
<td><strong>physical Volume Repository</strong></td>
<td>An HPSS server that manages the robotic agent responsible for mounting and dismounting cartridges or interfaces with the human agent responsible for mounting and dismounting cartridges.</td>
</tr>
<tr>
<td>PIO</td>
<td>Parallel I/O</td>
</tr>
<tr>
<td>PIOFS</td>
<td>Parallel I/O File System</td>
</tr>
<tr>
<td>POSIX</td>
<td>Portable Operating System Interface (for computer environments)</td>
</tr>
<tr>
<td>purge</td>
<td>Deletion of file data from a level in the file’s hierarchy after the data has been duplicated at lower levels in the hierarchy and is no longer needed at the deletion level.</td>
</tr>
<tr>
<td><strong>purge lock</strong></td>
<td>A lock applied to a bitfile which prohibits the bitfile from being purged.</td>
</tr>
<tr>
<td>PV</td>
<td>Physical Volume</td>
</tr>
<tr>
<td>PVL</td>
<td>Physical Volume Library</td>
</tr>
<tr>
<td>PVM</td>
<td>Physical Volume Manager</td>
</tr>
<tr>
<td>PVR</td>
<td>Physical Volume Repository</td>
</tr>
<tr>
<td>RAID</td>
<td>Redundant Array of Independent Disks</td>
</tr>
<tr>
<td>RAIT</td>
<td>Redundant Array of Independent Tapes</td>
</tr>
<tr>
<td>RAM</td>
<td>Random Access Memory</td>
</tr>
<tr>
<td>reclaim</td>
<td>The act of making previously written but now empty tape virtual volumes available for reuse. Reclaimed tape virtual volumes are assigned a new Virtual Volume ID, but retain the rest of their previous characteristics. Reclaim is also the name of the utility program that performs this task.</td>
</tr>
<tr>
<td><strong>registration</strong></td>
<td>The process by which SSM requests notification of changes to specified attributes of a managed object.</td>
</tr>
<tr>
<td><strong>reinitialization</strong></td>
<td>An HPSS SSM administrative operation that directs an HPSS server to reread its latest configuration information, and to change its operating parameters to match that configuration, without going through a server shutdown and restart.</td>
</tr>
<tr>
<td><strong>repack</strong></td>
<td>The act of moving data from a virtual volume onto another virtual volume with the same characteristics with the intention of removing all data from the source virtual volume. Repack is also the name of the utility program that performs this task.</td>
</tr>
<tr>
<td><strong>request</strong></td>
<td>A log record type used to report some action being performed by an HPSS server on behalf of a client.</td>
</tr>
<tr>
<td><strong>RISC</strong></td>
<td>Reduced Instruction Set Computer/Cycles</td>
</tr>
<tr>
<td><strong>RPC</strong></td>
<td>Remote Procedure Call</td>
</tr>
<tr>
<td><strong>SCSI</strong></td>
<td>Small Computer Systems Interface</td>
</tr>
<tr>
<td><strong>security</strong></td>
<td>A log record type used to report security related events (e.g., authorization failures).</td>
</tr>
<tr>
<td><strong>SGI</strong></td>
<td>Silicon Graphics</td>
</tr>
<tr>
<td><strong>shelf tape</strong></td>
<td>A cartridge which has been physically removed from a tape library but whose file metadata still resides in HPSS.</td>
</tr>
<tr>
<td><strong>shutdown</strong></td>
<td>An HPSS SSM administrative operation that causes a server to stop its execution gracefully.</td>
</tr>
<tr>
<td><strong>sink</strong></td>
<td>The set of destinations to which data is sent during a data transfer (e.g., disk devices, memory buffers, network addresses).</td>
</tr>
<tr>
<td><strong>SMC</strong></td>
<td>SCSI Medium Changer</td>
</tr>
<tr>
<td><strong>SNL</strong></td>
<td>Sandia National Laboratories</td>
</tr>
<tr>
<td><strong>SOID</strong></td>
<td>Storage Object ID. An internal HPSS storage object identifier that uniquely identifies a storage resource. The SOID contains an unique identifier for the object, and an unique identifier for the server that manages the object.</td>
</tr>
<tr>
<td><strong>source</strong></td>
<td>The set of origins from which data is received during a data transfer (e.g., disk devices, memory buffers, network addresses).</td>
</tr>
<tr>
<td><strong>SP</strong></td>
<td>Scalable Processor</td>
</tr>
<tr>
<td><strong>SS</strong></td>
<td>HPSS Storage Service</td>
</tr>
<tr>
<td><strong>SSH</strong></td>
<td>Secure Shell</td>
</tr>
<tr>
<td><strong>SSM</strong></td>
<td>Storage System Management</td>
</tr>
<tr>
<td><strong>SSM session</strong></td>
<td>The environment in which an SSM user interacts with the SSM System Manager to monitor and control HPSS. This environment may be the graphical user interface provided by the hpssgui program, or the command line user interface provided by the hpssadm program.</td>
</tr>
<tr>
<td><strong>stage</strong></td>
<td>To copy file data from a level in the file’s hierarchy onto the top level in the hierarchy.</td>
</tr>
<tr>
<td><strong>start-up</strong></td>
<td>An HPSS SSM administrative operation that causes a server to begin execution.</td>
</tr>
<tr>
<td><strong>status</strong></td>
<td>A log record type used to report progress for long running operations.</td>
</tr>
<tr>
<td><strong>STK</strong></td>
<td>Storage Technology Corporation (Oracle StorageTek)</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>----------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>storage class</strong></td>
<td>An HPSS object used to group storage media together to provide storage for HPSS data with specific characteristics. The characteristics are both physical and logical.</td>
</tr>
<tr>
<td><strong>storage hierarchy</strong></td>
<td>An ordered collection of storage classes. The hierarchy consists of a fixed number of storage levels numbered from level 1 to the number of levels in the hierarchy, with the maximum level being limited to 5 by HPSS. Each level is associated with a specific storage class. Migration and stage commands result in data being copied between different storage levels in the hierarchy. Each Class of Service has an associated hierarchy.</td>
</tr>
<tr>
<td><strong>storage level</strong></td>
<td>The relative position of a single storage class in a storage hierarchy. For example, if a storage class is at the top of a hierarchy, the storage level is 1.</td>
</tr>
<tr>
<td><strong>storage map</strong></td>
<td>An HPSS object managed by the Core Server to keep track of allocated storage space.</td>
</tr>
<tr>
<td><strong>storage segment</strong></td>
<td>An HPSS object managed by the Core Server to provide abstract storage for a bitfile or parts of a bitfile.</td>
</tr>
<tr>
<td><strong>Storage Service</strong></td>
<td>The portion of the Core Server which provides control over a hierarchy of virtual and physical storage resources.</td>
</tr>
<tr>
<td><strong>storage subsystem</strong></td>
<td>A portion of the HPSS namespace that is managed by an independent Core Server and (optionally) Migration/Purge Server.</td>
</tr>
<tr>
<td><strong>Storage System Management</strong></td>
<td>An HPSS component that provides monitoring and control of HPSS via a windowed operator interface or command line interface.</td>
</tr>
<tr>
<td><strong>stripe length</strong></td>
<td>The number of bytes that must be written to span all the physical storage media (physical volumes) that are grouped together to form the logical storage media (virtual volume). The stripe length equals the virtual volume block size multiplied by the number of physical volumes in the stripe group (i.e., stripe width).</td>
</tr>
<tr>
<td><strong>stripe width</strong></td>
<td>The number of physical volumes grouped together to represent a virtual volume.</td>
</tr>
<tr>
<td><strong>System Manager</strong></td>
<td>The Storage System Management (SSM) server. It communicates with all other HPSS components requiring monitoring or control. It also communicates with the SSM graphical user interface (hpssgui) and command line interface (hpssadm).</td>
</tr>
<tr>
<td><strong>TB</strong></td>
<td>Terabyte ($2^{40}$)</td>
</tr>
<tr>
<td><strong>TCP/IP</strong></td>
<td>Transmission Control Protocol/Internet Protocol</td>
</tr>
<tr>
<td><strong>trace</strong></td>
<td>A log record type used to record procedure entry/exit events during HPSS server software operation.</td>
</tr>
<tr>
<td><strong>transaction</strong></td>
<td>A programming construct that enables multiple data operations to possess the following properties:</td>
</tr>
<tr>
<td></td>
<td>- All operations commit or abort/roll-back together such that they form a single unit of work.</td>
</tr>
<tr>
<td></td>
<td>- All data modified as part of the same transaction are guaranteed to maintain a consistent state whether the transaction is aborted or committed.</td>
</tr>
</tbody>
</table>
• Data modified from one transaction are isolated from other transactions until the transaction is either committed or aborted.

• Once the transaction commits, all changes to data are guaranteed to be permanent.

UDT  User-defined Attribute
UDP  User Datagram Protocol
UID  User Identifier
UPC  Universal Product Code
UUID  Universal Unique Identifier
VPN  Virtual Private Network

**virtual** volume  An HPSS object managed by the Core Server that is used to represent logical media. A virtual volume is made up of a group of physical storage media (a stripe group of physical volumes).

**virtual** volume block size  The size of the block of data bytes that is written to each physical volume of a striped virtual volume before switching to the next physical volume.

VV  Virtual Volume

XDSM  The Open Group’s Data Storage Management standard. It defines APIs that use events to notify Data Management applications about operations on files.

XFS  A file system created by SGI available as open source for the Linux operating system.

XML  Extensible Markup Language
Appendix B. References

2. HPSS Error Manual.
3. HPSS Programmer’s Reference.
4. HPSS Installation Guide.
5. HPSS Management Guide.
6. Installing, Managing, and Using the IBM AIX Parallel I/O File System, Document Number H34- 6065-00.
Appendix C. Developer Acknowledgments

HPSS is a product of a government-industry collaboration. The project approach is based on the premise that no single company, government laboratory, or research organization has the ability to confront all of the system-level issues that must be resolved for significant advancement in high-performance storage system technology.

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