z/OS

Distributed File Service zSeries File System Administration

SC24-5989-07

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Note
Before using this information and the product it supports, be sure to read the general information in “Notices” on page 299.

Eighth Edition (September 2007)

This is a major revision of SC24-5989-06.

This edition applies to Version 1 Release 9 of z/OS (5694-A01) and to all subsequent releases and modifications until otherwise indicated in new editions.

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About this document

The purpose of this document is to provide complete and detailed guidance and reference information. This information is used by system administrators that work with the zSeries File System (zFS) component of the IBM® z/OS Distributed File Service base element.

How this document is organized

This document is divided into parts, each part divided into chapters:

- Part 1, "zFS administration guide," on page 1 discusses guidance information for the zSeries File System (zFS).
- Part 2, "zFS administration reference," on page 57 discusses the zSeries File System (zFS) reference information which includes z/OS system commands, zFS commands, and zFS data sets.

Conventions used in this document

This document uses the following typographic conventions

Bold — **Bold** words or characters represent system elements that you must enter into the system literally, such as commands.

Italic — Italicized words or characters represent values for variables that you must supply.

`Example Font` — Examples and information displayed by the system are printed using an example font that is a `constant width typeface`.

[ ] — Optional items found in format and syntax descriptions are enclosed in brackets.

{ } — A list from which you choose an item found in format and syntax descriptions are enclosed by braces.

| — A vertical bar separates items in a list of choices.

< > — Angle brackets enclose the name of a key on a keyboard.

... — Horizontal ellipsis points indicated that you can repeat the preceding item one or more times.

**** — A backslash is used as a continuation character when entering commands from the shell that exceed one line (255 characters). If the command exceeds one line, use the backslash character \ as the last non-blank character on the line to be continued, and continue the command on the next line.

Note: When you enter a command from this document that uses the backslash character (\) make sure you immediately press the Enter key and then continue with the rest of the command. In most cases, the backslash has been positioned for ease of readability.

— A pound sign is used to indicate a command is entered from the shell, specifically where **root** authority is needed (**root** refers to a user with a **UID = 0**).

This document used the following keying convention:

<Return> — The notation **<Return>** refers to the key on your terminal or workstation that is labeled with either the word "Return" or "Enter", with a left arrow.

Entering commands
When instructed to enter a command, type the command name and then press **<Return>**.

Where to find more information

Where necessary, this document references information in other documents, For complete titles and order numbers for all elements of z/OS, refer to the *z/OS Information Roadmap*.

Information about installing Distributed File Service components is found in *z/OS Program Directory*.

Information about Distributed File Service zSeries File System-related messages is found in *z/OS Distributed File Service Messages and Codes*.

Softcopy publications

The z/OS Distributed File Service library is available on a CD-ROM, *z/OS Collection*, SK3T-4269. The CD-ROM online library collections is a set of documents for z/OS and related products that includes the IBM Library Reader. This is a program that enables you to view the BookManager® files. This CD-ROM also contains the Portable Document Format (PDF) files. You can view or print these files with the Adobe Acrobat reader.

Internet sources

The softcopy z/OS publications are also available for web-browsing and for viewing or printing PDFs using the following URL: http://www.ibm.com/servers/eserver/zseries/zos/bkserv/e0zlib

You can also provide comments about this document and any other z/OS documentation by visiting that URL. Your feedback is important in helping to provide the most accurate and high-quality information.

Information updates on the web

For the latest information updates that have been provided in PTF cover letters and Documentation APARs for z/OS, see the online document at:

`http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/ZIDOCMST/CCONTENTS.`

This document is updated weekly and lists documentation changes before they are incorporated into z/OS publications.

Using LookAt to look up message explanations

LookAt is an online facility that lets you look up explanations for most of the IBM messages you encounter, as well as for some system abends and codes. Using LookAt to find information is faster than a conventional search because in most cases LookAt goes directly to the message explanation.

You can use LookAt from these locations to find IBM message explanations for z/OS® elements and features, z/VM®, z/VSE™, and Clusters for AIX® and Linux™:

- The Internet. You can access IBM message explanations directly from the LookAt Web site at www.ibm.com/servers/eserver/zseries/zos/bkserv/lookat/.
- Your z/OS TSO/E host system. You can install code on your z/OS systems to access IBM message explanations using LookAt from a TSO/E command line (for example: TSO/E prompt, ISPF, or z/OS UNIX® System Services).
- Your Microsoft® Windows® workstation. You can install LookAt directly from the *z/OS Collection* (SK3T-4269) or the *z/OS and Software Products DVD Collection* (SK3T-4271) and use it from the resulting Windows graphical user interface (GUI). The command prompt (also known as the DOS > command line) version can still be used from the directory in which you install the Windows version of LookAt.
- Your wireless handheld device. You can use the LookAt Mobile Edition from www.ibm.com/servers/eserver/zseries/zos/bkserv/lookat/lookatm.html with a handheld device that has wireless access and an Internet browser (for example: Internet Explorer for Pocket PCs, Blazer or Eudora for Palm OS, or Opera for Linux handheld devices).

You can obtain code to install LookAt on your host system or Microsoft Windows workstation from:

- A CD in the *z/OS Collection* (SK3T-4269).
- The *z/OS and Software Products DVD Collection* (SK3T-4271).
- The LookAt Web site (click **Download** and then select the platform, release, collection, and location that suit your needs). More information is available in the LOOKAT.ME files available during the download process.

Using IBM Health Checker for z/OS

IBM Health Checker for z/OS is a z/OS component that installations can use to gather information about their system environment and system parameters to help identify potential configuration problems before they impact availability or cause outages. Individual products, z/OS components, or ISV software can provide checks that take advantage of the IBM Health Checker for z/OS framework. This book might refer to checks or messages associated with this component.

For additional information about checks and about IBM Health Checker for z/OS, see *IBM Health Checker for z/OS: User's Guide*.

SDSF also provides functions to simplify the management of checks. See *z/OS SDSF Operation and Customization* for additional information.

Summary of Changes

Summary of changes
for SC24-5989-07
z/OS Version 1 Release 9

This document contains information previously presented in SC24-5989-06, which supports z/OS Version 1 Release 8.

Changed information

- The default for the IOEFSPRM **dir_cache_size** option is now 32M. See "IOEFSPRM" on page 126.
- Information about "Cloning a file system" on page 16 has been moved to Chapter 4, "Creating and managing zFS file systems using compatibility mode aggregates," on page 11.
- **MODIFY ZFS,QUERY** has new report options. See "Monitoring zFS performance" on page 38.

Deleted information

- The **zfsadm configquery** option *-allow_dup_fs* and the **zfsadm config** option *-allow_dup_fs* are removed.
- The IOEFSPRM *allow_duplicate_filesystems* option is no longer optional. As of z/OS V1R9, the condition is always *allow_duplicate_filesystems=on*.
- z/OS.e is not supported in z/OS V1R9.

You may notice changes in the style and structure of some content in this document—for example, headings that use uppercase for the first letter of initial words only, and procedures that have a different look and format. The changes are ongoing improvements to the consistency and retrievability of information in our documents.

This document includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Summary of changes
for SC24-5989-06
z/OS Version 1 Release 8

This document contains information previously presented in SC24-5989-05, which supports z/OS Version 1 Release 7.

New information

- In addition to displaying UNIX System Services reason codes, the UNIX System Services shell command, **bpxmtext**, also displays the text and action of zFS reason codes (EFxxnnnn) returned from the kernel.
- A new section is added, "Minimum and maximum file system sizes" on page 19.
- The zfs command "ioeagslv" on page 69 has a new option, converttov3. This option directs the Salvager to convert the specified aggregate from version 1.4 to version 1.3.
- The **zfsadm aggrinfo -long** option and **zfsadm lsfs -long** option have been enhanced to include the version of the aggregate. See "zfsadm aggrinfo" on page 79 and "zfsadm lsfs" on page 109.
- A new overview and procedure are added, "Understanding zFS hang detection" on page 51 and "Steps for resolving a zFS hang" on page 51.

Changed information

- Starting with z/OS Version 1 Release 8, when a zFS compatibility mode aggregate is mounted R/W (or a zFS multi-file system aggregate is attached R/W), the on-disk format of the aggregate is modified. It is

changed from a 1.3 aggregate to a 1.4 aggregate. This allows the performance of mount to be improved (especially for zFS file systems with many files and directories). See “Growing a compatibility mode aggregate” on page 13 and “Growing a multi-file system aggregate” on page 31 for additional information.

Note: This function has been rolled back and is supported on z/OS Version 1 Release 7.

- An attempt to mount a zFS file system that is contained in a zFS multi-file system aggregate running in a sysplex will be denied.

Deleted information

- zFS no longer supports the **stop zfs** command. This command is being replaced by the operator command **MODIFY OMVS,STOPPFS=ZFS** command.

This document contains terminology, maintenance, and editorial changes, including changes to improve consistency and retrievability.

Summary of changes
for SC24-5989-05
z/OS Version 1 Release 7

This document contains information previously presented in SC24-5989-04, which supports z/OS Version 1 Release 6.

New information

- “Using the z/OS HFS to zFS migration tool” on page 25.
- zFS supports the following additional characters in zFS file system names and zFS aggregate names: @ (at sign), # (number sign), and $ (dollar).
- All zfsadm commands that apply to zFS aggregates or file systems work against all aggregates and file systems across the sysplex. The following zfsadm commands can optionally direct their operation to a particular member of the sysplex: aggrinfo, attach, clonesys, config, configquery, define, detach, format, lsaggr, lsfs, and query.
- z/OS system command, **modify zfs process**, has been updated to support the unquiesce parameter. See “modify zfs process” on page 60.
- The following zFS commands have been added:
  - “zfsadm lssys” on page 114
- The following pfsctl Application Programming Interface command calls have been added:
  - “List Systems” on page 205
  - “Statistics Directory Cache Information” on page 229
  - “Statistics Kernel Information” on page 250
  - “Statistics Log Cache Information” on page 259
  - “Statistics Metadata Cache Information” on page 263
  - “Statistics Transaction Cache Information” on page 274
  - “Statistics Vnode Cache Information” on page 284

Changed information

- “zfsadm aggrinfo” on page 79 has been enhanced to include the **-fast** and **-long** options. The **-long** option displays additional information about space usage in an aggregate.
- “zfsadm configquery” on page 91 has been enhanced to include the **-group** and **-sysplex_state** options. The **-group** option displays the XCF group used by ZFS for communication between sysplex members. The **-sysplex_state** option displays the sysplex state of ZFS.

- "IOEFSPRM" on page 126 has been enhanced to include the **dir_cache_size** option, the **group** option, and the **xcf_trace_table_size** option. The dir_cache_size option specifies the size of the directory buffer cache. The group option specifies the XCF group name used by zFS. The xcf_trace_table_size option specifies the size of the XCF trace table.
- The IOEFSPRM **msg_output_dsn** option is only used during initialization.
- Terminology change: References to Shared HFS have been replaced with shared file system.
- Terminology change: References to OpenEdition have been replaced with z/OS UNIX System Services, or z/OS UNIX.
- The **zfsadm lsfs** command has added additional information when the **-long** option is specified.

This document includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations are indicated by a vertical line to the left of the change.

Part 1. zFS administration guide

This part of the document discusses guidance information for the zSeries File System (zFS).

Chapter 1. zSeries File System (zFS) overview

The z/OS Distributed File Service zSeries File System (zFS) is a z/OS UNIX System Services (z/OS UNIX) file system that can be used in addition to the hierarchical file system (HFS). zFS file systems contain files and directories that can be accessed with z/OS UNIX application programming interfaces (APIs). These file systems can support access control lists (ACLs). zFS file systems can be mounted into the z/OS UNIX hierarchy along with other local (or remote) file system types (for example, HFS, TFS, AUTOMNT and NFS).

Note: See *z/OS UNIX System Services Planning* for more information on ACLs.

zFS does not replace HFS, rather zFS is complementary to HFS. zFS can be used for all levels of the z/OS UNIX System Services hierarchy (including the root file system) when all members are at the z/OS V1R7 level. Because zFS has higher performance characteristics than HFS and is the strategic file system, HFS may no longer be supported in future releases and you will have to migrate the remaining HFS file systems to zFS.

zFS and HFS can both participate in shared sysplexes. However, only zFS supports security labels. Therefore, in a multilevel-secure environment, you must use zFS file systems instead of HFS file systems. See *z/OS Planning for Multilevel Security and the Common Criteria* for more information on multilevel security and migrating your HFS version root to a zFS version root with security labels.

Note: Multi-file system aggregate support is not planned to be enhanced and might be removed sometime in the future. In addition, beginning with z/OS Version 1 Release 8, zFS file systems that reside in a zFS multi-file system aggregate in a shared file system environment cannot be mounted. You should copy the data from that file system into a zFS compatibility mode file system using a prior release of z/OS.

Features

zFS provides many features and benefits:

Performance zFS provides significant performance gains in many customer environments accessing files approaching 8K in size that are frequently accessed and updated. The access performance of smaller files is equivalent to HFS.

Restart zFS provides a reduced exposure to loss of updates. zFS writes data blocks asynchronously and does not wait for a sync interval. zFS is a logging file system. It logs metadata updates. If a system failure occurs, zFS replays the log when it comes back up to ensure that the file system is consistent.

Cloning As an optional function, zFS allows the administrator to make a read-only clone of a file system in the same data set. This clone file system can be made available to users to provide a read-only point-in-time copy of a file system. The clone operation happens relatively quickly and does not take up too much additional space because only the metadata[1] is copied.

Note: This function has some restrictions. See Chapter 5, “Sysplex considerations,” on page 21 for information on these restrictions.

1. Metadata consists of things like owner, permissions and data block pointers.

Terminology

In order to discuss the details of zFS administration, a new concept and some new terminology is introduced. The new concept is multiple file systems in a single data set. This is in contrast to HFS which always has a single file system per data set.

The data set that contains zFS file systems is called a ***zFS aggregate***. A zFS aggregate can contain one[2] or more zFS file systems. A zFS aggregate is a Virtual Storage Access Method Linear Data Set (VSAM LDS). Once the zFS aggregate is defined and formatted, one or more zFS file systems can be created in the aggregate. A zFS aggregate that contains only a single read-write zFS file system can be defined and is called a compatibility mode aggregate. A compatibility mode aggregate can also contain a backup file system. Compatibility mode aggregates are more like HFS. It is recommended that as you begin to use zFS, you use compatibility mode aggregates. Aggregates that contain multiple file systems are called multi-file system aggregates. This support is not planned to be enhanced and might be removed in the future. Therefore, you should only use compatibility mode aggregates.

zFS does not support the use of a striped VSAM Linear Data Set as a zFS aggregate. If you attempt to mount a compatibility mode file system that had previously been formatted and is a striped VSAM LDS, it will only mount as read-only. zFS does not support a zFS aggregate that has guaranteed space.

The term ***zFS file system*** refers to a hierarchical organization of files and directories that has a root directory and can be mounted into the z/OS UNIX hierarchy. zFS file systems reside on DASD. The term ***zFS Physical File System (PFS)*** refers to the code that runs in the zFS address space. The zFS PFS can handle many users accessing many zFS file systems at the same time.

When discussing cloning, the zFS file system that is the source file system is referred to as the ***read-write file system***. The zFS file system that is the result of the clone operation is called the ***backup file system***. The backup file system is a read-only file system and can only be mounted as read-only.

When discussing file systems, the term ***zFS file system name*** refers to the name of the file system as zFS knows it. The term ***z/OS UNIX file system name*** or ***mount file system name*** refers to the name of the file system as z/OS UNIX knows it. We make this distinction because you can now specify a z/OS UNIX file system name (as specified in the MOUNT FILESYSTEM option) that is different from the zFS file system name (as optionally specified in the MOUNT PARM FILESYSTEM suboption). This latter specification may be required when working with multiple zFS file systems that have the same zFS file system name (in different zFS aggregates). However, this capability is only useful for multi-file system aggregates. Multi-file system aggregate function is not planned to be enhanced and might be removed in the future. Therefore, you should not use this capability. If you are currently using multi-file system aggregates, start planning to discontinue.

2. Actually, a zFS aggregate can contain zero or more zFS file systems.

Chapter 2. Post installation processing

zFS is part of the Distributed File Service base element of z/OS. Before using the zFS support, you must install the z/OS release, the Distributed File Service, and the other base elements of z/OS using the appropriate release documentation.

Note: If you are only using the zFS support of the Distributed File Service (and not the DCE DFS™ support nor the SMB server support of the Distributed File Service), DCE DFS and SMB do not need to be configured and DCE does not need to be configured. For more information on DCE DFS, refer to the *z/OS Distributed File Service DFS Administration* document. For more information on SMB, refer to the *z/OS Distributed File Service SMB Administration* document.

To use the zFS support, you must configure the support on the system. Configuration includes the following administrative tasks:

- Define the zFS physical file system to z/OS UNIX
- Create or update the zFS parameter data set (IOEFSPRM). See “IOEFSPRM” on page 126.
- Define zFS aggregates and file systems
- Create mount points and mount zFS file systems
- Change owner/group and set permissions on file system root
- Optionally, add MOUNT statements in your BPXPRMxx member(s) to cause zFS file systems to be mounted at IPL.

zFS installation and configuration steps

To install, configure, and access zFS, you must perform the following administrative steps:

1. Install and perform post-installation of the Distributed File Service by following the applicable instructions in the *z/OS Program Directory* or the *ServerPac: Installing Your Order*. The following is a summary of the information that is contained in those documents:
   a. Ensure that the target and distribution libraries for the Distributed File Service are available.
   b. Run the prefix.SIOESAMP(IOEISMKD) job from UID 0 to create the symbolic links used by the Distributed File Service. This job reads the member prefix.SIOESAMP(IOEMKDIR) to delete and create the symbolic links.
   c. Ensure that the DDDEFS for the Distributed File Service are defined by running the prefix.SIOESAMP(IOEISDDD) job.
   d. Install the Load Library for the Distributed File Service. The Load Library (hlq.SIOELMOD) must be APF authorized and must be in link list.
   e. Install the samples (hlq.SIOESAMP).
   f. Install the sample PROC for ZFS (hlq.SIOEPROC).
   g. Create a JCL PROC for the ZFS started task in SYS1.PROCLIB by copying the sample PROC from the previous step.

      The DDNAME IOEZPRM identifies the optional IOEFSPRM data set. Although this DD statement is optional, it is recommended that it be included to identify the parameter data set to be used for ZFS. For now, it is suggested that this DD refer to a PDS with a member called IOEFSPRM that has a single line that begins with an asterisk (*) in column 1. Subsequent modifications can be made to the IOEFSPRM member, refer to “IOEFSPRM” on page 126.

      As an alternative to the IOEZPRM DDNAME specification, the IOEFSPRM member can be specified as a true PARMLIB member. In this case, the member has the name IOEPRMxx, where xx is specified in the parmlib member list. Refer to “IOEFSPRM” on page 126 for additional information on IOEPRMxx.

If you want to run ZFS so that it is not under control of JES, see step 2 below. You might want to do this so that ZFS does not interfere with shutting down JES.

h. Add the following RACF® commands:

```
ADDGROUP DFSGRP SUPGROUP(SYS1) OMVS(GID(2))
ADDUSER DFS OMVS(HOME('/opt/dfslocal/home/dfscntl') UID(0)) DFLTGRP(DFSGRP) AUTHORITY(USE)
 UACC(NONE)
RDEFINE STARTED DFS.** STDATA(USER(DFS))
RDEFINE STARTED ZFS.** STDATA(USER(DFS))
SETROPTS RACLIST(STARTED)
SETROPTS RACLIST(STARTED) REFRESH
```

Note: The DFS user ID must have at least ALTER authority to all VSAM LDSes that contain zFS aggregates. A user ID other than DFS can be used to run the ZFS started task if it is defined with the same RACF characteristics as shown for the DFS user ID. As an alternative to PERMITting ALTER authority to all VSAM LDSes that contain zFS aggregates, you may assign the ZFS started task the TRUSTED attribute or you may give the userid of the ZFS started task the OPERATIONS attribute. Please consult the RACF documentation that describes these attributes.

2. Create a BPXPRMxx entry for ZFS.

   Add the following FILESYSTYPE statement to your BPXPRMxx:

   ```
   FILESYSTYPE TYPE(ZFS) ENTRYPOINT(IOEFSCM) ASNAME(ZFS)
   ```

   You should update your IEASYSxx parmlib member to contain the OMVS=(xx,yy) parameter for future IPLs.

   If necessary, you can specify that ZFS should not run under control of JES by specifying SUB=MSTR as in the following example:

   ```
   FILESYSTYPE TYPE(ZFS) ENTRYPOINT(IOEFSCM) ASNAME(ZFS,'SUB=MSTR')
   ```

3. Run the **dfs_cpfiles** program.

   Running this program as described in the program directory is recommended even if you plan to only use the zFS support. The only zFS configuration file is the **IOEFSPRM** data set and it is not created by the **dfs_cpfiles** program. But, to complete the installation of the Distributed File Service, the **dfs_cpfiles** program should be run to create other files needed by SMB or DCE DFS support. This avoids problems if the other support (SMB or DCE DFS) supplied by the Distributed File Service is subsequently activated.

   To run the **dfs_cpfiles** program:

   - Logon as root (UID 0) on the local machine.
   - From the z/OS UNIX shell, enter **/usr/lpp/dfs/global/scripts/dfs_cpfiles**.

4. Create or update the zFS parameter data set (IOEFSPRM).

   The zFS parameter data set is optional. The IOEZPRM DD can be omitted from the ZFS PROC or the **IOEFSPRM** data set can exist, with no parameters contained in it. Parameters are only required if you want to override the defaults for the zFS parameters. As mentioned previously, it is recommended that you create an empty **IOEFSPRM** member in a PDS. The **IOEFSPRM** member should have a single line in it that is a comment (an asterisk(*) in column 1). Update the IOEZPRM DD statement in the ZFS PROC to contain the name of the IOEFSPRM member. For example:

   ```
   IOEZPRM   DD   DSN=SYS4.PVT.PARMLIB(IOEFSPRM),DISP=SHR
   ```

   If you are running a sysplex, you may want to have different IOEFSPRM data sets for different systems. Refer to Chapter 5, “Sysplex considerations,” on page 21 for reasons why you may need to use different **IOEFSPRM** data sets. In this case, you may want to specify a system qualifier in the data set name in the IOEZPRM DD. For example:

   ```
   IOEZPRM   DD   DSN=SYS4.&SYSNAME..PARMLIB(IOEFSPRM),DISP=SHR
   ```

   As an alternative to the IOEZPRM DDNAME specification, the IOEFSPRM member can be specified as a true PARMLIB member. In this case, the member has the name IOEPRMxx, where xx is specified in the parmlib member list. Refer to “IOEFSPRM” on page 126 for additional information on IOEPRMxx.

The PDS (organization PO) should have a record format of FB with a record length of 80. The block size can be any multiple of 80 that is appropriate for the device. A sample **IOEFSPRM** is provided in hlq.SIOESAMP(IOEFSPRM). **IOEFSPRM** is also known as **IOEZS001**. Refer to Chapter 12, "zFS data sets," on page 125 for a full description of the options that can be specified in **IOEFSPRM**.

5. Preallocate data sets for debugging - Allocate the zFS trace output data set as a PDSE with RECFM=VB, LRECL=133 with a primary allocation of at least 50 cylinders and a secondary allocation of 30 cylinders. The name of this trace output data set should be specified in the trace_dsn option in the **IOEFSPRM** file. Also, allocate a debug settings data set as a PDS member with an LRECL=80. You can put one comment line in the member (Use a /* followed by */). The name of this debug settings data set member should be specified in the debug_settings_dsn option of the **IOEFSPRM** file. You should do each of these for each member of the sysplex.
6. Create a zFS (compatibility mode) file system.

   A zFS file system resides in a zFS aggregate. A zFS aggregate is a VSAM Linear Data Set. Refer to Chapter 4, "Creating and managing zFS file systems using compatibility mode aggregates," on page 11 for details on creating zFS file systems.
7. Create a directory and mount the zFS file system on it.

   A directory can be created with the z/OS UNIX **mkdir** command. (You can also use an existing directory.) The TSO/E MOUNT command or the **/usr/sbin/mount** REXX exec can be used to mount the zFS file system on the directory. Refer to Chapter 4, "Creating and managing zFS file systems using compatibility mode aggregates," on page 11 for details on mounting zFS file systems.

   Note: Steps 6 and 7 can be repeated as many times as necessary for each permanently mounted zFS file system. Only step 6 is needed for zFS automounted file systems (assuming that the automount file system has been set up.)
8. Add mount statements to BPXPRMxx members so that the zFS file systems are mounted on the next IPL.

   For example:

```
MOUNT FILESYSTEM('OMVS.PRV.COMPAT.AGGR001') TYPE(ZFS) MOUNTPOINT('/etc/mountpt')
```

Chapter 3. Managing zFS processes

This section describes the zFS address space and then discusses starting zFS, stopping zFS, and other activities required to manage zFS.

zFS runs as a z/OS UNIX colony address space. There must be an entry in a BPXPRMxx parmlib member for zFS and the zFS PROC must be available. zFS is started by z/OS UNIX based on the FILESYSTYPE statement for zFS in the BPXPRMxx parmlib member.

zFS can be started at IPL if the BPXPRMxx parmlib member is in the IEASYSxx parmlib member's OMVS=(xx,yy) list. It can also be started later by using the **setomvs reset=(xx)** operator command.

zFS can be stopped using the **MODIFY OMVS,STOPPFS=ZFS** operator command. zFS file systems will be unmounted or moved to another sysplex member before stopping zFS. When zFS is stopped, you receive the following message (after replying Y to message BPXI078D):

```
nn BPXF032D FILESYSTYPE ZFS TERMINATED. REPLY 'R' WHEN READY TO RESTART. REPLY 'I' TO IGNORE.
```

In general, you should not stop zFS. Stopping zFS is disruptive to applications that are using zFS file systems. zFS will be stopped automatically when you shut down z/OS UNIX.

To restart zFS, reply **r** to message nn. (For example, **r 1,r**). If you want zFS to remain stopped, you can reply **i** and this removes the prompt. In this case, zFS may be redefined at a later time using the **setomvs reset=(xx)** operator command. However, this can result in zFS file systems becoming NOT ACTIVE. An unmount and remount is required to activate a file system that is NOT ACTIVE. If you plan to restart zFS, you should reply r to the message.

Note: Stopping zFS may have shared file system (sysplex) implications. Refer to Chapter 5, "Sysplex considerations," on page 21 for information on shared file systems.

If the zFS colony address space has an internal failure, it will normally not terminate. It may disable an aggregate (see "Diagnosing disabled aggregates" on page 54). If it is a case where it does terminate, normally the ZFS colony address space will restart automatically. Otherwise, message BPXF032D (the same message you receive when the **MODIFY OMVS,STOPPFS=ZFS** operator command is used) will be issued and a reply will be requested.

If zFS terminates, all zFS file systems on that system will be unmounted (or moved if AUTOMOVE in a sysplex is specified). Applications with an open file on these file systems will receive I/O errors until the file is closed. Once zFS is restarted, you must remount any file systems that were locally mounted (that is, file systems that were owned by that system and were not moved). This can be done by using the **MODIFY BPXOINIT,FILESYS=REINIT** operator command. This causes a remount for each file system that was mounted through a BPXPRMxx parmlib statement.

If you need to determine if zFS is currently active or not, use the following steps:

1. If the BPXF032D message is outstanding, ZFS is not active.
2. If the operator command **D A,ZFS** says ZFS is not found, ZFS is not active.
3. If the operator command **D A,ZFS** gives the ZFS address space information, ZFS is active.

Chapter 4. Creating and managing zFS file systems using compatibility mode aggregates

This section discusses creating compatibility mode aggregates and file systems. Refer to Chapter 8, “Multi-file system aggregates,” on page 27 for information on multi-file system aggregates.

Note: Multi-file system aggregate support is not planned to be enhanced and might be removed sometime in the future.

Creating a compatibility mode aggregate

A zFS file system is created in a zFS aggregate (which is a VSAM Linear Data Set). When using compatibility mode aggregates, the aggregate and the file system are created at the same time. For simplicity, we refer to a file system in a compatibility mode aggregate as a compatibility mode file system. A compatibility mode file system is created using the **IOEAGFMT** utility. This is a two step process:

1. Create a VSAM Linear Data Set using **IDCAMS**. The VSAM Linear Data Set must have a secondary allocation size specified, if you want to use dynamic grow. See “Dynamically growing a compatibility mode aggregate” on page 13 for additional information.
2. Format the VSAM LDS as a compatibility mode aggregate and create a file system in the aggregate using **IOEAGFMT** (see “ioeagfmt” on page 66 for additional information). When using ioeagfmt, it is required that the user must have ALTER authority to the VSAM LDS and must be UID 0 or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

The VSAM LDS, the aggregate, and the file system all have the same name and that name is equal to the VSAM LDS cluster name. The zFS file system is then mounted into the z/OS UNIX hierarchy.

The Control Interval (CI) size of a VSAM LDS that will be formatted as a zFS aggregate must be 4K. This is the default for IDCAMS and is, therefore, unspecified in the following example.

Figure 1 shows an example of a job that creates a compatibility mode file system.

```
//USERIDA  JOB ,'Compatibility Mode',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//DEFINE   EXEC   PGM=IDCAMS
//SYSPRINT DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//AMSDUMP  DD     SYSOUT=H
//DASD0    DD     DISP=OLD,UNIT=3390,VOL=SER=PRV000
//SYSIN    DD     *
     DEFINE CLUSTER (NAME(OMVS.PRV.COMPAT.AGGR001) -
            VOLUMES(PRV000) -
            LINEAR CYL(25 0) SHAREOPTIONS(3))
/*
//CREATE   EXEC   PGM=IOEAGFMT,REGION=0M,
// PARM=('-aggregate OMVS.PRV.COMPAT.AGGR001 -compat')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 1. Job to create a compatibility mode file system

Note, the **-compat** parameter in the CREATE step. That is what tells **IOEAGFMT** to create a compatibility mode file system. The result of this job is a VSAM LDS that is formatted as a zFS aggregate and contains one zFS file system. The zFS file system has the same name as the zFS aggregate (and the VSAM LDS). The size of the zFS file system (that is, its quota) is based on the size of the aggregate.

The default for the size of the aggregate is the number of 8K blocks that fits in the primary allocation. You can specify a **-size** option giving the number of 8K blocks for the aggregate. If you specify a number that is less than (or equal to) the number of blocks that fits into the primary allocation, the primary allocation size is used. If you specify a number that is larger than the number of 8K blocks that fits into the primary allocation, the VSAM LDS is extended to the size specified as long as the total size will fit in the primary allocation and a single extension. The single extension must be no larger than a single volume. This occurs during its initial formatting. Sufficient space must be available on the volume(s). Multiple volumes can be specified on the DEFINE of the VSAM LDS. The multiple volumes are used during extension of the data set at a later time. If you want to create a multi-volume data set initially that is larger than two volumes, see “Creating a multi-volume compatibility mode aggregate” on page 14. DFSMS decides when to allocate on these volumes during extension. Any VSAM LDS greater then 4 GB can be specified by using the extended format and extended addressability capability in the data class of the data set. Refer to *z/OS DFSMS Using Data Sets* for information on VSAM data sets greater than 4 GB in size. zFS does not support the use of a striped VSAM Linear Data Set as a zFS aggregate. If you attempt to mount a compatibility mode file system that had previously been formatted and is a striped VSAM LDS, it will only mount as read-only.

There are several other options that can be used when creating a compatibility mode file system that set the owner, group, and the permissions of the root directory. The **-owner** option specifies the owner of the root directory. The **-group** option specifies the group of the root directory. The **-perms** option specifies the permissions on the root directory. Refer to Chapter 11, “zFS commands,” on page 65 for more information on **IOEAGFMT**.

The zFS file system can now be mounted into the z/OS UNIX hierarchy. This is accomplished with the TSO/E MOUNT command. Here is an example of mounting the compatibility mode file system that was just created:

```
MOUNT FILESYSTEM('OMVS.PRV.COMPAT.AGGR001') TYPE(ZFS) MODE(RDWR) MOUNTPOINT('/usr/mountpt1')
```

| This assumes that the directory `/usr/mountpt1` exists and is available to become a `mountpoint`. See *z/OS*
| *UNIX System Services Planning* for complete information about mount points.

Here is an example of mounting the compatibility mode file system that was just created using the z/OS UNIX **mount** command:

```
/usr/sbin/mount -t ZFS -f OMVS.PRV.COMPAT.AGGR001 /usr/mountpt1
```

Starting with z/OS Version 1 Release 7, when a zFS compatibility mode aggregate is mounted R/W, the on-disk format of the aggregate is modified. It is changed from a version 1.3 aggregate to a version 1.4 aggregate. This allows the performance of mount to be improved (especially for zFS file systems with many files and directories). During the automatic conversion, you will see messages such as:

```
IOEZ00500I Converting  PLEX.JMS.AGGR007.LDS0007 for fast mount processing
IOEZ00518I Converting filesystem PLEX.JMS.AGGR007.LDS0007 to allow for fast mount
```

You must install toleration APAR OA11573 on prior releases. This will allow the prior releases to correctly access the new structure (version 1.4) for zFS aggregates. If you do not install toleration APAR OA11573 on prior releases, prior releases will not be able to correctly access the new structure.

In this case, you can convert a zFS aggregate back to a version 1.3 structure so that it can be accessed. (You should, of course, apply toleration APAR OA11573 as soon as possible.) To convert a zFS aggregate back to a version 1.3 structure, use the zFS IOEAGSLV (salvager) utility. A new IOEAGSLV utility option (-converttov3) is provided in z/OS V1R7 to convert a version 1.4 zFS aggregate back to a version 1.3 zFS aggregate. IOEAGSLV is also installed in the MIGLIB PDS. IOEAGSLV can be executed from any supported release by STEPLIBing to MIGLIB. Here is a sample job:

```
//USERIDA  JOB ,'Salvage',
// CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//STEPLIB  DD DSN=hlq.MIGLIB,DISP=OLD
//SALVAGE  EXEC PGM=IOEAGSLV,REGION=0M,
```

```
// PARM=('-aggregate PLEX.JMS.AGGR007.LDS0007 -converttov3')
//SYSPRINT DD SYSOUT=H
//STDOUT   DD SYSOUT=H
//STDERR   DD SYSOUT=H
//SYSUDUMP DD SYSOUT=H
//CEEDUMP  DD SYSOUT=H
//*
```

Growing a compatibility mode aggregate

If a compatibility mode aggregate becomes full, the administrator can grow the aggregate (that is, cause an additional allocation to occur and format it to be part of the aggregate). This is accomplished with the **zfsadm grow** command. There must be space available on the volume(s) to extend the aggregate's VSAM Linear Data Set. The size specified on the **zfsadm grow** command must be larger than the current size of the aggregate.

For example, suppose a 2 cylinder (primary allocation, 3390) aggregate has a total of 180 8K blocks and a (potential) secondary allocation of 1 cylinder. 180 8K blocks is 1440K bytes. A **zfsadm aggrinfo** command for this aggregate might show 1440K. This is a total of 1440K. **zfsadm grow** does this by calling DFSMS to allocate the additional DASD space. You might need to specify a few blocks larger than the current size before an allocation occurs because DFSMS might require some number of reserved blocks. Refer to the following example:

```
zfsadm aggrinfo omvs.prv.aggr003.lds0003

OMVS.PRV.AGGR003.LDS0003 (R/W COMP): 1286 K free out of total 1440
zfsadm grow omvs.prv.aggr003.lds0003 1440

IOEZ00173I Aggregate OMVS.PRV.AGGR003.LDS0003 successfully grown
OMVS.PRV.AGGR003.LDS0003 (R/W COMP): 1286 K free out of total 1440
```

Notice that the **zfsadm grow** command indicates success, but the aggregate was not made any larger because the size specified on the command was the same as the existing size.

```
zfsadm grow omvs.prv.aggr003.lds0003 1441

IOEZ00173I Aggregate OMVS.PRV.AGGR003.LDS0003 successfully grown
OMVS.PRV.AGGR003.LDS0003 (R/W COMP): 2006 K free out of total 2160
```

The aggregate now has a total size of 2160K bytes. You can specify 0 for the size to get a secondary allocation size extension. The file system quota has also been increased based on the new aggregate size. Aggregates cannot be made smaller.

Dynamically growing a compatibility mode aggregate

An administrator can specify that an aggregate should be dynamically grown if it becomes full. This is specified by the AGGRGROW PARM on the MOUNT command or globally by the aggrgrow option of the IOEFSPRM file (see "IOEFSPRM" on page 126 for additional information). The aggregate (that is, the VSAM Linear Data Set) must have secondary allocation specified when it is defined and space must be available on the volume(s). The aggregate will be extended when an operation cannot complete because the aggregate is full.

If the extension is successful, the operation will again be transparently driven to the application. During the extension, a portion of the extension is formatted. Applications that cause new blocks to be allocated or that are reading a file that is being extended will wait. Other applications will not wait. Applications that must wait, will wait for the extension and the (portion) format. Look for HI-A-RBA, the size of the data set in bytes, and HI-U-RBA, how much of it is formatted in bytes. If the aggregate has previously been extended but not fully formatted (that is, the HI-U-RBA (or hi-used-RBA) is less than the HI-A-RBA (or hi-allocated-RBA)), zFS will format another portion of the existing extension to make more space available.

You can determine the HI-U-RBA and HI-A-RBA by using the IDCAMS LISTCAT ALL utility against the zFS aggregate and looking for HI-U-RBA and HI-A-RBA in the job output. Dividing HI-A-RBA or HI-U-RBA by 8192 will convert them to the number of 8K blocks.

When a dynamic extension fails (for example, because of insufficient space), zFS sets an internal indicator to avoid attempting another dynamic extension. This indicator can be reset by a successful explicit grow (for example, by using the zfsadm grow command) or by an unmount and mount of the file system.

Creating a multi-volume compatibility mode aggregate

To create a large zFS aggregate (for example, 10 full volumes), you need:

- 10 empty volumes, and
- a DFSMS DATACLASS that provides extended addressability (since the total size is greater than 4 GB), and
- a JOB that defines and formats the aggregate.

Assuming that each volume is a 3390 with 3338 cylinders (with 3336 cylinders free), that there are 15 tracks per cylinder and that you can get 6 8K blocks per track (15 x 6 = 90 8K blocks per cylinder), you should get 90 x 3336 = 300240 8K blocks per volume and 10 x 300240 = 3002400 8K blocks in the aggregate. Figure 2 is an example JOB that defines the VSAM Linear Data Set in the first step and formats it as a zFS aggregate in the second step. The FORMAT step formats the primary allocation (3336 cylinders, and then extends the data set by the -grow amount (300240 8K blocks) multiple times until it reaches the total -size amount (3002400 8K blocks).

```
//USERIDA  JOB ,'Multi-Volume',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//DEFINE   EXEC   PGM=IDCAMS
//SYSPRINT DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//AMSDUMP  DD     SYSOUT=H
//SYSIN    DD     *
     DEFINE CLUSTER (NAME(OMVS.VOL10.COMPAT.AGGR001) -
            VOLUMES(PRV000 PRV001 PRV002 PRV003 PRV004 -
                    PRV005 PRV006 PRV007 PRV008 PRV009) -
            DATACLASS(EXTATTR) -
            LINEAR CYL(3336 5) SHAREOPTIONS(3))
/*
//FORMAT   EXEC   PGM=IOEAGFMT,REGION=0M,
// PARM=('-aggregate OMVS.VOL10.COMPAT.AGGR001 -compat -size 3002400 -gX
//             row 300240')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 2. Job to create a multi-volume compatibility mode aggregate

Adding a volume to a compatibility mode aggregate

To add a candidate volume to a zFS aggregate, use the IDCAMS utility ALTER command with the ADDVOLUMES parameter. The following example job adds two volumes to the (SMS-managed) OMVS.ZFS.AGGR1 zFS aggregate:

```
//SUIMGVMA JOB (ACCTNO),'SYSPROG',CLASS=A,
//         MSGCLASS=H,MSGLEVEL=(1,1),NOTIFY=&SYSUID
//STEP01   EXEC PGM=IDCAMS
//SYSPRINT DD  SYSOUT=*
```

```
//SYSIN    DD  *
           ALTER OMVS.ZFS.AGGR1.DATA -
           ADDVOLUMES(* *)
/*
```

In this case, DFSMS is choosing the particular candidate volumes. If you want to specify the volumes, use their volume serials in place of the asterisks. See *z/OS DFSMS Access Method Services for Catalogs* for additional information on IDCAMS ALTER ADDVOLUMES. DFSMS states, if an ALTER ADDVOLUMES is done to a data set already opened and allocated, the data set must be closed, unallocated, reallocated, and reopened before VSAM can extend onto the newly-added candidate volume.

For zFS, this means that if the zFS aggregate is already attached when the ALTER ADDVOLUMES is done, it must be detached and attached again before zFS can extend to the newly-added candidate volume(s). Compatibility mode aggregates must be unmounted and mounted again (because that is when they are detached and attached). If a backup file system (created by the clone operation) is mounted, it must also be unmounted when the read-write file system is unmounted. Otherwise, the aggregate will not be detached. If only the read-write file system is mounted, you can use the remount capability of z/OS UNIX. For details, see the topic on Remounting a mounted file system in *z/OS UNIX System Services Planning*.

Renaming or deleting a compatibility mode aggregate

To rename a compatibility mode aggregate, use the IDCAMS **ALTER** command with the NEWNAME parameter. The aggregate must not be mounted to rename it.

The name of the file system stored in the zFS aggregate will not match the aggregate name. This is a requirement for compatibility mode zFS aggregates. To reconcile the file system and aggregate name, the zFS file system must be mounted initially as read-write after the IDCAMS **RENAME** is complete. This allows zFS to reconcile the file system name with the new aggregate name. After the name is reconciled, the aggregate can then be mounted read-only.

The following example assumes that:

- the data component name is the same as the cluster name with DATA appended
- you want to rename both the cluster name and the data component name.

```
//SUIMGVMS JOB (ACCTNO),'SYSPROG',CLASS=A,
//             MSGCLASS=X,MSGLEVEL=(1,1),NOTIFY=&SYSUID
//STEP01   EXEC PGM=IDCAMS
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  *
           ALTER PLEX.JMS.AGGR006.LDS0006 -
              NEWNAME(PLEX.JMS.AGGR008.LDS0008)
           ALTER PLEX.JMS.AGGR006.LDS0006.* -
              NEWNAME(PLEX.JMS.AGGR008.LDS0008.*)
/*
```

To delete a compatibility mode aggregate, use the IDCAMS utility **DELETE** command. The aggregate must not be mounted to delete it. The following example deletes both the cluster name and the data component.

```
//SUIMGVMD JOB (ACCTNO),'SYSPROG',CLASS=A,
//             MSGCLASS=H,MSGLEVEL=(1,1),NOTIFY=&SYSUID
//STEP01   EXEC PGM=IDCAMS
//SYSPRINT DD  SYSOUT=*
//SYSIN    DD  *
           DELETE PLEX.JMS.AGGR006.LDS0006
/*
```

See *z/OS DFSMS Access Method Services for Catalogs* for information and restrictions on IDCAMS **ALTER** NEWNAME and **DELETE**.

Cloning a file system

zFS provides the ability to clone a file system by using the **zfsadm clone** command. When a you clone a file system, you create a copy of the file system in the same aggregate. There must be enough physical space available in the aggregate for the clone to be successful. This copy of the file system is read-only and is called a ***backup file system***. The name of the backup file system is the same as the original (read-write) file system with **.bak** (in lower case) appended to the file system name. This means that you need to limit the length of the file system name to 40 characters if you want to clone it.

Here is an example of a **zfsadm clone** command:

```
zfsadm clone -filesystem OMVS.PRV.FS1

IOEZ00225I File system OMVS.PRV.FS1 successfully cloned.
```

A backup file system takes up a relatively small amount of space because only the metadata is copied, not the user data. The backup file system's data block pointers point to the same data blocks that the read-write file system's data block pointers point to. After a clone operation, if the read-write file system user data is updated, zFS ensures that new physical blocks are allocated to hold the updates, while maintaining the backup file system's data pointers to the original data. The backup file system remains a point-in-time read-only copy in the face of updates to the read-write file system. This backup file system can be mounted (read-only) so that users who have the backup mounted can have an online backup of that file system available. That is, if a user accidently erases a file from the read-write file system, they can simply copy the file from the backup into the read-write file system to restore the file to the time the backup was created.

Here is an example of a TSO/E MOUNT command for the backup file system:

```
MOUNT FILESYSTEM('''OMVS.PRV.FS1.bak''') MOUNTPOINT('/etc/mountpt3') TYPE(ZFS) MODE(READ) NOAUTOMOVE
```

Here is an example of an OMVS **mount** command for the backup file system:

```
/usr/sbin/mount -t ZFS -r -a no -f OMVS.PRV.FS1.bak /etc/mountpt3
```

The read-write file system can be cloned again (re-clone). When a backup file system already exists, it is replaced during the clone operation. One backup file system can exist for each read-write file system. Backup file systems cannot be mounted during the clone operation.

You can clone or re-clone a set of file systems with the **zfsadm clonesys** command. This can be specified in terms of file systems with a file system name prefix or file systems in an aggregate or both.

zFS disk space allocation

A zFS aggregate is an array of 8K blocks. There are three special objects in a zFS aggregate (and are present in all zFS aggregates) that take up space in an aggregate and hence that space cannot be used for user files:

- **Log file** - This is used to record metadata changes. It is by default 1% of the disk size.
- **Bitmap** - This records which blocks are free on disk, and is as big as needed. How big it is depends on the size of the aggregate.
- **Aggregate File System List** - This describes the file systems contained in the aggregate. For compatibility mode aggregates it is usually only 1 8KB block. For multi-file system aggregates, its size depends on how many file systems there are.

The **zfsadm aggrinfo** command shows aggregate disk space usage. This is based on the number of 8KB blocks. It subtracts the space reserved for the above three objects in its calculations (and tells you this in the output). The **zfsadm aggrinfo** command shows output in units of 1KB blocks. If you use the **-long** option of the **zfsadm aggrinfo** command, it shows the number of free 8K blocks, the number of free 1K fragments and the size (in K) taken up by the log file, the filesystem table and the bitmap.

The zFS threshold monitoring function **aggrfull** reports space usage based on total aggregate disk size. It incorporates the space for the above three special objects when showing total disk space and amount used on disk in its messages. The **aggrfull** message shows units in 8K blocks.

zFS aggregates are all capable of containing multiple file systems, even compatibility mode aggregates. Compatibility mode aggregates can have backup file systems in them that take space if the clone operation is used. Each file system has a quota represented in 1KB fragments. The quota of a file system is a logical number and can be smaller or larger than the size of the disk (if the size of the disk were expressed in 1KB fragments).

For compatibility mode aggregates the file system quota is set to be the following size:

- total disk size (in 1KB units) - size of the above three special objects (in 1KB units)

The **zfsadm lsquota** command will show the quota in 1KB units and will also show the aggregate size and usage in 1KB units (it shows the amount of space used for the three special objects above also).

The **df** command shows the file system quota, but since the **df** command shows things in 512 byte units, normally the **df** output for zFS is exactly twice the numbers shown for quota.

zFS stores files on disk in one of three ways:

- **inline** - if the file is 52 bytes or less its stored in the same data structure on disk that holds the file status (things like owner, size and permissions). A file 52 bytes or less takes no extra disk space.
- **fragmented** - if the file is 7KB or less and has never been larger than 7KB, it is stored in 1KB fragments (hence it is stored in part of an 8KB block). Multiple small files can share the same 8KB block on disk.
- **blocked** - if the file is over 7 KB, it is stored as an array of 8 KB blocks.

The reason zFS uses these three methods for storing data is to conserve disk space. Each small file does not need to use a full 8 KB block of disk space. However, as a result of these three methods of storing data, the amount of free space displayed by the z/OS UNIX **df** command might not give the entire picture of free space. The **df -k** command displays free space in a file system in 1 KB units. In zFS, this space is a combination of full 8 KB blocks plus the free 1 KB fragments in fragmented blocks. As shown in Figure 3 for example, if there were two 8 KB blocks and twenty 1 KB blocks left, **df -k** would report 36 KB available.

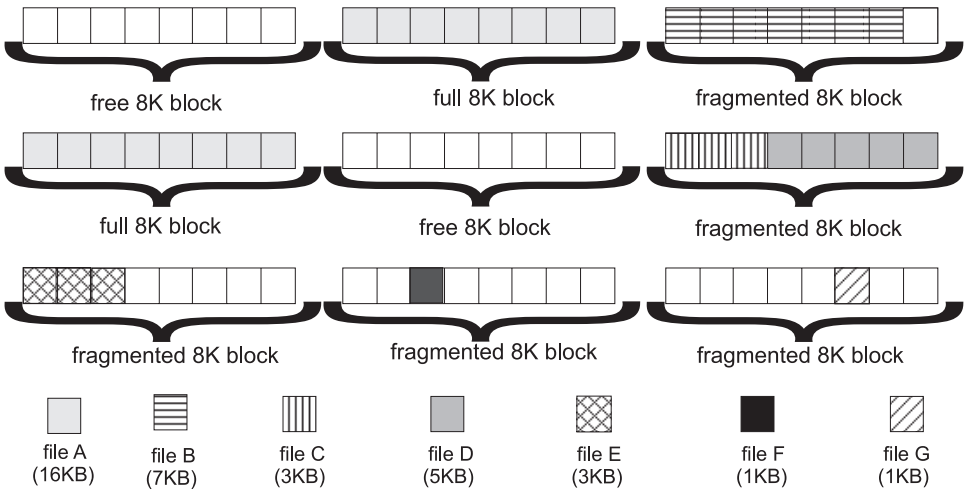

Figure 3. Disk space allocation example 1

Because it is a combination of 8KB blocks and 1KB blocks, it can happen that there are many 1KB blocks available but no 8KB blocks left. As shown in Figure 4 on page 18 for example, if there were 0 8KB blocks

left and 20 1KB blocks available, **df -k** would report 20 KB available. Now, if you try to create a 10 KB file, you might think that there is plenty of space. However, a 10 KB file is larger than 7 KB and therefore uses full 8KB blocks. Since there are no 8KB blocks available, there is no room for a 10 KB file even though there is 20 KB free space.

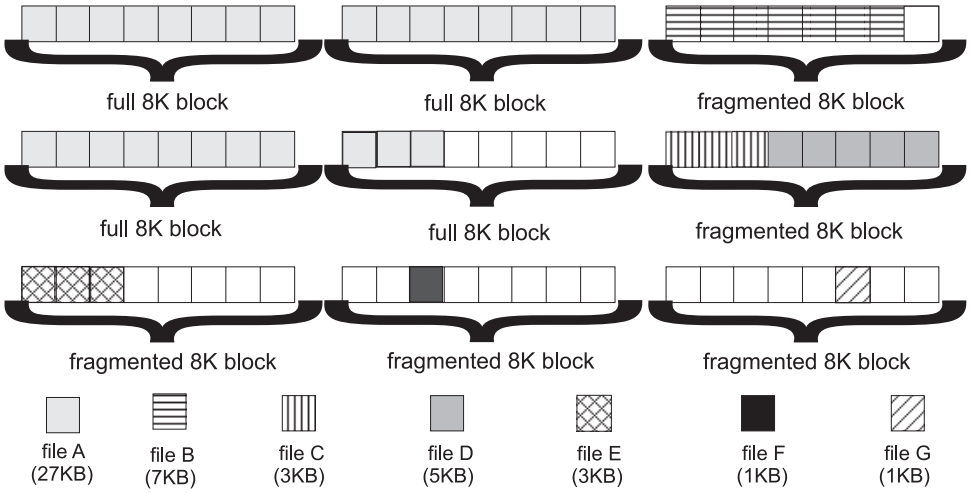

Figure 4. Disk space allocation example 2

There are other rules that can further restrict how free space is used. A file that is 7 KB must be stored in 7 contiguous fragments. So, even if there is 20 KB available in the file system, if there is no fragmented block with 7 contiguous 1KB blocks available, the file system will report that there is no space for the file. Also, a file stored as fragments cannot share the same 8KB block as a directory stored as fragments.

Fragments save disk space but make space allocation more complicated. To provide the maximum options for space allocation, you need to have free 8KB blocks. The **aggrfull** option of **MOUNT**, **zfsadm attach**, **IOEFSPRM** and **define_aggr** indicates the amount of free 8KB blocks. If you are out of 8KB blocks, you will be limited in how much additional file space that can be allocated in the file system. You should grow the aggregate or allow it to be dynamically extended.

When a zFS compatibility mode aggregate becomes full, you can make more space available. This will happen automatically if you have specified **aggrgrow** for the aggregate and you specified a secondary allocation size when you defined the aggregate (that is, the VSAM LDS). You can increase the size of the aggregate with the **zfsadm grow** command. Of course, in each of these cases, you must have space available on the volume(s) to extend into. Or, you might be able to erase some files from the file system to free up some space. However, if you have cloned the file system, you will not be able to free space by erasing files. A cloned file system requires additional space in the aggregate to erase a file. In this case, you might be able to free some space by recloning the file system.

| Note that because of the difference between how HFS and zFS manages disk space and block sizes,
| certain z/OS UNIX commands, such as **df** and **du** may display information differently.

| Sharing zFS data in a non-shared file system sysplex

| For sharing zFS data in a shared file system sysplex environment, see Chapter 5, “Sysplex considerations,” on page 21.

| The only fully supported way to share zFS data between systems in a non-shared file system sysplex
| environment is read-only sharing, where a zFS file system is mounted read-only to each system.

There is limited support for a zFS filesystem to be mounted read-write to one system and mounted read-only on another system.

If you mount a zFS file system read-write to a system (system A), you cannot mount that file system read-write to any other system (system B). If you attempt to mount the file system read-write to another system (system B), the mount will fail.

If you subsequently mount the file system read-only on another system (system B), the mount will succeed if no data has been written to the file system since it was attached read-write (to system A). If data has been written, you will receive reason code EFxx6271 indicating that the log must be replayed and the read-only mount (to system B) will fail.

However, the examples shown here only work when:

- You do not share Global Resource Serialization (GRS) between these systems. (When you share GRS across the systems, the first mounted read-write data set is allocated as EXCL, and the second mounted read-only data set tries to allocate as SHR, which results in an enqueue failure.)
- You share the catalog or you have a way to get the zFS file system data set name into the other catalog.

Notes:

1. If you are running z/OS V1R5 on the system where the file system is mounted read-write, you can use the remount capability to clear the log. See “Disabled compatibility mode aggregate” on page 55.
2. If you are running z/OS V1R6 or higher on the system where the file system is mounted read-write, you can quiesce and unquiesce the aggregate and clear the log. For example,

   zfsadm quiesce -aggrname *name*

   and then

   zfsadm unquiesce -aggrname *name*

Otherwise, you need to unmount the read-write file system from the system (system A) and then mount the file system read-write on that same system (system A). This will clear the log and allow it to be mounted read-only. Once the file system is successfully mounted read-only, you will receive a message (informational message ″IOEZ00439I Read-only aggregate *aggrname* is attached read-write on another system″) and errors may occur on the read-only file system (system B) if writes have occurred on the file system from the system where it is read-write mounted (system A). To recover from the errors on the read-only file system, you need to unmount the read-write file system (system A) and then remount it read-write (system A). Then you can unmount the read-only file system and then remount it read-only (system B).

Minimum and maximum file system sizes

The minimum zFS compatibility mode aggregate size is six 3390 tracks, which hold thirty-six 8 KB blocks (six 8 KB blocks per track × 6 tracks). This only leaves 143 KB of free space available for files and directories (see the example below). Small file systems tend to fill up quickly because of block and fragment allocation and can appear to have free space when they really do not (for more information, see “zFS disk space allocation” on page 16). IBM does not recommend using such small file systems. You can let the file system grow automatically (you must have **aggrgrow=on** in IOEFSPRM file or in the MOUNT PARM and you must have a secondary allocation specified on the define - specified as 5 in the example below). However, your log file size is very small and might cause contention. The log file size cannot be increased after the aggregate is formatted.

```
# zfsadm define -aggr PLEX.JMS.AGGR007.LDS0007 -volumes CFC000 -tracks 6 5

IOEZ00248I VSAM linear dataset PLEX.JMS.AGGR007.LDS0007 successfully created.

# zfsadm format -aggr PLEX.JMS.AGGR007.LDS0007 -compat
```

```
IOEZ00077I HFS-compatibility aggregate PLEX.JMS.AGGR007.LDS0007 has been successfully created
# /usr/sbin/mount -t ZFS -f PLEX.JMS.AGGR007.LDS0007 -o 'AGGRGROW' /zfsmnt3
# zfsadm aggrinfo -aggr PLEX.JMS.AGGR007.LDS0007 -long
PLEX.JMS.AGGR007.LDS0007 (R/W COMP): 143 K free out of total 288
version 1.4

            17 free 8k blocks;          7 free 1K fragments
           112 K log file;              8 K filesystem table
             8 K bitmap file
```

The architected maximum zFS compatibility mode aggregate size is approximately 4 TB (1KB × 4GB). If you use 3390s that have 65520 cylinders per volume, you can create a compatibility mode aggregate of about 2,850,088,550,400 bytes: 65520 cylinders per volume × 90 blocks per cylinder × 8KB per block × 59 volumes = 2654 GB = 2.59 TB. The usable free space in the file system would be a small amount less than this. However, if you plan to do this, you should consider the implications of backup and recovery for failures (media failure, data corruption, and others).

Chapter 5. Sysplex considerations

zFS supports a shared file system sysplex environment. That is, users in a sysplex can access zFS data that is ***owned*** by another system in the sysplex. Some options may not apply. See *z/OS UNIX System Services Planning* for information on automount. For full sysplex support, zFS must be running on all systems in the sysplex and all zFS file systems must be compatibility mode file systems (that is, they cannot be file systems in multi-file system aggregates).

The following considerations apply when using zFS in a sysplex in shared file system mode:

- The file system hierarchy appears different when viewed from systems with zFS mounted file systems than it does from those systems not running zFS. Pathname traversal through zFS mountpoints have different results in such cases since the zFS file system is not mounted on those systems not running zFS.
- zFS file systems owned by another system are accessible from a member of the sysplex that is running zFS.
- zFS compatibility mode file systems can be automoved and automounted. A zFS compatibility mode file system can only be automoved to a system where zFS is running.
- Although the clone operation is allowed in a compatibility mode aggregate, if both file systems (the read-write and the backup file systems) are mounted, some restrictions and limitations apply to the compatibility mode aggregate because there are really two mounted file systems in the aggregate. **chmount** and **setomvs** cannot be used to move ownership. **MOUNT** (that is, the mount of the second file system from a different system) and **AUTOMOVE** (as long as you do not have incompatible AUTOMOVE SYSTEM LISTs) do work properly in z/OS V1R4 and above.
- In order to share **IOEFSPRM** across a sysplex, the following specifications must use system symbols to differentiate the data set names:
  - **trace_dsn**
  - **msg_output_dsn**
  - multi-file system aggregate

  In this case you should use the **&SYSNAME** system variable in the **IOEZPRM DD** of the ZFS PROC to specify a different **IOEFSPRM** for different systems.

  If you are only using compatibility mode aggregates (and file systems), and you are not specifying a **msg_output_dsn** or a **trace_dsn** (or you can use system symbols), and you use the same options for all ZFS PFSs on all systems, you can share the same **IOEFSPRM** across systems.

  If you want to share **IOEFSPRM** and you want to specify data set names in **IOEFSPRM**, you may be able to use system symbols. For example, if you have sysplex member systems SY1 and SY2, and you have allocated trace data sets named USERA.SY1.ZFS.TRACE and USERA.SY2.ZFS.TRACE, you can specify **trace_dsn=USERA.&SYSNAME..ZFS.TRACE** in your shared **IOEFSPRM**. You can also use system symbols in the **define_aggr** option of **IOEFSPRM**.

  As an alternative to the IOEZPRM DDNAME specification, the IOEFSPRM member can be specified as a true PARMLIB member. In this case, the member has the name IOEPRMxx, where xx is specified in the parmlib member list. It is possible to have multiple IOEPRMxx members and it is also possible to have a IOEPRMxx members that are shared among all members of the sysplex and another IOEPRMxx member that contains options that are specific to a particular sysplex member. See “IOEFSPRM” on page 126 for more information on IOEPRMxx.

The following describes z/OS UNIX considerations that relate to the level of z/OS running on the members of the sysplex:

- When all members of the sysplex are at z/OS V1R2 or later and some or all systems are running zFS:
  - All systems running zFS see zFS file systems. The file system hierarchy appears differently when viewed from systems with zFS mounted file systems than it does from those systems not running zFS. Pathname traversal through zFS mountpoints have different results in such cases since the zFS file system is not mounted on those systems not running zFS.

  - If a system running zFS is brought down,
    - zFS compatibility mode file systems owned by the system that can be automoved are automoved to another system running zFS. If this function fails to find another owner, the file system becomes unowned.
    - zFS file systems that are noautomove, become unowned.
    - File systems which are unowned are not visible in the file system hierarchy, but can be seen from a **D OMVS,F** command. To recover a file system that is mounted and unowned, the file system must be unmounted.
  - If zFS is brought down on one system in the sysplex,
    - zFS compatibility mode file systems owned by the system that can be automoved are automoved to another system running zFS. If this function fails to find another owner, the file system and all file systems mounted under it are unmounted in the sysplex.
    - zFS file systems that are noautomove and all file systems mounted under them are unmounted in the sysplex.
- Beginning with z/OS V1R7, zfsadm commands work across the shared file system environment. You can display and modify zFS aggregates and file systems using zfsadm from any member of the sysplex regardless of which member owns the aggregate.

Multi-file system aggregates and shared file systems

Multi-file system aggregates in a shared file system environment have very limited support. They can be attached but file systems that reside in multi-file system aggregates cannot be mounted. You should use compatibility mode aggregates only. If you have data in file systems that reside in multi-file system aggregates, you should copy each file system into a compatibility mode aggregate using a prior release of z/OS or a non-shared file system environment. See Chapter 7, “Migrating data from HFS to zFS,” on page 25 for more information about copying data from one file system to another.

Chapter 6. Backing up zFS

This section describes how to back up a zFS aggregate using a DFSMSdss™ logical dump. File systems in the aggregate may or may not be mounted. The following job consists of a single step:

1. Back up the aggregate (and all the file systems)

DFSMSdss automatically quiesces the zFS aggregate before dumping the data set and unquiesces it when it is done.

Note: If any systems in the sysplex are running a release prior to z/OS V1R7, the job must be run on the sysplex member where the aggregate(s) is attached. If the job is not run on the same member of the sysplex, the quiesce will fail and the job will terminate. However, if all systems in the sysplex are running z/OS V1R7, you can run the backup job on any member of the sysplex.

The size of the target sequential data set should have sufficient space.

Figure 5 shows an example of a job backing up a zFS aggregate. For additional information on the **DUMP** command and its keywords, see *z/OS DFSMS Storage Administration Reference*.

```
//ZFSBKUP1 JOB (OS390),'PROGRAMMER',CLASS=A,
//             MSGCLASS=X,MSGLEVEL=(1,1)
//*-------------------------------------------------------------------
//* THIS JOB QUIESCES A ZFS AGGREGATE, DUMPS IT, THEN UNQUIESCES IT.
//*-------------------------------------------------------------------
//DUMP    EXEC PGM=ADRDSSU,REGION=4096K
//SYSPRINT DD  SYSOUT=*
//SYSABEND DD  SYSOUT=*
//OUT      DD  DSN=hlq.AGGR004.BACKUP,
//             DISP=(NEW,CATLG,DELETE),SPACE=(CYL,(5,1),RLSE)
//SYSIN    DD  *
 DUMP DATASET(INCLUDE(hlq.ZFS.AGGR004)) -
 CONCURRENT -
 OUTDD(OUT)
/*
//
```

Figure 5. Job to back up a zFS aggregate

The zFS aggregate can be restored using DFSMSdss logical restore. It is restored into a new aggregate (in this case, OMVS.PRV.AGGR005.LDS0005) if the original aggregate (in this case, hlq.ZFS.AGGR004) still exists. Figure 6 on page 24 is an example of a restore job.

```
//ZFSREST1 JOB (OS390),'PROGRAMMER',CLASS=A,
//             MSGCLASS=X,MSGLEVEL=(1,1)
//*-------------------------------------------------------------
//* THIS JOB RESTORES A ZFS AGGREGATE.
//*-------------------------------------------------------------
//ZFSREST EXEC PGM=ADRDSSU,REGION=0M
//SYSPRINT DD  SYSOUT=*
//SYSABEND DD  SYSOUT=*
//INDS     DD  DISP=SHR,DSN=SUIMGUR.ZFS.DUMP1
//SYSIN    DD  *
  RESTORE DATASET(INCLUDE(**)) -
          CATALOG -
          RENAMEU( -
           (hlq.ZFS.AGGR004, -
              OMVS.PRV.AGGR005.LDS0005) -
                 ) -
          WRITECHECK -
          INDD(INDS)
```

Figure 6. Job to restore a zFS aggregate

After the aggregate is restored, you need to do the following steps for a compatibility mode aggregate:

1. Unmount the original aggregate (in this case, hlq.ZFS.AGGR004) if it still exists (this also detaches it).
2. Mount the file system in the restored aggregate (in this case, OMVS.PRV.AGGR005.LDS0005).

After the aggregate is restored, you need to do the following steps for a multi-file system aggregate:

1. Unmount the file systems in the original aggregate (if any are mounted).
2. Detach the original aggregate (in this case, hlq.ZFS.AGGR004) if it still exists.
3. Attach the restored aggregate (in this case, OMVS.PRV.AGGR005.LDS0005).
4. Mount the file systems in the restored aggregate.

Another example of a logical restore of a zFS aggregate using DFSMSdss by replacing the existing aggregate is shown. The backup is restored into the original aggregate (in this case, hlq.ZFS.AGGR004). The aggregate cannot be mounted (or attached) during the restore operation. Figure 7 is an example of a restore replace job.

```
//ZFSREST2 JOB (OS390),'PROGRAMMER',CLASS=A,
// MSGCLASS=X,MSGLEVEL=(1,1)
//*-------------------------------------------------
//* THIS JOB RESTORES A ZFS AGGREGATE.
//*-------------------------------------------------
//ZFSREST EXEC PGM=ADRDSSU,REGION=0M
//SYSPRINT DD SYSOUT=*
//SYSABEND DD SYSOUT=*
//INDS DD DISP=SHR,DSN=SUIMGUR.ZFS.DUMP1
//SYSIN DD *
  RESTORE DATASET(INCLUDE(hlq.ZFS.AGGR004)) -
          CATALOG -
          REPLACE  -
          WRITECHECK -
          INDD(INDS)
```

Figure 7. Job to restore a zFS aggregate with replace

Chapter 7. Migrating data from HFS to zFS

This section discusses how to migrate data from HFS to zFS.

Using the z/OS HFS to zFS migration tool

You can use the ISPF-based tool (z/OS UNIX utility), BPXWH2Z, to migrate HFS file systems to zFS file systems. It has a panel interface that enables you to alter the space allocation, placement, SMS classes and data set names. With this tool, you can:

- Migrate HFS file systems (both mounted and unmounted) to zFS file systems. If the HFS being migrated is mounted, the tool automatically unmounts it and then mounts the new zFS file system on its current mount point.
- Define zFS aggregates by default to be approximately the same size as the HFS. The new allocation size can also be increased or decreased.
- Have the migration run in TSO foreground or z/OS UNIX background.

Note: The number of blocks to store a zFS file system might not be exactly the same as HFS.

For additional information on migrating data from HFS to zFS see *z/OS Migration*.

Using the z/OS UNIX pax command

You can copy data from an HFS file system to a zFS file system by using the z/OS UNIX **pax** command with or without using an intermediate archive file. Refer to the *z/OS UNIX System Services Command Reference* for more information on the **pax** command. When the data is being copied, the file system(s) being accessed must be mounted. You can also use **pax** to copy a file system that resides in a multi-file system aggregate into a compatibility mode aggregate. You must do this using a prior release or a non-shared file system environment since file systems that reside in multi-file system aggregates cannot be mounted when running in a shared file system environment.

Note: If you are migrating a file system that contains additional file systems mounted below it, by default, the **pax** command will also copy the files and directories contained in those file systems. To avoid this, you can either specify the **pax -X** option, or unmount the lower file systems prior to issuing the pax command.

Using an intermediate archive file

Use the **pax** command to copy the source (HFS) file system into an intermediate archive file and then use the **pax** command to copy from the archive file into the target (zFS) file system. This archive file can be a z/OS UNIX file or it can be an MVS™ data set.

Suppose you have an HFS file system mounted at **/etc/dfs**. You want to copy this into an empty zFS file system mounted at **/etc/dce/testzfs1**. You issue the following commands from z/OS UNIX:

1. Position to the source (HFS) file system mounted at **/etc/dfs**

   ```
   cd /etc/dfs
   ```

2. Create a z/OS UNIX archive file called **/tmp/zfs1.pax** that contains the HFS file system mounted at **/etc/dfs**

   ```
   pax -wvf /tmp/zfs1.pax .
   ```

3. Position to the target (zFS) file system mounted at **/etc/dce/testzfs1**

   ```
   cd /etc/dce/testzfs1
   ```

4. Read the archive file into the zFS file system mounted at **/etc/dce/testzfs1**

   ```
   pax -rv -p e -f /tmp/zfs1.pax
   ```

Without using an intermediate archive file

Use the **pax** command to copy the source (HFS) file system to the target (zFS) file system, without an intermediate archive file.

Suppose you have an HFS file system mounted at **/etc/dfs**. You want to copy this into an empty zFS file system mounted at **/etc/dce/testzfs1**. You issue the following commands from OMVS:

1. Position to the source (HFS) file system mounted at **/etc/dfs**

   ```
   cd /etc/dfs
   ```

2. Copy the (HFS) file system mounted at /etc/dfs to the (zFS) file system mounted at **/etc/dce/testzfs1**

   ```
   pax -rwvCDM -p eW . /etc/dce/testzfs1
   ```

Chapter 8. Multi-file system aggregates

This section discusses multi-file system aggregates, however, it is recommended that you use compatibility mode aggregates because they are more like HFS file systems. Refer to Chapter 1, “zSeries File System (zFS) overview,” on page 3. Compatibility mode aggregates have a single file system in the aggregate and are fully supported in a sysplex (shared file system) environment. Refer to Chapter 4, “Creating and managing zFS file systems using compatibility mode aggregates,” on page 11 for information on zFS compatibility mode aggregates and file systems.

Note: Multi-file system aggregate support is not planned to be enhanced and might be removed sometime in the future.

Multi-file system aggregates are not supported in a sysplex shared file system environment. Refer to Chapter 5, “Sysplex considerations,” on page 21 for information on shared file systems.

Multi-file system aggregates allow the administrator to create multiple file systems in a single aggregate. This allows space sharing between different file systems in the same aggregate. Therefore, if files are being deleted from one file system, another file system (in the same aggregate) can use that physical space for creating new files.

Creating a multi-file system aggregate

A multi-file system aggregate is a VSAM Linear Data Set (LDS) that can contain multiple zFS file systems. The multi-file system aggregate and the zFS file systems that are contained in the aggregate are created separately. First, the multi-file system aggregate is created using the zFS **ioeagfmt** utility. The aggregate must be attached and then one or more zFS file systems are created in the aggregate using one or more **zfsadm create** commands. Creating a zFS multi-file system aggregate is a two step process:

1. Create a VSAM LDS using **IDCAMS**. The VSAM Linear Data Set must have a secondary allocation size specified, if you want to use dynamic grow. See “Dynamically growing a multi-file system aggregate” on page 31 for additional information.
2. Format the VSAM LDS as a multi-file system aggregate using **ioeagfmt**.

The VSAM LDS and the zFS multi-file system aggregate both have the same name and that name is equal to the VSAM LDS cluster name.

Figure 8 on page 28 shows an example of a job that creates and formats a zFS multi-file system aggregate.

```
//USERIDA  JOB ,'Multi-File System',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//DEFINE   EXEC   PGM=IDCAMS
//SYSPRINT DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//AMSDUMP  DD     SYSOUT=H
//DASD0    DD     DISP=OLD,UNIT=3390,VOL=SER=PRV000
//SYSIN    DD     *
     DEFINE CLUSTER (NAME(OMVS.PRV.MULTI.AGGR002) -
            VOLUMES(PRV000) -
            LINEAR CYL(25 0) SHAREOPTIONS(3))
/*
//CREATE   EXEC   PGM=IOEAGFMT,REGION=0M,
// PARM=('-aggregate OMVS.PRV.MULTI.AGGR002')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 8. Job to create a multi-file system aggregate

After the multi-file system aggregate is formatted, it contains zero zFS file systems in it. The size of the aggregate is reported by **ioeagfmt** as the number of 8K blocks that fit into the primary allocation or as specified on the **-size** option. The multi-file system aggregate must then be attached on a system before any **zfsadm** commands can be issued against it.

The default for the size of the aggregate is the number of 8K blocks that fits in the primary allocation. You can specify a **-size** option giving the number of 8K blocks for the aggregate. If you specify a number that is less than (or equal to) the number of blocks that fits into the primary allocation, the primary allocation size is used. If you specify a number that is larger than the number of 8K blocks that will fit into the primary allocation, the VSAM LDS is extended to the size specified. (You may need to specify the **-grow** option if the extension will not fit on a single volume.) A secondary allocation on the VSAM LDS is not required. This occurs during its initial formatting. Sufficient space must be available on the volume(s). Multiple volumes may be specified on the DEFINE of the VSAM LDS. DFSMS decides when to allocate on these volumes during extension. VSAM LDSes greater then 4 GB may be specified by using the extended format and extended addressability capability in the data class of the data set. Refer to *z/OS DFSMS Using Data Sets* for information on VSAM data sets greater than 4 GB in size. zFS does not support the use of a striped VSAM Linear Data Set as a zFS aggregate. If you attempt to attach a zFS aggregate that had previously been formatted and is a striped VSAM LDS, it will only attach as read-only.

When you attach a multi-file system aggregate on a system, the zFS Physical File System (PFS) must be active on that system. Refer to Chapter 3, “Managing zFS processes,” on page 9 for information on starting zFS. You can attach in one of the following ways:

- The **zfsadm attach** command can be issued on that system, or
- A **define_aggr** statement can be placed in the **IOEFSPRM** file for that system and the ZFS PFS can be started (or restarted).

After a new multi-file system aggregate is defined and formatted, the zFS administrator attaches it by issuing the **zfsadm attach** command and then adds a **define_aggr** statement for the aggregate in that system’s **IOEFSPRM** file so that the aggregate is automatically attached each time the ZFS PFS is subsequently started (or restarted). The **define_aggr** statement does not have to be added to the **IOEFSPRM** file but then the aggregate would need to be attached (by using the **zfsadm attach** command) each time the ZFS PFS is started (or restarted).

The **zfsadm attach** command for the multi-file system aggregate just created is shown in the following example:

```
zfsadm attach -aggregate omvs.prv.multi.aggr002
```

A **define_aggr** statement in the **IOEFSPRM** file for the multi-file system aggregate just created is shown in the following example:

```
define_aggr cluster(omvs.prv.multi.aggr002)
```

Note: zFS aggregate names are case insensitive. Since they are always VSAM LDS names, they are always folded to upper case.

After the multi-file system aggregate is attached, the administrator can now create zFS file systems in the aggregate. This is accomplished using the OMVS **zfsadm create** command. The following example shows an example of creating a file system in the aggregate you just created and attached:

```
zfsadm create -filesystem OMVS.PRV.FS1 -aggregate omvs.prv.multi.aggr002 -size 5000
```

The previous example creates a zFS file system (named `OMVS.PRV.FS1`) in the OMVS.PRV.MULTI.AGGR002 aggregate. The file system has a maximum size of 5000 1K blocks.

Note: zFS file system names are case sensitive. The file system name specified on the **zfsadm create** command is not folded to upper case. If you create a zFS file system using lower case letters, it must be mounted using these same lower case letters. This can be accomplished by using the TSO/E MOUNT command and surrounding the file system name with a pair of three single quotes. Refer to the *z/OS UNIX System Services Command Reference* for information on the TSO/E MOUNT command.

If you are using both multi-file system aggregates and compatibility mode aggregates, do not name any file systems in multi-file system aggregates with the same name as any of your compatibility mode aggregates. If you do this, you will get a different file system mounted depending on whether an aggregate is attached or not. For example, suppose you have compatibility mode aggregate A.B.C and you have multi-file system aggregate D.E.F that contains file system A.B.C. When you mount file system A.B.C, you will get the one in aggregate D.E.F mounted if D.E.F is attached. If D.E.F is not attached, you will get compatibility mode aggregate A.B.C mounted.

The maximum size of the file system you just created is known as its ***quota***. This is a logical number that is compared against each time additional blocks are allocated to the file system. When the quota is reached, the file system indicates that it is full (even if there are more physical blocks available in the aggregate). A quota can be smaller than the space available in the aggregate (this is typical), it can be equal or it can be larger. If the quota is larger than the space available in the aggregate, or more typically, if the sum of the quotas for all file systems in an aggregate is larger than the space available in the aggregate, the file system can run out of physical space before it reaches its quota.

The quota of a file system can be displayed by using the **zfsadm lsquota** command and it can be increased by using the **zfsadm setquota** command. The quota of a file system can also be decreased (as long as the usage has not exceeded the new quota) by using the **zfsadm setquota** command. The quota is the number used when determining if a message to the operator is required due to the **FSFULL** parameter of the **MOUNT** command. Refer to “MOUNT” on page 72 for more information.

A file system’s quota can be dynamically increased if the **FSGROW PARM** was specified on the **MOUNT** or if the **fsgrow** option is specified in the **IOEFSPRM** file. You must specify the amount that the quota should grow (in k-bytes) and the number of times that the quota should be increased. (A history of the number of times the quota has been increased is not kept across instances of the ZFS PFS. That is, the number of times the quota has been increased is lost when ZFS is stopped and restarted.)

If you attempt to attach an aggregate that contains a duplicate file system name, the attach is successful and a message is issued that states there are two file systems with the same *filesystemname* in use. The **zfsadm** commands that refer to file systems allow a **-aggregate** option to qualify the file system name. **MOUNT** allows an **AGGREGATE PARM**.

After creating a zFS file system in a multi-file system aggregate, the file system can be mounted. (The aggregate must be attached before any file systems in a multi-file system aggregate can be MOUNTed.) Following is an example of a TSO/E MOUNT command for the zFS file system just created:

```
MOUNT FILESYSTEM('OMVS.PRV.FS1') MOUNTPOINT('/etc/mountpt2') TYPE(ZFS) MODE(RDWR) NOAUTOMOVE
```

The previous example assumes that the directory `/etc/mountpt2` exists and is available to become a mount point. Note that the **TYPE** parameter of the **MOUNT** command specifies **ZFS**. This is required for any zFS file systems in multi-file system aggregates. Once the zFS file system is mounted, applications and commands can be executed and files and directories can be accessed in zFS just as in HFS. Refer to Chapter 5, “Sysplex considerations,” on page 21 for the reason that **NOAUTOMOVE** is specified for file systems in multi-file system aggregates.

When multiple file systems are created in an aggregate, this allows the possibility of space sharing between those file systems. That is, physical DASD space that is made available by erasing files in one file system (A), is potentially available to another file system (B) in the same aggregate (assuming that the other file system (B) is not at its quota limit).

Starting with z/OS V1R7, when a zFS multi-file system aggregate is attached R/W, the on-disk format of the aggregate is modified. It is changed from a version 1.3 aggregate to a version 1.4 aggregate. This allows the performance of mount to be improved (especially for zFS file systems with many files and directories). During the automatic conversion, you will see messages such as:

```
IOEZ00500I Converting  PLEX.JMS.AGGR007.LDS0007 for fast mount processing
IOEZ00518I Converting filesystem PLEX.JMS.AGGR007.LDS0007 to allow for fast mount
```

You must install toleration APAR OA11573 on prior releases. This will allow the prior releases to correctly access the new structure (version 1.4) for zFS aggregates. If you do not install toleration APAR OA11573 on prior releases, prior releases will not be able to correctly access the new structure.

In this case, you can convert a zFS aggregate back to a version 1.3 structure so that it can be accessed. (You should, of course, apply toleration APAR OA11573 as soon as possible.) To convert a zFS aggregate back to a version 1.3 structure, use the zFS IOEAGSLV (salvager) utility. A new option (-converttov3) is provided to convert a version 1.4 zFS aggregate back to a version 1.3 zFS aggregate. The IOEAGSLV utility (with the new -converttov3 option) is provided with z/OS Version 1 Release 8. IOEAGSLV is also installed in the MIGLIB PDS. IOEAGSLV can be executed from any supported release by STEPLIBing to MIGLIB. Here is a sample job:

```
//USERIDA  JOB ,'Salvage',
// CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//STEPLIB  DD DSN=hlq.MIGLIB,DISP=OLD
//SALVAGE  EXEC PGM=IOEAGSLV,REGION=0M,
// PARM=('-aggregate PLEX.JMS.AGGR007.LDS0007 -converttov3')
//SYSPRINT DD SYSOUT=H
//STDOUT   DD SYSOUT=H
//STDERR   DD SYSOUT=H
//SYSUDUMP DD SYSOUT=H
//CEEDUMP  DD SYSOUT=H
//*
```

Growing a multi-file system aggregate

If the sum of the quotas of all the file systems in an aggregate is greater than the physical space available in the aggregate, it is possible for a file system to run out of physical space before exceeding its quota. If this occurs, the application gets ENOSPC as a return code (the same return code it would get for exceeding its quota). The administrator can grow the aggregate (that is, cause an additional allocation to occur and format it to be part of the aggregate). This is accomplished with the **zfsadm grow** command. There must be space on the volume(s) to extend the aggregate's VSAM LDS. The size specified on the **zfsadm grow** command must be larger than the current size of the aggregate.

For example, suppose a 2 cylinder (primary allocation, 3390) aggregate has a total of 180 8K blocks and a (potential) secondary allocation of 1 cylinder. 180 8K blocks is 1440K bytes. A **zfsadm aggrinfo** command for this aggregate might show 1440K. This is a total of 1440K.**zfsadm grow** does this by calling DFSMS to allocate the additional DASD space. You may need to specify a few blocks larger than the current size before an allocation occurs because DFSMS may require some number of reserved blocks. Refer to the following example:

```
zfsadm aggrinfo omvs.prv.aggr004.lds0004

OMVS.PRV.AGGR004.LDS0004 (R/W MULT): 1295 K free out of total 1440
zfsadm grow omvs.prv.aggr004.lds0004 1440

IOEZ00173I Aggregate OMVS.PRV.AGGR004.LDS0004 successfully grown
OMVS.PRV.AGGR004.LDS0004 (R/W MULT): 1295 K free out of total 1440
zfsadm grow omvs.prv.aggr004.lds0004 1441

OMVS.PRV.AGGR004.LDS0004 (R/W MULT): 2015 K free out of total 2160
```

The aggregate now has a total size of 2160K bytes. The size of the aggregate is rounded up to the control area (CA) size. You can specify 0 for the size to get a secondary allocation size extension. In this case, a secondary allocation must have been specified on the VSAM LDS. File systems that have not exceeded their quota can now use the additional physical space that is available. (If necessary, a file system quota can be increased with the **zfsadm setquota** command.) Aggregates cannot be made smaller.

Dynamically growing a multi-file system aggregate

An administrator can specify that an aggregate should be dynamically grown if it becomes full. This is specified by the **-aggrgrow** option on the **zfsadm attach** command or the **aggrgrow** suboption of the **define_aggr** option of the **IOEFSPRM** file or globally by the **aggrgrow** option of the **IOEFSPRM** file. The aggregate (that is, the VSAM Linear Data Set) must have secondary allocation specified when it is defined and space must be available on the volume(s). The aggregate will be extended when an operation cannot complete because the aggregate is full. If the extension is successful, the operation will be redriven transparently to the application.

When an aggregate or file system becomes full

When a zFS file system in a multi-file system aggregate becomes full, you can add more space. But first, you must first determine if you have run out of physical space in the aggregate or if you have reached the file system quota limit. You can determine how much free space there is in the aggregate by using the **zfsadm aggrinfo** command. For example:

```
zfsadm aggrinfo PLEX.JMS.AGGR001.LDS0001
PLEX.JMS.AGGR001.LDS0001 (R/W MULT): 2964 K free out of total 3600
```

You can determine how full the file system is by using the zfsadm lsquota command. For example:

```
zfsadm lsquota -filesystem OMVS.PRV.FS3 -aggregate PLEX.JMS.AGGR001.LDS0001
Filesys Name       Quota     Used  Percent    Used                 Aggregate
OMVS.PRV.FS3       7000       9     0         17 = 636/3600         (zFS)
```

You can allow an aggregate to grow automatically or you can explicitly grow it. Also, you can allow a file system quota to grow automatically or you can explicitly set it larger. See the following table:

Automatic	Explicit
• Specify secondary allocation in DEFINE of VSAM LDS, and • Specify -aggrgrow in IOEFSPRM or on **zfsadm attach**, and • have space available on volume(s)	**zfsadm grow** *aggrname newsizeinK*
• Specify fsgrow(x,y) in IOEFSPRM or on MOUNT PARM	**zfsadm setquota** *filesystemname newsizeinK*

Another way to relieve a file system full condition is to erase some files. If your aggregate is full and you have cloned file systems in the aggregate, you may be able to free some physical space by recloning one or more of the file systems.

Comparing compatibility mode aggregates and multi-file system aggregates

The difference between a compatibility mode aggregate and a multi-file system aggregate is simply the number of read-write file systems in the aggregate and whether the aggregate has been explicitly attached or not. There is no special bit stored on the disk that indicates whether an aggregate is compatibility mode or multi-file system.

A compatibility mode aggregate has exactly one read-write file system in the aggregate and it is not attached before being mounted. It is only mounted and unmounted. (An implicit attach occurs during the mount; an implicit detach occurs during the unmount. If the MOUNT is of type RDWR, the aggregate is attached R/W. If the MOUNT is of type READ, the aggregate is attached R/O unless the RW PARM is specified on the MOUNT.) To mount a compatibility mode aggregate, the aggregate name is specified as the file system name. The decision as to whether to treat an aggregate as a compatibility mode aggregate is made at mount time or explicit attach time. If no attach has been done and the mount is successful, the aggregate is treated as a compatibility mode aggregate. The mount will only be successful if there is exactly one read-write file system in the aggregate. If the name of the (only) file system in the aggregate does not match the aggregate name, the file system name will be renamed so its name is the same as the aggregate name. For a mount of type RDWR, the file system name will be changed on disk. For a mount of type READ, the changed name will be kept in memory.

If an explicit attach is done before any mounting, the aggregate is treated as a multi-file system aggregate. If you want, you can cause zFS to treat an aggregate that has been formatted with the **-compat** option, as a multi-file system aggregate by attaching it before you mount the file system. This would allow you to create another file system in the aggregate. This would, however, mean that the aggregate cannot be treated as a compatibility mode aggregate anymore.

You can always query an (attached) aggregate to determine if it is compatibility mode or multi-file system using the **zfsadm aggrinfo** command. COMP indicates compatibility mode; MULT indicates multi-file system.

Sharing zFS data between systems

The only fully supported mechanisms for sharing zFS data between systems are the following:

- using shared file systems in a sysplex (see Chapter 5, “Sysplex considerations,” on page 21)
- read-only sharing (a zFS aggregate is attached read-only to multiple systems and no system has the aggregate attached read-write)

There is limited support for a zFS aggregate to be attached read-write to one system and attached read-only on another system.

If you attach a zFS aggregate read-write to a system (system A), you cannot attach that aggregate read-write to any other system (system B). If you attempt to attach the aggregate read-write to another system (system B), the attach will fail.

If you subsequently attach the aggregate read-only on another system (system B), the attach will succeed if no data has been written to the aggregate since it was attached read-write. If data has been written, you will receive reason code EFxx6271 indicating that the log must be replayed and the read-only attach will fail.

Note: If you are running z/OS V1R6 or later on the system where the file system is mounted read-write, you can quiesce and unquiesce the aggregate and clear the log. For example,

zfsadm quiesce -aggrname *name*

and then

zfsadm unquiesce -aggrname *name*

Otherwise, you need to detach the read-write aggregate from the system (system A) and then attach the aggregate read-write on that same system (system A). This will clear the log and allow it to be attached read-only (on system B). Once the aggregate is successfully attached read-only, you will receive a message (informational message ″IOEZ00439I Read-only aggregate *aggrname* is attached read-write on another system.″) and errors may occur on the read-only aggregate (system B) if writes have occurred on the aggregate from the system where it is read-write attached. To recover from the errors on the read-only aggregate, you need to detach the read-write aggregate (system A) and then attach it read-write (system A). Then you can detach the read-only aggregate and then attach it read-only (system B).

Chapter 9. Performance and debugging

This section discusses performance tuning techniques and what should be done if a problem occurs that requires IBM service assistance. The examples presented here are for illustrative purposes only—it is normal for the output of some reports to wrap.

Performance tuning

zFS performance is dependent on many factors. zFS provides performance information to help the administrator determine bottlenecks. The **IOEFSPRM** file contains many tuning options that can be adjusted. The output of the operator modify query commands provide feedback about the operation of zFS. This section describes those **IOEFSPRM** options and the operator commands that relate to performance.

zFS performance can be optimized by tailoring the size of its caches to reduce I/O rates and pathlength. It is also important to monitor DASD performance to ensure there are no volumes or channels that are pushed beyond their capacity. The following describes some of the considerations when tuning zFS performance.

Total cache size

The total storage size for all of the caches that reside in the zFS address space must be less than 2 GB. zFS terminates when it cannot obtain all the storage it needs for the caches specified in **IOEFSPRM** file. In addition to the zFS address space caches, storage is necessary for processing file requests and for the products zFS might use. As a result, you must restrict the total zFS address space cache storage to approximately 1.5 GB. Use **MODIFY ZFS,QUERY,STORAGE** to determine the total allocated zFS storage.

The **MODIFY ZFS,QUERY,ALL** command also shows the total zFS storage allocated, but includes the storage allocated for all the caches and everything else zFS might need. The zFS address space caches include:

- "Metadata cache"
- "Transaction cache" on page 36
- "Vnode cache" on page 36

The user data cache, log file cache, and metadata backing cache reside in data spaces and do not use zFS address space storage.

Metadata cache

The metadata cache is used to contain all file system metadata which includes all directory contents, file status information (such as atime, mtime, size, permission bits, and so on), file system structures and additionally, it also caches data for files smaller than 7 K. Essentially, zFS stores a file by using one of the following three methods. For additional information on how zFS shows free blocks, see "zFS disk space allocation" on page 16.

inline If the file is smaller than 52 bytes, its data is stored in the structure that contains the status information for the file.

fragmented If the file is less than 7 K it is stored in blocks on disk that could be shared with other files, hence multiple files are stored in the same physical disk block. Physical disk blocks are always 8K in size.

blocked Files larger than 7 K are stored in multiple blocks, blocked files are only stored in the user file cache, and all I/O is performed directly to or from user file cache buffers.

Because inline files are stored in the status block, files that are stored on disk by using the inline method are stored in the metadata and hence are cached in the metadata cache (and also in the user file cache).

Because the metadata cache is the only component that knows about multiple files sharing the same disk blocks, small fragmented files are stored in the metadata cache (and also in the user file cache) and I/O is performed directly to or from the metadata cache for these small user files.

Generally metadata is referred to and updated very frequently for most zFS file operations, hence achieving a good hit ratio is often essential to good performance for most workloads. A good hit ratio might be considered to be 90% or more depending on your workload.

The metadata cache is stored in the primary address space and its default size is 32 M. Because the metadata cache only contains metadata and small files it normally does not need to be nearly as large as the user file cache. The operator **MODIFY ZFS,QUERY,ALL** command output shows statistics for the metadata cache including the cache hit ratio.

An optional metadata backing cache can be specified that extends the size of the metadata cache. It resides in a data space and increases the amount of metadata that can be kept in memory. It might improve the performance of workloads that require large amounts of metadata.

Transaction cache

Every change to zFS file system metadata is bounded by a transaction describing its changes by using records written to the log file. The transaction cache is a cache of data structures representing transactions.

The transaction cache is stored in the zFS primary address space with a default of 2000 transactions. zFS dynamically increases the size of this cache based on the number of concurrent pending transactions (transactions that have not been fully committed to disk) in the zFS file system. Therefore, the administrator does not have to tailor the transaction cache size. However, the **MODIFY ZFS,QUERY,ALL** output will show the transaction count at any given time.

Vnode cache

Every object in the zFS file system is represented by a data structure called a vnode in memory. zFS keeps a cache of these and recycles these vnodes in an LRU fashion. Every operation in zFS requires a vnode and z/OS UNIX keeps pointers to zFS vnodes. Because z/OS UNIX keeps references to zFS vnodes, zFS might be forced to dynamically increase the size of this cache to meet the demands of z/OS UNIX. To create a zFS vnode for a newly referenced file or a newly created file for a user requires the pathlength to initialize the structure and obtain its status information from the metadata cache. If the file's status is not in the metadata cache then a disk I/O might also be required.

The vnode cache is stored in the zFS primary address space and the default number of vnodes is 32768. As with any cache a good hit ratio is desirable and the operator **MODIFY ZFS,QUERY,ALL** command shows the vnode cache hit ratio. Because the vnode cache is essentially backed by the metadata cache, if the vnode hit ratio is low but the metadata cache hit ratio is high your performance might not suffer too much since a vnode cache miss only requires some pathlength to initialize the vnode structures.

User file cache

The user file cache is used to cache all ″regular″ files. It caches any file no matter what its size and performs write-behind and asynchronous read-ahead for files. It performs I/O for all files that are 7 K or larger. For files smaller than 7 K, I/O is normally performed through the metadata cache.

The user file cache is allocated in data spaces. Its size by default is 256M and can be tailored to meet your performance needs based on your overall system memory. The maximum size is 65536M (which is 64G). The general rule for any cache is to ensure a good hit ratio and additionally, for a user file cache it is good to have it large enough to allow write-behind activity to occur (if the cache is too small you need to

recycle buffers more frequently and it could degrade write-behind performance). The operator **MODIFY ZFS,QUERY,ALL** command output shows the cache hit ratio. (Actually, it shows the ″Fault Ratio″. To get the hit ratio subtract the fault ratio from 100%).

In general you should have hit ratios of at least 80% or more, over 90% usually gives good performance. However, the desired hit ratio is very much workload dependent. For example, a zFS file system exported exclusively to SMB clients by using the SMB server would likely have a low hit ratio because the SMB client and the SMB server caches data, making the zFS cache achieve a low hit ratio in this case. That is expected and is not considered a problem.

NOREADAHEAD option

For sequential file access, read-ahead provides an overlap of I/O with processing that can result in smaller response time for file read requests. However for random file access, read-ahead can degrade performance. zFS generally attempts to first determine if a file's access pattern is sequential or random before it decides if read-ahead should be performed for that file. Because zFS really has no knowledge of an applications future requests sometimes zFS can make the wrong guess. For file systems that have random access patterns, which are typical for database systems such as Lotus Notes®, sequential access is rare and the administrator can disable read-ahead for that file system by specifying the **NOREADAHEAD** option for the **MOUNT** command. This ensures that zFS never performs read-ahead for any files in that file system and avoids any overhead due to unnecessary read-aheads.

Log files

Every zFS aggregate contains a log file used to record transactions describing changes to the file system structure. This log file is, by default, 1% of the aggregate size but is tailorable by the administrator on the **ioeagfmt** command. Usually, 1% is sufficient for most aggregates. However, larger aggregates might need less than 1%, while very small aggregates might need more than 1% if a high degree of parallel update activity occurs for the aggregate.

Log file cache

The log file cache is a pool of 8 K buffers used to contain log file updates. Log file buffers are always written asynchronously to disk and normally only need to be waited upon when the log is becoming full, or if a file is being fsync'ed.

The log file cache is stored in a data space and its default is 64 M. The log file cache is grown dynamically by adding one 8 K buffer for each attached aggregate. This ensures each aggregate always has one 8 K buffer to use to record its most recent changes to file system metadata. Because log files are written asynchronously, the cache essentially allows write-behind of log files and because the cache is shared among all aggregates, aggregates that have a higher write rate use more buffers in the cache using a least-recently-used (LRU) algorithm.

The log file cache is a write-only cache, so a read hit ratio is not relevant, however the operator **MODIFY ZFS,QUERY,ALL** command does show log file I/O waits. It is desirable to make the log file cache large enough so that log file I/O waits do not occur too frequently. However, every workload is different. For example, workloads that issued fsync operations force zFS to sync the log file more frequently.

Fixed storage

By default, zFS does not fix any pages in any of the caches except when an I/O is pending to or from the cache buffers. The administrator can permanently page fix the user file cache, the metadata cache, and/or the log file cache by choosing the **fixed** option for the cache. This ensures the cache experiences no paging and avoids the overhead of page fixing for each I/O but comes at the expense of using real storage for the given cache which means the real storage is not available for other applications.

If your file system performance is critical and you have enough real memory to support it, the **fixed** option can be useful. Otherwise, you should not set it.

I/O balancing

Any file system's performance is heavily dependent on DASD I/O performance. If any channel(s) or DASD volume(s) are overloaded, then excessive I/O waits could occur for that DASD.

Performance products such as RMF™ will show DASD performance.

zFS operator **MODIFY ZFS,QUERY,ALL** commands also provide reports that show I/O rates per aggregate, and file system request rates per aggregate and per file system. This information, along with DASD performance information from RMF or performance products similar to RMF can be used to easily balance I/O among your DASD. For example, you can use the **QUERY** output to show which file systems could be moved to different DASD to achieve a better balance among disks.

Monitoring zFS performance

You can monitor zFS performance through the **MODIFY** command. The syntax of this command is:

```
MODIFY ZFS,QUERY,<report>,<option>
```

where <report> is:

KN This report provides counts of calls made to zFS from z/OS UNIX and the average response time of each call. This is the basic measure of zFS performance. There are no <options>s for this report. See "KN" on page 39 for details of the report.

VM This report provides performance information for the user file cache including cache hit ratios, I/O rates and storage usage. There are no <option>s for this report. See for details of the report. See "VM" on page 40 for details of the report.

LFS This report provides detailed file system statistics including the performance of the zFS metadata caches, the vnode cache and the aggregate I/O statistics. There are no <option>s for this report. See "LFS" on page 42 for details of the report.

LOCK This report provides a measure of how much lock contention and how often z/OS UNIX threads wait for certain events such as user file cache reclaim. There are no <option>s for this report. See "LOCK" on page 46 for details of the report.

STOR This report provides a detailed breakdown of zFS allocated storage by component. By default this report just lists storage usage by zFS component, if you use the details option then you will get more detailed information for each zFS component. See "STOR" on page 47 for details of the report.

FILE This report provides a detailed breakdown of requests per zFS files system and aggregate. By default this report lists only file systems and aggregates that had active requests since the last statistics reset. If you use the ALL option you get all file system and aggregates regardless of whether they were active or not. See "FILE" on page 48 for details of the report.

ALL This report shows all the above reports. However, for the **STOR** report, the details option is off and the **FILE** report indicates only active file systems.

You can also reset the statistics for any given zFS report or reset all of the internal zFS statistics. The syntax of this command is:

```
MODIFY ZFS,RESET,<report>
```

where <report> is *KN, VM, LFS, LOCK, STOR, FILE, ALL*.

Resetting the statistics is useful if you want to view zFS performance for a given time of day, such as during peak usage. For example, if you want performance of zFS between 1 p.m. and 3 p.m. you would enter **MODIFY ZFS,RESET,ALL** at 1 p.m and enter **MODIFY ZFS,QUERY,ALL** at 3 p.m.:

```
MODIFY ZFS,RESET,ALL
```

| Monitor period
| `MODIFY ZFS,QUERY,ALL`

The zFS query output from the **MODIFY ZFS,QUERY**, <report> command is written to the system log.

Sample zFS query reports

The next sections show sample zFS query outputs and describes the relevant fields of each report. Some fields are used mainly by IBM service but are included here for completeness.

KN

The QUERY,KN report shows basic zFS performance, it shows all calls made to zFS by z/OS UNIX since the last statistics reset and the average response time in milliseconds for each request. These requests are the official interface between z/OS UNIX and zFS and is the most fundamental measure of zFS performance because it includes any CPU, I/O wait time or lock wait time.

The times here are only the zFS portion of the overall command response time. For example, entering a **mkdir** command from z/OS UNIX will actually result in many zFS calls, and the zfs_mkdir time is only the portion of time it took zFS to perform the actual **mkdir**. Hence, application time and time spent processing in z/OS UNIX is not included here.

```
| F ZFS,QUERY,KN
| IOEZ00438I Starting Query Command KN.
|            PFS Calls on Owner
|            --------------------
| Operation               Count  XCF req.    Avg Time
| ---------          ----------  ----------  ----------
| zfs_opens                   4           0       0.148
| zfs_closes                  4           0       0.519
| zfs_reads                   1           0       0.434
| zfs_writes              30000           0       0.063
| zfs_ioctls                  0           0       0.000
| zfs_getattrs                7           0       0.283
| zfs_setattrs                0           0       0.000
| zfs_accesses                1           0       0.132
| zfs_lookups                 9           0      23.787
| zfs_creates                 0           0       0.000
| zfs_removes                 0           0       0.000
| zfs_links                   0           0       0.000
| zfs_renames                 0           0       0.000
| zfs_mkdirs                  0           0       0.000
| zfs_rmdirs                  0           0       0.000
| zfs_readdirs                0           0       0.000
| zfs_symlinks                0           0       0.000
| zfs_readlinks               0           0       0.000
| zfs_fsyncs                  0           0       0.000
| zfs_truncs                  1           0      55.180
| zfs_lockctls                0           0       0.000
| zfs_audits                  4           0       0.221
| zfs_inactives               1           0       0.048
| zfs_recoveries              0           0       0.000
| zfs_vgets                   1           0       0.024
| zfs_pfsctls                 4           0     492.122
| zfs_statfss                 0           0       0.000
| zfs_mounts                  4           0    2138.552
| zfs_unmounts                0           0       0.000
| zfs_vinacts                 0           0       0.000
| ---------          ----------  ----------  ----------
| *TOTALS*                30041           0       0.423
|
|
| IOEZ00438I Starting Query Command KN.
|            PFS Calls on Client
|            --------------------
```

```
| Operation              Count  XCF req.    Avg Time
| ---------          ----------  ----------  ----------
| zfs_opens                  0           0       0.000
| zfs_closes                 0           0       0.000
| zfs_reads                  0           0       0.000
| zfs_writes                 0           0       0.000
| zfs_ioctls                 0           0       0.000
| zfs_getattrs               0           0       0.000
| zfs_setattrs               0           0       0.000
| zfs_accesses               0           0       0.000
| zfs_lookups                0           0       0.000
| zfs_creates                0           0       0.000
| zfs_removes                0           0       0.000
| zfs_links                  0           0       0.000
| zfs_renames                0           0       0.000
| zfs_mkdirs                 0           0       0.000
| zfs_rmdirs                 0           0       0.000
| zfs_readdirs               0           0       0.000
| zfs_symlinks               0           0       0.000
| zfs_readlinks              0           0       0.000
| zfs_fsyncs                 0           0       0.000
| zfs_truncs                 0           0       0.000
| zfs_lockctls               0           0       0.000
| zfs_audits                 0           0       0.000
| zfs_inactives              0           0       0.000
| zfs_recoveries             0           0       0.000
| zfs_vgets                  0           0       0.000
| zfs_pfsctls                0           0       0.000
| zfs_statfss                0           0       0.000
| zfs_mounts                 0           0       0.000
| zfs_unmounts               0           0       0.000
| zfs_vinacts                0           0       0.000
| ---------          ----------  ----------  ----------
| *TOTALS*                   0           0       0.000
|
|
| IOEZ00025I zFS kernel: MODIFY command - QUERY,KN completed successfully.
```

VM

The User File (VM) Caching System Statistics report shows the performance of the zFS user file cache. This size of the cache is controlled by the **user_cache_size** zFS configuration option or the **zfsadm config** command.

The zFS user file cache data is stored in a collection of dataspaces. zFS prefers to use multiple dataspaces rather than one large dataspace when it can to reduce lock contention (as shown in this example). zFS has a structure for each file currently cached, each cached file is broken into 64K segments and each segment is broken into 4K pages. A segment is assigned to a dataspace, hence the pages for any given segment belong only to one dataspace. A file's segments can be scattered throughout multiple segments.

At any given time a file need not (and for large files often might not) have all of its segments in the cache. Furthermore, any segment need not (and often might not) have all of its pages in the cache. Reuse of pages and segments is done in an LRU fashion.

The cache provides asynchronous read-ahead and write-behind of large files when access is considered sequential. Read-ahead and write-behind for a file is performed by reading/writing segments (up to 64K).

```
|
|                   User File (VM) Caching System Statistics
|                   ----------------------------------------
|
| External Requests:
| ------------------
| Reads              1     Fsyncs             0     Schedules          3
```

```
| Writes         30000     Setattrs           1     Unmaps             0
| Asy Reads          1     Getattrs           9     Flushes            0
|
| File System Reads:
| ------------------
| Reads Faulted           1     (Fault Ratio  100.00%)
| Writes Faulted          0     (Fault Ratio    0.00%)
| Read Waits              0     (Wait Ratio    0.00%)
| Total Reads             1
|
| File System Writes:
| -------------------
| Scheduled Writes            96     Sync  Waits            0
| Error Writes                 0     Error Waits            0
| Scheduled deletes            0
| Page Reclaim Writes          0     Reclaim Waits          0
| Write Waits                  0     (Wait Ratio    0.00%)
|
| Page Management (Segment Size = 64K) ) (Page Size = 4K)
| ------------------------------------------------
| Total Pages        2560     Free               1026
| Segments          16384
| Steal Invocations          0     Waits for Reclaim           0
|
| Number of dataspaces used:     1  Pages per dataspace:        2560
|
| Dataspace   Allocated     Free
| Name        Segments      Pages
| --------    ----------    ----------
| ZFSUCD00            97          1026
|
```

| The following section describes the fields of the User File (VM) Caching System Statistics report:

External Requests: This section of the report describes the requests made to the user file cache to perform operations as requested by applications. Reads, Writes show how often the cache was called to read or write files. Asy Reads shows how often read-ahead is performed. Fsync shows how often applications requested that zFS sync a file's data to disk. Unmaps are the count of file deletions.

File System Reads: This section shows how often the cache had to read data from disk for a file. The ″Reads Faulted″ shows the count of read requests that needed to perform at least 1 I/O to read the requested portion of the file from disk. ″Writes Faulted″ show the count of how often a write to a file needed to perform a read from disk. If a write only updates a portion of a page of a file on disk and that page is not in memory then the page needs to be read in (the zFS I/O driver can only perform I/O in whole pages) before the new data is written to the in-memory page. Read Waits show how often a read had to wait for a pending I/O (for example, how often a read of a file found that the desired range of the file is pending read probably due to asynchronous read ahead). ″Total Reads″ is the total number of file system reads made for any reason. Cache misses and read I/Os degrade application response time, the goal is for all these numbers to be as low as possible. Increasing the cache size is the usual method for lowering these numbers.

File System Writes: This section shows how often the cache wrote the data to disk. In general, it is desirable to minimize the ″Page Reclaim Writes″ and ″Reclaim Waits″. If these occur often relative to the external zFS request rate (the KN report shows that), then the cache might be too small.

- **Scheduled Writes** is the count of how often the cache wrote out dirty segments for a file. Segments are written as soon as every page becomes dirty. When a file is closed all of its dirty segments are scheduled asynchronously and segments are also written asynchronously during filesystem syncs via the zFS sync daemon (which by default runs every 30 seconds).
- **Sync Waits** is the count of how often an fsync request needed to wait on pending I/O for dirty segments.

- **Error Writes** and ″Error Waits″ are error handling paths and should almost always be 0 unless a disk hardware error occurs. Whenever an unexpected error occurs for a file all of its dirty segments are written and synced to disk. (Note that a filesystem running out of space is not an error condition that causes the cache to sync a file, the cache reserves storage for files as they are written which ensures no unexpected out of space conditions arise).
- **Scheduled Deletes** is the count of times a pending I/O was cancelled due to a file being deleted. In this case the data is not desired to be on disk (because the file is 0 link count) and thus if an I/O wait can be avoided by cancelling the I/O it is done. Thus this is a performance optimization for file remove.
- **Page Reclaim Writes** is the count of times that a dirty segment had to be written to reclaim space in the cache. ″Page Reclaim Waits″ is the count of times that the reclaim function needed to wait on pending I/O to reclaim the pages of a segment.
- **Write Waits** is the count of times a write occurred to a page that was already pending I/O. In this case the I/O needs to be waited upon before the page is updated with the new data.

Page Management: This section of the report shows the user file cache storage use. It shows total pages, number of free pages, and total number of segments. Each dataspace used to hold cache pages is shown with the total number of pages and number of free pages and allocated segments.

LFS

```
LFS:
                              zFS Vnode Op Counts

Vnode Op                       Count   Vnode Op                       Count
-----------------------  ----------   -----------------------  ----------
efs_hold                           0   efs_readdir                      114
efs_rele                           0   efs_create                       307
efs_inactive                       0   efs_remove                       308
efs_getattr                     2926   efs_rename                        13
efs_setattr                       17   efs_mkdir                         27
efs_access                      6772   efs_rmdir                         27
efs_lookup                      2303   efs_link                           1
efs_getvolume                      0   efs_symlink                        4
efs_getlength                      0   efs_readlink                       5
efs_afsfid                         0   efs_rdwr                           0
efs_fid                            0   efs_fsync                          0
efs_vmread                         6   efs_waitIO                      4439
efs_vmwrite                     4595   efs_cancelIO                    4268
efs_clrsetid                       0   efs_audit                          0
efs_atime                          0   efs_vmblkinfo                    131

Total zFS Vnode Ops      26263


                           zFS Vnode Cache Statistics

Vnodes      Requests     Hits    Ratio  Allocates   Deletes
---------- ---------- ---------- ----- ---------- ----------
       130        926        921 99.460%      338        318

zFS Vnode structure size: 296 bytes

                          Metadata Caching Statistics

Buffers    (K bytes)  Requests     Hits    Ratio  Updates
---------- --------- ---------- ---------- ----- ----------
      4224     33792     139453     104957 75.2%     179863

                       Metadata Backing Caching Statistics

Buffers    (K bytes)  Requests     Hits    Ratio  Discards
---------- --------- ---------- ---------- ----- ----------
      4096     32768        340          0  0.0%          0
```

```
                          Directory Cache Statistics

Dir Blocks (K bytes)  Requests     Hits    Ratio  Deletes
---------- --------- ---------- ---------- ----- ----------
       256      2048       3961       3934  99.318%         27

                        Transaction Cache Statistics

Transactions started:   11422  Lookups on tran:  238405    EC Merges: 1195
Allocated Transactions:  2000  (Act= 0, Pend= 0, Comp= 1456, Free= 544)

                 I/O Summary By Type
                 -------------------

Count       Waits       Cancels     Merges      Type
----------  ----------  ----------  ----------  ----------
       177         209           0           0  File System Metadata
      1418         197           0        1027  Log File
      4595         150        1727           0  User File Data

                 I/O Summary By Circumstance
                 ---------------------------

Count       Waits       Cancels     Merges      Circumstance
----------  ----------  ----------  ----------  ------------
         6           6           0           0  Metadata cache read
         3           1           0           0  User file cache direct read
         0           0           0           0  Log file read
         0           0           0           0  Metadata cache async delete write
         0           0           0           0  Metadata cache async write
       148          68           0           0  Metadata cache lazy write
         0           0           0           0  Metadata cache sync delete write
         0           0           0           0  Metadata cache sync write
      4440          77        1727           0  User File cache direct write
         0           0           0           0  Metadata cache file sync write
        78          51           0           0  Metadata cache sync daemon write
         0           0           0           0  Metadata cache aggregate detach write
         0           0           0           0  Metadata cache buffer block reclaim write
         0           0           0           0  Metadata cache buffer allocation write
         0           0           0           0  Metadata cache file system quiesce write
        97         156           0           0  Metadata cache log file full write
      1418         197           0        1027  Log file write
         0           0           0           0  Metadata cache shutdown write

                   zFS I/O by Currently Attached Aggregate

DASD   PAV
VOLSER IOs Mode       Reads     K bytes      Writes     K bytes  Dataset Name
------ --- ----  ----------  ----------  ----------  ----------  ------------
PRV001   1  R/W           0           0           0           0  SUDFS5.PRIVATE.LFSNET
PRV001   1  R/W           0           0           0           0  SUDFS5.PRIVATE.LFS106
PRV002   1  R/W           9         188        3427      205608  SUDFS5.PRIVATE.LFSFS
PRV001   1  R/W           0           0           0           0  SUDFS5.PRIVATE.TESTGROW
------           ----------  ----------  ----------  ----------
     4                   9         188        3427      205608  *TOTALS*


Total number of waits for I/O:        556
Average I/O wait time:                62.215 (msecs)
```

zFS Vnode Op Counts: This section shows the number of calls to the lower layer zFS components. One request from z/OS UNIX typically requires more than one lower layer call. Note that the output of this report wraps.

zFS Vnode Cache Statistics: This section shows the zFS vnode cache statistics. It shows the number of currently allocated vnodes and the vnode hit ratio. ″Allocates″ and ″Deletes″ show requests to create new vnodes (for operations like create or mkdir) and delete vnodes (for operations like remove or failed creates or mkdirs). The size of this cache is controlled by the vnode_cache_size parameter and the demand for zFS vnodes placed by z/OS UNIX. In general zFS tries to honor the setting of the vnode_cache_size parameter and recycle vnode structures to represent different files. However, if z/OS UNIX requests more vnodes than zFS has allocated then zFS must allocate vnodes to avoid applications failing. In general a good hit ratio for this cache is desirable because a miss means initializing the data structures and the initialization requires a read of the object's status from disk. Often this would be in the metadata cache but it's not guaranteed. Hence a vnode cache lookup miss might sometimes require an I/O wait.

The vnode structure size is shown, however there are additional data structures anchored from the vnode which also takes space, everything added together yields over 1K of storage per vnode. So you should consider this when planning the size of this cache. Also note that initializing a vnode will not require an I/O if the object's status information is in the metadata cache, thus a good size metadata cache can be as useful, and often more useful than an extremely large vnode cache.

Metadata Caching Statistics: This section shows the basic performance characteristics of the metadata cache. The metadata cache contains a cache of all disk blocks that contain metadata and any file data for files less than 7K in size. For files smaller than 7K, zFS will place multiple files in one disk block (for zFS a disk block is 8K bytes). Only the lower metadata management layers have the block fragmentation information so user file I/O for small files is performed directly through this cache rather than the user file cache. The statistics show the total number of buffers (each are 8K in size), the total bytes, the request rates and hit ratio of the cache. The higher the hit ratio the better the performance. Metadata is accessed frequently in zFS and all metadata is contained only (for the most part) in the metadata cache so a hit ratio of 80% or more is usually desirable.

Metadata Backing Cache Statistics: This section describes the performance of the extension to the metadata cache. The size of this extension is controlled by the metaback_cache_size configuration option. The backing cache is stored in a dataspace and is used only to avoid metadata reads from disk. All metadata updates and write I/O are performed from the primary metadata cache. Similar statistics to the metadata cache are shown for this cache. Every hit in this cache avoids one disk read, but normally the metadata backing cache is not needed except for workloads with many small user files or that are constrained in the zFS primary address space (possibly due to a large demand of zFS vnodes made by z/OS UNIX and its applications). Thus if the zFS address space has primary space available, the space should be given to the primary metadata cache. In the example above the metadata backing cache is providing no performance benefit (as shown by its 0 hit ratio). The metadata backing cache is not created by default. It can only be created by specifying the metaback_cache_size configuration option of the **IOEFSPRM** file or the **zfsadm config** command.

| **Directory Cache Statistics:** zFS maintains a cache of directory buffers. This directory cache is also
| backed by the metadata cache (that is, a directory page is always read to/from the metadata cache
| into/out of the directory cache). The size is controlled by the dir_cache_size configuration option in
| "IOEFSPRM" on page 126.

Transaction Cache Statistics: zFS updates metadata on disk by writing the changes to the metadata to a log file. Each operation will create one or more transactions, write the updates to the logs associated with the transaction and then end the transaction. Each transaction has an associated state (Active, Pending, Complete or Committed):

Active There are still records being written to the log file describing updates being made by this transaction, hence the transaction was started but has not yet ended. (This is shown as ″Act″ in the report.)

Complete
The transaction has ended, all updates were written to the log file and the end transaction record is also written to the log for that transaction. (This is shown as ″Comp″ in the report.)

Committed

The transaction has ended and all updates are written to the log file AND all the log file pages that contain information about this transaction reside on disk. At this point the transaction is guaranteed. The update would not be lost if the system stopped. (In the report statistics for this count is not shown. As soon as a transaction is committed the structure representing the transaction is ″free″ for reuse for another transaction.)

Equivalence Classes

zFS does not use a common technique called 2 phase locking or commit. Rather, transactions that are related are grouped into equivalence classes. zFS will decide when a transaction is related to or dependent on another transaction. When this determination is made the transactions are grouped into an equivalence class. Any transactions in the same equivalence class are committed together or backed out together in the event of a system failure. By using equivalence classes, threads running transactions simply run in parallel without added serialization between the two (other than locks if they hit common structures) and simply add their associated transactions to the same class. This thus increases throughput. The merge of equivalence classes occurs when two transactions that need to be made equivalent are both already in equivalence classes. In this case both classes are merged ″EC Merges″.

Pending

A transaction is pending when all its updates are written to the log file but other transactions in its same equivalence class have not ended. (This is ″Pend″.)

The transaction cache size is by default 2000 transactions. It can be changed by the tran_cache_size configuration option. In general, zFS will increase the size of the cache if it determines too many I/O waits are occurring to sync log file pages to commit transactions so their structure can be freed and this improves performance. Also, if you are using the zfsadm config command to set the tran_cache_size, the transaction cache will not be shrunk too small as to cause excessive log file syncs and you will see a failure if you attempt to set the cache too small. As a rule of thumb the default should be fine for most customers. If zFS determines more are needed for performance it will allocate more. zFS is a little conservative about adding more transaction structures, so you might get a small performance boost by starting with a larger transaction cache size so zFS does not need to make checks to determine if it can increase the size or sync log file pages.

I/O Summary By Type & Circumstance: This section is mainly for IBM internal use in diagnosing performance related problems. zFS keeps detailed statistics on how often it performs I/O for various circumstances and how often it waits on that I/O to allow for easy determination of performance problems.

zFS I/O by Currently Attached Aggregate: The zFS I/O driver is essentially an I/O queue manager (one I/O queue per DASD). It uses Media Manager to issue I/O to VSAM datasets. It generally sends no more than 1 I/O per DASD volume to disk at one time. The exception is parallel access volume (PAV) DASD. These DASD often have multiple paths and can perform multiple I/O in parallel. In this case zFS will divide the number of access paths by 2 and round any fraction up. (Example, for a PAV DASD with 5 paths zFS will issue at most 3 I/Os at one time to Media Manager).

The reason zFS limits the I/O is that it uses a dynamic reordering and prioritization scheme to improve performance by reordering the I/O queue on demand. Thus high priority I/Os (I/Os that are currently being waited on for example) are placed up front, and an I/O can be made high priority at any time during its life.

This reordering has been proven to provide the best performance, and for PAV DASD, performance tests have shown that not sending quite as many I/Os as available paths allows zFS to reorder I/Os and leave paths available for I/Os that become high priority.

Another feature of the zFS I/O driver is that by queueing I/Os it allows I/Os to be cancelled (and thus the overhead of doing the I/O is removed). This is done in cases where a file was written and then immediately deleted for example. Finally, the zFS I/O driver will merge adjacent I/Os into one larger I/O to reduce I/O scheduling overhead, this is often done with log file I/Os because often times multiple log file

I/Os are in the queue at one time and the log file blocks are contiguous on disk. This allows log file pages to be written aggressively (making it less likely that users lose data in a failure) and yet allow them to be batched together for performance if the disk has a high load.

Thus the ″PAV IOs″ column shows how many I/Os are sent in parallel to Media Manager by zFS, non PAV DASD always shows the value 1.

The DASD volser for the primary extent of each aggregate is shown along with the total number of I/Os and bytes read/written.

Finally, the number of times a thread processing a request must wait on I/O and the average wait time in milliseconds is shown. By using this information in conjunction with the KN report, you can break down zFS response time into what percentage of the response time is for I/O wait. To reduce I/O waits you can run with larger cache sizes. Small log files (small aggregates) that are heavily updated might result in I/Os to sync metadata to reclaim log file pages resulting in additional I/O waits. Note that this number is *NOT* DASD response time. It's affected by it but it's not the same. If a thread does not have to wait for an I/O then it has no I/O wait, if a thread has to wait for an I/O but there are other I/Os being processed it might actually wait for more than 1 I/O (the time in queue plus the time for the I/O).

This report along with RMF DASD reports and the zFS FILE report can be used to balance zFS aggregates among DASD volumes to ensure an even I/O spread.

LOCK

The LOCK report is mainly for IBM service to use when diagnosing performance problems relating to lock contention.

The report shows a detailed breakdown of how often zFS waits for locks and which locks cause the most contention. It also monitors how often a thread sleeps waiting for an event. The lock waits and lock wait time and sleep waits and sleep wait time can be used in conjunction with the KN report to break down zFS response time into what percentage of the time zFS is waiting on internal locks or events to occur. See the following example:

```
LOCK:
                                  Locking Statistics


Untimed sleeps:         22   Timed Sleeps:          0   Wakeups:         21

Total waits for locks:                           3698
Average lock wait time:             8.261 (msecs)

Total monitored sleeps:                            22
Average monitored sleep time:             0.792 (msecs)

               Top 15 Most Highly Contended Locks
  Thread      Async       Spin
   Wait       Disp.       Resol.     Pct.    Description
----------  ----------  ----------   -----   -------------
       877           0         899    35.763%   Log system map lock
      1464           0          40    30.285%   Anode bitmap allocation handle
       481           0          28    10.249%   Anode fileset quota lock
       291           0          42     6.705%   Transaction lock
       205           0          62     5.376%   Metadata-cache buffer lock
       210           0           4     4.309%   Anode fileset handle lock
        84          68           7     3.201%   User file cache main segment lo
         0          55           0     1.107%   Volser I/O queue lock
        38           0           0     0.765%   Vnode-cache access lock
         2          23          11     0.724%   Transaction-cache main lock
        19           0           3     0.443%   Transaction-cache equivalence c
        21           0           0     0.422%   Async IO event lock
         0          14           0     0.281%   Cache Services association main
         6           0           0     0.120%   Cache Services hashtable resize
```

```
         0           0           5     0.100%   Transaction-cache complete list

Total lock contention of all kinds:       4966

                Top 5 Most Common Thread Sleeps
Thread Wait     Pct.      Description
-----------     -----     -----------
         22    100.0%     Transaction allocation wait
          0      0.0%     OSI cache item cleanup wait
          0      0.0%     Directory Cache Buffer Wait
          0      0.0%     User file cache Page Wait
          0      0.0%     User file cache File Wait
```

```
Example:
  From the KN report we get the following:
  Total zFS requests:     91905
  Avg. Resp. Time:        1.108

  From the LFS report we get:
  Total I/O waits:          556
  Avg. I/O wait time:    62.215

  Avg. I/O wait time per request = 556/91905 * 62.215 = 0.376
                                   (this is 34% of the response time (0.376/1.108=.34)).

  From the locking report we get:
  Total Waits for Locks:    3698
  Avg. Lock wait time:     8.261

  Avg. Lock wait time per request = 3698/91905 * 8.261 = 0.332
                                   (this is 30% of the response time (0.332/1.108=.30)).
```

By extrapolation, you can guess that the remaining time is CPU time and processor wait time.

STOR

The STOR report provides a breakdown of zFS storage usage. It can be used to determine how much storage zFS uses based on a configuration change (such as increasing or decreasing a zFS cache via the zfsadm config command).

Not shown here is the output of **QUERY,STOR,DETAILS**. That report breaks down each component and shows how much storage is used for each data structure class and is intended primarily for IBM service.

```
STOR:
                zFS Primary Address Space Storage Usage
                ---------------------------------------

Total Bytes Allocated: 75907620 (74128K) (72M)
Total Pieces Allocated: 131853
Total Allocation Requests: 16783
Total Free Requests: 385

            Storage Usage By Component
            --------------------------
Bytes               No. of  No. of
Allocated   Pieces  Allocs  Frees   Component
----------  ------  ------  ------  ---------

     66019       5       0       0  z/OS UNIX Interface
     91956    4120    3750       0  Media Manager I/O driver
  33555876       4       0       0  Trace Facility
    281236       3       0       0  Message Service
     35636      34       3       0  Miscellaneous
      1064      13       0       0  Aggregate Management
    111300     103       0       0  Filesystem Management
     10753      16      18      17  Administration Command Handling
     45976     280      50       2  Vnode Management
```

```
   211600    2515    1677       0  Anode Management
  2146508       9       0       0  Directory Management
   378632    5418       0       0  Log File Management
 36162280   25127       3       0  Metadata Cache
   372504    4020       6       0  Transaction Management
   328292     986     844       0  Asynchronous I/O Component
    35340      63      14       0  Lock Facility
     2172      51       3       0  Threading Services
   104424    2645    1567     356  Cache Services
    12832      11       0       0  Configuration parameters processing
  1922308   86385    8848      10  User File Cache
    30912      45       0       0  Storage Management
```

FILE

The FILE report lists every file system that was active since last reset by default (it will list all of them if you use the ALL option). To conserve space the internal aggregate number is shown rather than the name of the aggregate that contains the file system. Use the **zfsadm lsfs** command to determine the aggregate name for each file system. The file systems are grouped in the report by aggregate with the most active file systems listed first. The most active aggregates are listed first.

The `Flg` column indicates the aggregate status as attached (`A`), mounted (`M`), or both (`AM`).

The `Operations` column indicates the count of z/OS UNIX vnode calls to that particular file system. It is not an I/O rate. If desired, use the RMF DASD reports, the LFS Aggregate I/O report, and the FILE report to balance your file systems and aggregates among disks to provide a more even I/O spread.

```
FILE:
File System Name                            Aggr #  Flg  Operations
------------------------------------------  ------  ---  ----------

OMVS.ZFS.DFBLD.DFSSRC                       100008  AM       274472

OMVS.ZFS.LOCAL                              100009  AM       111722

OMVS.ZFS.DCEDFBLD.DCES390.ETC.DCE           100010  AM        81632

OMVS.ZFS.DCEDFBLD.DFSLOCAL                  100012  AM        52154

OMVS.ZFS.DCEDFBLD.OS390R10.ETC              100004  AM        44108

OMVS.ZFS.GPLTOOLS                           100006  AM         8458

OMVS.ZFS.BLDTOOLS                           100007  AM         8120

OMVS.ZFS.DCEDFBLD.VAR                       100005  AM          314

OMVS.ZFS.USR.LOCAL                          100011  AM           54
```

Debugging aids for zFS

If a problem occurs in zFS that requires the attention of IBM support, it is important to obtain the appropriate problem determination information to help resolve the problem quickly. This section covers the following topics:

Trace options for zFS

One of the most important aspects of zFS problem determination is its tracing capability. zFS has an internal (wrap around) trace table that is always tracing certain events. The size of this trace table is controlled by the **IOEFSPRM trace_table_size** option.

Steps for tracing on zFS

If you are recreating a problem and need to minimize the amount of information the trace generates, you can reset (set to empty) the trace table. To accomplish this:

1. Enter the **MODIFY ZFS,TRACE,RESET** command.
2. Allocate the trace output data set and specify its name in the **IOEFSPRM trace_dsn** option.
3. Format and send the trace table and trace output data set using the **MODIFY ZFS,TRACE,PRINT** command.
4. Capture the ZFSKNT*nn* member from the trace output data set (for example, copy it to a sequential data set) so that it can be sent to IBM service.

A separate trace output data set is required for each member of a Sysplex.

1. Ensure that you set up the trace data sets so that each system in the sysplex can write to its own trace output data set concurrently. This requires separate **IOEFSPRM** files or the use of system symbols in the **trace_dsn** name or the use of an **IOEPRMxx** PARMLIB member. For more information, see Chapter 5, “Sysplex considerations,” on page 21.
2. Allocate the data set as a PDSE, RECFM=VB, LRECL=133 with a primary allocation of at least 50 cylinders and a secondary allocation of 30 cylinders. Each trace output is created as a new member with a name of ZFSKNT*nn*. *nn* starts at 01 and increments for each trace output until zFS is restarted. After restart, when the next trace output is sent to the trace output data set, ZFSKNT01 is overlaid. You should not be accessing the trace output data set while a trace is being sent to the trace output data set. The space used by a particular trace depends on how large the **trace_table_size** is and how recently the trace was reset.

For example, a 32M **trace_table_size** can generate a trace output member of 100 cylinders of 3390. It is important that the trace output data set be large enough to hold the trace output. If it runs out of room while sending the trace to the trace output data set, the complete trace will not be captured .

IBM service might need more events to be traced. Additional tracing can be specified in two ways:

- Add events to trace by specifying the ioedebug statements in a data set that is read when zFS is started (or restarted). The data set name is specified in the **IOEFSPRM debug_settings_dsn** option. It is a PDS member with an LRECL of at least 80. IBM specifies the exact statements needed in the data set.
- Add the events to trace dynamically by entering the **MODIFY ZFS,IOEDEBUG** command. IBM specifies the exact statements needed.

You can also enter the operator **MODIFY ZFS,ABORT** command to cause zFS to send the trace to the trace output data set and to perform a dump. This also causes zFS to terminate and attempt to restart.

If you have a zFS dump but could not capture the trace, the trace can be obtained from the dump.

Overview of dumping for zFS

Another important source of information is a zFS dump. Any time a zFS failure occurs, you should check the system log to see if zFS has performed a dump. In a sysplex, zFS will normally request a dump on the other sysplex members so you should also check to see if other members have zFS dumps. Normally these will have the following message:

```
IOEZ00337E zFS kernel: non-terminating exception 2C3 occurred, reason EA2F0385
```

The abend reason of EAxx0385 indicates that the dump was requested by zFS from another sysplex member. If zFS does not automatically request a dump from the other sysplex members, you should enter the **MODIFY ZFS,DUMP** command on these other systems.

zFS also sends the trace to the trace output data set when a zFS dump occurs. Note that when a zFS abend occurs, other application failures might occur. For problem determination, these failures are not as important as the original zFS failure and dump(s).

Normally, zFS does not terminate as a result of a zFS failure. An aggregate might become disabled (see "Diagnosing disabled aggregates" on page 54). If zFS does terminate, zFS attempts to restart after the terminating exception occurs. If the restart is successful, you might need to remount any zFS file systems.

If a failure of a zFS operation occurs (other than a user error), but zFS does not dump, you should get a trace of the failure, if possible. Perform the steps outlined in "Steps for tracing on zFS" on page 48:

You can also obtain a dump of the zFS address space by entering the **MODIFY ZFS,DUMP** command. The dump should contain the zFS trace table. You must ensure the dump is complete. Partial dumps are of little use.

Understanding zFS messages

Beginning with z/OS V1R7, zFS administration commands use XCF communications to exchange zFS aggregate and file system information between members of the sysplex. During zFS initialization, zFS must contact each other zFS system that is active in the sysplex group to announce itself to the other members of the group and to receive information about attached aggregates from the other members of the group. You might see messages (if there are other z/OS V1R7 members with zFS active) on the operator console and in the system log such as:

```
10.27.58 DCEIMGVQ          *IOEZ00525I Starting initialization with DCEIMGVN
10.28.03 DCEIMGVQ          *IOEZ00526I Requesting aggregate information from DCEIMGVN
10.28.07 DCEIMGVQ           IOEZ00528I Initialization with DCEIMGVN complete.
```

These messages are written to the operator console and then are deleted (DOMed) when the target system (DCEIMGVN in this case) responds. Sometimes the messages will be deleted from the operator console before they are displayed. In that case, they will not appear on the operator console (they will always appear in the system log). On the target system(s), you will find messages (in the system log) such as:

```
IOEZ00529I Preparing for initialization with DCEIMGVQ.
IOEZ00530I Ready to initialize with DCEIMGVQ.
IOEZ00532I Sending aggregate information to DCEIMGVQ.
IOEZ00533I Done initializing with DCEIMGVQ.
```

These messages do not appear on the operator console (except for IOEZ00530I which can appear on the operator console). If a failure occurs, you might see a failure message on the initializing or the target system. There can be an abend and a dump associated with this failure. The dump should be sent to IBM service.

If the messages on the initializing system (IOEZ00525I or IOEZ00526I) or the message on the target system (IOEZ00530I) do not get deleted from the operator console in a reasonable period of time, there might be a problem with the initializing system or the target system. You should check to see if there is an outstanding WTOR on either system or if there is a hang on either system.

The **IOEFSPRM msg_output_dsn** option can be specified. It specifies the name of a data set that contains any output messages that come from the zFS PFS. This message output data set is only used for zFS initialization messages. This might be helpful for debugging because this data set can be sent to IBM service if needed. The **msg_output_dsn** is optional. If it is not specified, zFS PFS messages go only to the system log. If it is specified, the data set should be pre-allocated as a sequential data set with a RECFM=VB and LRECL=248 and should be large enough to contain all zFS PFS initialization messages between restarts. The space used depends on how many zFS initialization messages are issued. A suggested primary allocation is two cylinders with a secondary allocation of two cylinders. If the data set fills up, no more messages will be written to the data set. (They will still go to the system log.) After zFS restart, the msg_output_dsn data set specified is overwritten.

Determining service levels

The service level of the zFS physical file system can be determined by examining the messages that occur on the operator's console when zFS initializes as shown in the following example:

```
IOEZ00559I zFS kernel: Initializing z/OS zSeries File System
Version 01.09.00 Service Level 0000000 - HZFS390.
Created on Fri Mar 16 09:25:37 EST 2007.
Address space asid x3F
```

Or use the **MODIFY ZFS,QUERY,LEVEL** operator command and look for the following message:

```
IOEZ00020I zFS kernel: Initializing z/OS zSeries File System
Version 01.09.00 Service Level 0000000 - HZFS390.
Created on Fri Mar 16 09:25:37 EST 2007.
```

In addition, the service level of the **zfsadm** command can be determined by using the **-level** option of the **zfsadm** command. For example:

```
zfsadm -level
IOEZ00020I zfsadm: z/OS zSeries File System
Version 01.09.00 Service Level 0000000 - HZFS390.
Created on Fri Mar 16 09:27:54 EST 2007.
```

Understanding zFS hang detection

The zFS hang detector monitors the current location of the various tasks processing in zFS. At a set interval, the hang detector thread wakes up and scans the current user requests that have been called into zFS. The hang detector processes this list of tasks and notes various pieces of information that allow it to determine the location of the task. When the hang detector determines that a task has remained in the same location for a predefined period of time, it attempts to determine why it is hung and if so, the hang detector flags the task as a potential hang and either issues message IOEZ00524I and produces a dump or issues IOEZ00547I to the console. If on a subsequent iteration the hang detector recognizes that this task has finally progressed, it will DOM the message (remove it from the console). If the message is removed, it means that the hang condition cleared. Messages IOEZ00524I and IOEZ00547I are also issued and cleared when slowdown occurs—this is not an indication of a real hang, but that things are progressing slowly because of a stressful workload or some other issue. In this case, you can discard the dump.

Guideline: IOEZ00524I or IOEZ00547I only indicate a potential hang. Further review of the situation is necessary to determine if a hang condition really exists.

Steps for resolving a zFS hang

Perform the following steps when a hang condition occurs.

1. Continually monitor for the following messages:

   IOEZ00524I
   zFS has a potentially hanging thread caused by: *UserList* where: *UserList* is a list of address space IDs and TCB addresses causing the hang.

   IOEZ00547I
   zFS has a potentially hanging XCF request on systems: *Systemnames* where: *Systemnames* is the list of system names.

   To start investigating, enter **D OMVS,W** to check the state of sysplex messages/waiters. Message IOEZ00547I (hanging XCF request) can indicate an XCF issue. Check any outstanding message that might need a response to determine if a system is leaving the sysplex or not (for example, IXC402D). This might look like a zFS hang until that message gets a response.
2. Enter the **MODIFY ZFS,QUERY,THREADS** command to determine if any zFS threads are hanging and why.

Note: The type and amount of information displayed as a result of this command is for internal use and can vary between releases or service levels.

3. Enter the **D A,ZFS** command to determine the zFS ASID.
4. Enter **F ZFS,QUERY,THREADS** at one to two minute intervals for six minutes.
5. Interrogate the output for any user tasks (tasks that do not show the zFS ASID) that are repeatedly in the same state during the time you requested **F ZFS,QUERY,THREADS**. If there is a hang, this user task will persist unchanged over the course of this time span. If the information is different each time, there is no hang.
6. Verify that no zFS aggregates are in the **QUIESCED** state by checking their status using the **zfsadm lsaggr** or **zfsadm aggrinfo** command. For example, quiesced aggregates display as follows:

```
DCESVPI:/home/susvpi/> zfsadm lsaggr
IOEZ00106I A total of 1 aggregates are attached
SUSVPI.HIGHRISK.TEST                          DCESVPI   R/W QUIESCE
DCESVPI:/home/susvpi/> zfsadm aggrinfo
IOEZ00370I A total of 1 aggregates are attached.
SUSVPI.HIGHRISK.TEST (R/W COMP QUIESCED): 35582 K free out of total 36000
DCESVPI:/home/susvpi/>
```

   Resolve the **QUIESCED** state continuing to determine if there is a real hang condition. The hang condition message can remain on the console for up to a minute after the aggregate is unquiesced.

   Note: Message IOEZ00581E appears on the system that contains at least one zFS aggregate that is quiesced. There is a time delay between when the aggregate is quiesced and when the message appears. When there are no quiesced zFS aggregates on the system, this message is DOMed. There is also a delay between when the last aggregate is unquiesced and when the message is DOMed. This message is handled by a thread that wakes up every 30 seconds and checks for any quiesced aggregates owned by this system. It is possible for an aggregate to be quiesced and unquiesced in the 30 second sleep window of the thread and no quiesce message to appear. This message remains if one aggregate is unquiesced and another is quiesced within the 30 second sleep window.

7. Verify that there no zFS file systems being cloned by checking their status using the **zfsadm lsfs -long** command. For example, cloning file systems display as follows:

```
# zfsadm190075 lsfs -aggregate PLEX.JMS.AGGR004.LDS0004 -long
IOEZ00129I Total of 2 file systems found for aggregate PLEX.JMS.AGGR004.LDS0004
PLEX.JMS.AGGR004.LDS0004 100003,,6 RW (Mounted R/W)      states 0x10001 (Clone running)
    4294967232 K alloc limit;         16 K alloc usage
          5040 K quota limit;         26 K quota usage
            16 K Filesystem Inode Table            14 file requests

    version 1.4
    Creation Tue Jun 11 19:18:04 2002
    Last Update Thu Oct  5 14:27:59 2006

PLEX.JMS.AGGR004.LDS0004.bak 100003,,5 BK (Not Mounted)      states 0x30002 On-line
    4294967232 K alloc limit;         26 K alloc usage
          5040 K quota limit;         26 K quota usage
            16 K Filesystem Inode Table             2 file requests

    version 1.4
    Creation Tue Jun 11 19:17:27 2002
    Last Update Thu Oct  5 14:27:59 2006
```

   Note: Message IOEZ00588E appears on the system that contains the cloning file system.

8. Check if any user tasks are hung focusing on the tasks issued by IOEZ00524I. User tasks will not have the same address space identifier (ASID) as the zFS address space. One or more threads consistently at the same location might indicate a hang (for example, Recov, TCB, ASID Stack,

Routine, State). The threads in the zFS address space with the zFS ASID (for example, xcf_server) are usually waiting for work. It is normal for the routine these threads are waiting in to have the same name as the entry routine.

```
MODIFY ZFS,QUERY,THREADS
IOEZ00438I Starting Query Command THREADS.
            zFS and USS Tasks
            --------------------
Recov     TCB       ASID  Stack     Routine               State
--------  --------  ----  --------  --------              --------
7047EA68  007FF290  0050  0BC46000  efscm_mkdir           WAITLOCK
       since  May 26  2:27:34 2006  Current DSA: 0BC46CB8
       wait code location offset=039C rtn=elbb_ReadGeneral
  lock=717E9CD8 state=F0753A69 owner=(70753A68 0053 7DFE88)
       lock description=Metadata-cache buffer lock
    ReadLock held for 70AA7D88 state=00000002 00000000
       lock description=User-cache resize lock
    ReadLock held for 713C53D0 state=00000002 00000000
       lock description=Anode handle lock

704489B8  007DDA48  0053  0BC43E70  agown_takeover_worke  WAITLOCK
       since  May 26  2:28:10 2006  Current DSA: 0BC44710
       wait code location offset=00E0 rtn=start_aggr_cmd
  lock=71888C70 state=F047F0E9 owner=(7047F0E8 0053 7DDC68)
       lock description=Aggregate syscall lock

7047F0E8  007DDC68  0053  0BC3FE70  agown_takeover_worke  WAITLOCK
       since  May 26  2:28:10 2006  Current DSA: 0BC40980
       wait code location offset=14B0 rtn=internal_assoc_iterate
  lock=704478A0 state=F072B309 owner=(7072B308 0053 7DFA60)
       lock description=Aggregate lock

7047E2D8  007DDE88  0053  0BC3DE70  agown_takeover_worke  WAITLOCK
       since  May 26  2:28:10 2006  Current DSA: 0BC3E710
       wait code location offset=00E0 rtn=start_aggr_cmd
  lock=71888C70 state=F047F0E9 owner=(7047F0E8 0053 7DDC68)
       lock description=Aggregate syscall lock

7047E608  007E00D0  0053  0BC3BE70  agown_master          WAITLOCK
       since  May 26  2:28:40 2006  Current DSA: 0BC3C2B8
       wait code location offset=030C rtn=agown_master
  lock=71888C70 state=F047F0E9 owner=(7047F0E8 0053 7DDC68)
       lock description=Aggregate syscall lock

7072B308  007DFA60  0053  0BC1DE70  block_zero_daemon     IOWAIT
       since  May 26  2:28:09 2006

70753A68  007DFE88  0053  0BC13E70  local_sync_daemon     IOWAIT
       since  May 26  2:27:33 2006
    ReadLock held for 716D4178 state=00000002 00000000
       lock description=Log file cache resize lock

70754D68  007E4380  0053  0BC17E70  comm_daemon           RUNNING
       since  May 26  2:32:59 2006

IOEZ00025I zFS kernel: MODIFY command - QUERY,THREADS completed
successfully.
```

Note: This information is for example purposes only.

9. After you ensure there is a valid hang condition and not a slowdown, obtain the proper dumps if none are present. IBM Support must have dumps of zFS, OMVS and the OMVS data spaces for problem resolution. Obtain and save SYSLOG and dumps of zFS, OMVS and the OMVS data spaces using `JOBNAME=(OMVS,ZFS),DSPNAME=('OMVS'.*)` in your reply to the **DUMP** command. If you are running in

a sysplex and zFS is running on other systems in the sysplex, dump all the systems in the sysplex where zFS is running, dumping zFS, OMVS and OMVS data spaces. The following is an example of the **DUMP** command:

```
DUMP COMM=(zfs hang)
R x,JOBNAME=(OMVS,ZFS),SDATA=(RGN,LPA,SQA,LSQA,PSA,CSA,GRSQ,TRT,SUM,COUPLE),
DSPNAME=('OMVS'.*),END
```

Rule: You must capture dumps for IBM Support before taking any recovery actions (HANGBREAK, CANCEL).

10. If you know which user task is hung (for example, returned in IOEZ00524I), enter the **CANCEL** or **STOP** command to clear that task from the system.
11. Finally, if the previous steps do not clear the hang, do one of the following:
    - Enter the **MODIFY ZFS,HANGBREAK** command to attempt to break the hang condition. The **MODIFY ZFS,HANGBREAK** command posts any threads that zFS suspects are in a hang condition with an error and can cause abends and dumps to occur, which you can ignore. After entering the **MODIFY ZFS,HANGBREAK** command, the hang message can remain on the console for up to one minute. When the **MODIFY ZFS,HANGBREAK** command completes, it issues message IOEZ00025I. However, IOEZ00025I does not mean the system cleared the hang. Enter **F ZFS,QUERY,THREADS** to check the output for indication the hang is clear. It is possible that the **MODIFY ZFS,HANGBREAK** command can clear the current hang condition only to encounter yet another hang. You might have to enter the **MODIFY ZFS,HANGBREAK** command several times.
    - Or, if you users are hung in the file system, forcefully unmount the file system by entering the **MODIFY ZFS,ABORT** command.

    If you question the hang condition or if the commands mentioned above do not seem to resolve the situation, contact IBM Support and provide all the dumps and SYSLOG information.

Diagnosing disabled aggregates

If an internal error is detected by zFS (causing a 2C3 abend) on an aggregate that is mounted R/W, zFS will attempt to isolate the failure rather than taking zFS down. As a result, zFS might mark an aggregate unavailable and issue a message similar to the following.

```
IOEZ00422E Aggregate PLEX.JMS.AGGR001.LDS0001 disabled for writing
```

This is in addition to a dump and possibly zFS trace information. You can contact IBM service and provide the dump and the trace and any other information that is useful for diagnosing the problem (for example, what was running on the system when the problem occurred).

When an aggregate is disabled, applications cannot write to the aggregate. Other aggregates that are not involved in the failure remain available. The disabled aggregate will be unavailable for writing until it is unmounted and mounted.

Note: Even though the aggregate is disabled, z/OS UNIX System Services will continue to display the aggregate mounted as R/W. To determine if the aggregate has been marked as disabled, use the **zfsadm lsaggr** command or the **zfsadm aggrinfo** command.

An aggregate that has been disabled might potentially be corrupted. (zFS has had an internal problem and has disabled the aggregate in order to avoid writing anything invalid into the aggregate. However, because this is an internal failure, zFS cannot guarantee that the aggregate has no internal inconsistencies.) In order to be sure the aggregate is internally consistent, run the **IOEAGSLV** utility against the aggregate that was disabled. (See “ioeagslv” on page 69 for information on running the IOEAGSLV utility.)

Disabled compatibility mode aggregate

The compatibility mode aggregate (file system) should be unmounted. If there are other file systems mounted below the disabled aggregate, these should be unmounted also. Run the IOEAGSLV utility to ensure that the aggregate is internally consistent. Messages similar to the following will be issued if you do not unmount before running IOEAGSLV.

```
IKJ56225I DATA SET PLEX.JMS.AGGR001.LDS0001 ALREADY IN USE, TRY LATER+
IKJ56225I DATA SET IS ALLOCATED TO ANOTHER JOB OR USER
IOEZ00003E While opening minor device 1, could not open dataset
PLEX.JMS.AGGR001.LDS0001.
```

After you have run IOEAGSLV and are satisfied that the aggregate is in a consistent state, mount the aggregate.

If you choose not to run IOEAGSLV, you still need to unmount and mount the aggregate so that it is not disabled any longer. If there are file systems mounted below the disabled aggregate, you can use the remount capability of z/OS UNIX in order to avoid unmounting those lower file systems. Remount allows you to change a mounted file system from read-only to read-write or from read-write to read-only without affecting lower mounted file systems.

Note: If you are in a shared file system environment, you must be at z/OS V1R5 or higher to use the remount capability. Otherwise, you need to unmount the file system (and possibly lower file systems) and then mount the file system.

For example, if PLEX.JMS.AGGR001.LDS0001 is mounted read-write at /zfsmnt1 then you can change it to a read-only mount by entering the following TSO/E UNMOUNT command:

```
UNMOUNT FILESYSTEM('PLEX.JMS.AGGR001.LDS0001') REMOUNT(READ)
```

or the following **OMVS chmount** command:

```
/usr/sbin/chmount -r /zfsmnt1
```

Note: You might see messages such as:

- When entering the TSO/E UNMOUNT command:

  ```
  RETURN CODE 0000008D, REASON CODE EF096271.
  THE UNMOUNT FAILED FOR FILE SYSTEM PLEX.JMS.AGGR001.LDS0001.
  ```

- When entering the OMVS chmount command:

  ```
  FOMF0504I remount error: 8D EF096271
  EROFS: The specified file system is read only
  ```

  In either of these cases, the message indicates that the remount to read-only failed because zFS needs to run log recovery for this aggregate. In this case, z/OS UNIX will mount the file system back to read-write, so these messages can be ignored. You can verify that the file system is mounted read-write by using the z/OS UNIX **df -v** command against the mount point (for example, df -v /zfsmnt1). In that case, you can skip the next step (remount or chmount to read-write).

If this succeeds, then you should change it back to read-write mode with one of the following commands:

```
UNMOUNT FILESYSTEM('PLEX.JMS.AGGR001.LDS0001') REMOUNT(RDWR)
```

or

```
/usr/sbin/chmount -w /zfsmnt1
```

You will have accomplished your unmount and mount.

If the remount (to read-only) fails, then z/OS UNIX will attempt to mount it read-write again. If this succeeds, then you have accomplished your unmount and mount. If it fails, then the aggregate will be unavailable for writing until zFS is stopped and restarted.

You can use the OMVS df -v command to determine if your file system is mounted and whether it is mounted read-only or read-write.

Disabled multi-file system aggregate

All file systems in a multi-file system aggregate that are mounted must be unmounted before the aggregate can be detached. Of course, if there are other file systems mounted on these file systems, they must be unmounted also. Once all the file systems have been unmounted, the aggregate can be detached. If this is successful, then you should then run the IOEAGSLV utility to ensure that the aggregate is internally consistent. Messages similar to the following will be issued if you do not detach before running IOEAGSLV.

```
IKJ56225I DATA SET PLEX.JMS.AGGR001.LDS0001 ALREADY IN USE, TRY LATER+
IKJ56225I DATA SET IS ALLOCATED TO ANOTHER JOB OR USER
IOEZ00003E While opening minor device 1, could not open dataset
PLEX.JMS.AGGR001.LDS0001.
```

If the detach is unsuccessful, then the aggregate will be unavailable for writing until zFS is stopped and restarted.

To determine the names of the file systems contained within the disabled aggregate, enter the **zfsadm lsfs -aggregate** command (see “zfsadm lsfs” on page 109).

For each filesystem in that aggregate that is mounted, unmount it by using the TSO/E UNMOUNT command:

```
UNMOUNT FILESYSTEM(filesystem name)
```

or the following OMVS command:

```
/usr/sbin/unmount pathname
```

Next, detach the aggregate using the following command:

```
zfsadm detach -aggregate name
```

Then, run IOEAGSLV. After you have run IOEAGSLV and are satisfied that the aggregate is in a consistent state, attach the aggregate using the following command:

```
zfsadm attach -aggregate name
```

Then, mount the file systems that were previously mounted using the TSO/E MOUNT command:

```
MOUNT FILESYSTEM(filesystem name) TYPE(ZFS) MODE(RDWR) MOUNTPOINT(pathname)
```

or the following OMVS command:

```
/usr/sbin/mount -t ZFS -f filesystemname pathname
```

Part 2. zFS administration reference

This part of the document discusses the zSeries File System (zFS) reference information.

Chapter 10. z/OS system commands

This section introduces you to the following z/OS system commands:

- **MODIFY**, a system command which enables you to query internal counters and values. It also allows you to initiate or gather debugging information.
- **SETOMVS RESET**, a system command that starts the ZFS Physical File System (PFS) if it has not been started at IPL or if it has been stopped and the BPXF032D message has been responded to with a reply of i.

These commands may be invoked from the operator console or from a Spool Display and Search Facility (SDSF) screen.

modify zfs process

Purpose

Enables you to query internal ZFS counters and values. They are displayed on the system log. It also allows you to initiate or gather debugging information. The ZFS PFS must be running to use this command.

Format

You can use any of the following formats for this command.

```
modify procname,query,{all | level | settings | storage | threads[,allwait]}

modify procname,reset,{all | storage}

modify procname,trace,{reset | print}

modify procname,abort

modify procname,dump

modify procname,hangbreak

modify procname,unquiesce,aggregate_name
```

Parameters

procname The name of the ZFS PFS PROC. The default procname is **ZFS**.

command The action that is performed on the ZFS PFS. This parameter can have one of the following values:

query Displays ZFS counters or values.

all Displays all the ZFS counters.

level Displays the ZFS level for the ZFS physical file system kernel.

settings
Displays the ZFS configuration settings. These are based on the **IOEFSPRM** file and defaults.

storage
Displays the ZFS storage values.

threads[,allwait]
Displays the threads being monitored by the zFS hang detector. To display all zFS threads, use the **modify zfs,query,threads,allwait** command.

Refer to “Monitoring zFS performance” on page 38. Performance and debugging for other query options available.

reset Resets ZFS counters to zero.

all Resets all the ZFS counters to zero.

storage
Resets the ZFS storage counters to zero.

trace Resets or prints the internal ZFS trace table.

reset Resets the internal (wrap around) trace table to empty.

print Formats and sends the current trace table to the data set specified

in the **IOEFSPRM** file **trace_dsn** entry. This data set must be preallocated as a PDSE with RECFM VB and LRECL 133. It must be large enough to hold the formatted trace table. Refer to Chapter 9, “Performance and debugging,” on page 35 for more information of the trace output data set.

abort Causes the ZFS PFS to abnormally terminate and dump. The internal trace table is also printed to the data set specified in the **IOEFSPRM** file **trace_dsn** entry.

dump Causes the ZFS PFS to dump. The internal trace table is not printed. The **modify zfs,trace,print** command can be used if the internal trace table is desired.

hangbreak Causes zFS to post with a failure any requests in zFS that are waiting and are suspected of being hung by the hang detector. It will not break threads working on administration tasks. This may allow the hang condition to be broken and resolved. This should only be used if you suspect that there is a hang involving zFS. The **modify zfs,query,threads** operator command can be used to determine if one or more requestor threads remain in the same wait over several queries. If this command does not successfully break the hang, you will need to stop or cancel zFS. If you suspect that zFS is in an infinite loop, you will need to cancel zFS. For additional information, see “Steps for resolving a zFS hang” on page 51.

unquiesce Causes a quiesced aggregate to become unquiesced. Only locally attached aggregates can be unquiesced using the **MODIFY UNQUIESCE** command. You must issue this command on the system that owns the aggregate. Use the z/OS UNIX **zfsadm lsaggr** command to determine which system owns the aggregate.

Usage

The **modify zfs** command is used to display ZFS counters or values and to initiate or gather debugging information.

Privilege Required

This command is a z/OS system command.

Examples

The following example queries all the ZFS counters:

```
modify zfs,query,all
```

The following example resets the ZFS storage counters:

```
modify zfs,reset,storage
```

The following example formats and sends the trace table to the data set specified in the **IOEFSPRM** file **trace_dsn** entry:

```
modify zfs,trace,print
```

The following example causes the ZFS PFS to dump and terminate:

```
modify zfs,abort
```

Related Information

File:

IOEFSPRM

modify zfs process

For details on stopping zFS, see in the topic on Recycling z/OS UNIX System Services in *z/OS MVS System Commands*.

setomvs reset

Purpose

Can be used to start the ZFS PFS if it has not been started at IPL. It can also be used to redefine it if it has been terminated by replying **i** to the BPXF032D operator message (after stopping the ZFS PFS).

Format

setomvs reset=(*xx***)**

Parameters

xx The suffix of a BPXPRMxx member of PARMLIB that contains the FILESYSTYPE statement for the ZFS PFS.

Usage

The **setomvs reset** command can be used to start the ZFS PFS.

Privilege Required

This command is a z/OS system command.

Examples

The following command starts the ZFS Physical File System if the BPXPRMSS member of the PARMLIB contains the ZFS FILESYSTYPE statement:

```
setomvs reset=(ss)
```

Related Information

File:

IOEFSPRM

| In z/OS V1R7 and above, the SETOMVS command also processes zFS FILESYSTYPE statements. For
| more information, see SETOMVS command in *z/OS MVS System Commands*.

Chapter 11. zFS commands

This section provides a description of the relevant zFS commands.

Note: In addition to displaying UNIX System Services reason codes, the UNIX System Services shell command, **bpxmtext**, also displays the text and action of zFS reason codes (EFxxnnnn) returned from the kernel. zFS does not use the xx part of the reason code to display a module name. It always displays zFS. If you only know the nnnn part of the zFS reason code, you can use EF00nnnn as the reason code. The date and time returned with the zFS reason code matches the date and time returned from the zFS kernel (displayed with operator command **MODIFY ZFS,QUERY,LEVEL**). For additional information on the bpxmtext command, see the *z/OS UNIX System Services Command Reference*, SA22-7802.

ioeagfmt

Purpose

Creates an HFS compatibility mode aggregate or a multi-file system aggregate.

Format

```
ioeagfmt -aggregate name [-initialempty blocks] [-size blocks] [-logsize blocks] [-overwrite] [-compat]
                         [-owner {uid|name}][-group {gid|name}] [-perms {number}] [-grow blocks]
                         [-level] [-help]
```

Options

-aggregate *name*

Specifies the name of the data set to format. This is also the aggregate name. The aggregate name is always translated to upper case. The following characters can be included in the name of an aggregate:

- All uppercase and lowercase alphabetic characters (a to z, A to Z)
- All numerals (0 to 9)
- The . (period)
- The - (dash)
- The _ (underscore)
- The @ (at sign)
- The # (number sign)
- The $ (dollar).

The name can be no longer than 44 characters. If this is a compatibility mode aggregate (refer to the **-compat** option), and you intend to clone the file system (refer to the **zfsadm clone** command), you may want to limit the aggregate name to 40 characters.

-initialempty *blocks*

Specifies the number of 8K blocks that will be left empty at the beginning of the aggregate. The default is 1. If you specify 0, you will get 1 block. This option is not normally specified.

-size *blocks* Specifies the number of 8K blocks that should be formatted to form the zFS aggregate. The default is the number of blocks that will fit in the primary allocation of the VSAM Linear Data Set (LDS). If a number less than the default is specified, it is rounded up to the default. If a number greater than the default is specified, a single extend of the VSAM LDS is attempted after the primary allocation is formatted unless the **-grow** option is specified. In that case, multiple extensions of the amount specified in the **-grow** option will be attempted until the **-size** is satisfied. The size may be rounded up to a control area (CA) boundary by DFSMS. It is not necessary to specify a secondary allocation size on the DEFINE of the VSAM LDS for this extension to occur. Space must be available on the volume(s).

-logsize *blocks*

Specifies the size in 8K blocks of the log. The default is 1% of the aggregate size or 128 megabytes, whichever is smaller. This is normally sufficient. However, a small aggregate that is grown to be very large will still have a small log. You might want to specify a larger log if you expect the aggregate to grow very large.

-overwrite Required if you are reformatting an existing aggregate. Use this option with caution, since it destroys any existing data. This option is not usually specified.

-compat Indicates that a compatibility mode aggregate should be created. This means that in addition to formatting the VSAM LDS as a zFS aggregate, a zFS file system by the same name (the aggregate name) is created and its quota is set to the size of the available blocks on the aggregate. This option should normally be specified unless you want to

create a multi-file system aggregate. Refer to Chapter 8, “Multi-file system aggregates,” on page 27 for more information on multi-file system aggregates.

-owner *uid* | *name*
Specifies the owner for the root directory of the file system. This is used with the **-compat** option, otherwise it is ignored. It may be specified as a z/OS user ID or as a *uid*. The default is the *uid* of the issuer of **ioeagfmt**.

-group *gid* | *name*
Specifies the group owner for the root directory of the file system. This is used with the **-compat** option, otherwise it is ignored. It may be specified as a z/OS group name or as a *gid*. The default is the *gid* of the issuer of **ioeagfmt**. If only **-owner** name is specified, the group is that owner’s default group. If only **-owner** uid is specified, the group is the issuer’s group.

-perms *number*
Specifies the permissions for the root directory of the file system. This is used with the **-compat** option, otherwise it is ignored. The number can be specified as octal (for example, o755), as hexadecimal (for example, x1ED), or as decimal (for example, 493). The default is o755 (owner read/write/execute, group read/execute, other read/execute).

-grow *blocks* Specifies the number of 8K blocks that zFS will use as the increment for extension when the **-size** option specifies a size greater than the primary allocation.

-level Prints the level of the **ioeagfmt** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **ioeagfmt** utility is used to format an existing VSAM LDS as a zFS aggregate. All zFS aggregates must be formatted before use (including HFS compatibility mode aggregates). You can run **ioeagfmt** even if the zFS PFS is not active on the system. The size of the aggregate is as many 8K blocks as fits in the primary allocation of the VSAM LDS or as specified in the **-size** option. The **-size** option can cause one additional extension to occur during formatting. To extend it further, use the **zfsadm grow** command. If **-overwrite** is specified, all existing primary and secondary allocations are formatted and the size includes all of that space. If the VSAM LDS has a SHAREOPTIONS value of other than 3, **ioeagfmt** will change it to SHAREOPTIONS 3 during format.

Privilege Required

The user must have ALTER authority to the VSAM LDS or must be UID 0 or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. In fact, UPDATE authority to the VSAM LDS is sufficient for format, but zFS will not be able to set the zFS bit in the catalog unless the issuer has ALTER authority.

Examples

Figure 9 on page 68 shows an example of a job that creates a compatibility mode aggregate and file system.

```
//USERIDA  JOB ,'Compatibility Mode',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//DEFINE   EXEC   PGM=IDCAMS
//SYSPRINT DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//AMSDUMP  DD     SYSOUT=H
//DASD0    DD     DISP=OLD,UNIT=3390,VOL=SER=PRV000
//SYSIN    DD     *
     DEFINE CLUSTER (NAME(OMVS.PRV.COMPAT.AGGR001) -
            VOLUMES(PRV000) -
            LINEAR CYL(25 0) SHAREOPTIONS(3))
/*
//CREATE   EXEC   PGM=IOEAGFMT,REGION=0M,
// PARM=('-aggregate OMVS.PRV.COMPAT.AGGR001 -compat')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 9. Job to create a compatibility mode aggregate and file system

Note: In the PARM=('-aggregate OMVS.PRV.COMPAT.AGGR001 -compat') statement, the values for `-aggregate` and `-compat` must be in lower case.

ioeagslv

Purpose

Scans an aggregate and reports inconsistencies. Aggregates can be verified, recovered (that is, the log is replayed), or salvaged (that is, the aggregate is repaired). This utility is known as the Salvager.

Note: This utility is not normally needed. If a system failure occurs, the aggregate log is replayed automatically, the next time the aggregate is attached (or for compatibility mode aggregates, the next time the file system is mounted). This normally brings the aggregate (and all the file systems) back to a consistent state. The aggregate must not be mounted (or attached) when **ioeagslv** is run.

Format

```
ioeagslv -aggregate name [-recoveronly] [{-converttov3 | -verifyonly | -salvageonly}] [-verbose]
                         [-level] [-help]
```

Options

-aggregate *name*
: Specifies the name of the aggregate to be verified, recovered, or salvaged.

-recoveronly
: Directs the Salvager to recover the specified aggregate. The Salvager replays the log of metadata changes that resides on the aggregate. Refer to “Usage” for information about using and combining the command’s options.

-converttov3
: Directs the Salvager to convert the specified aggregate. The aggregate is converted from a version 1.4 aggregate to a version 1.3 aggregate. This should normally not be necessary. It would be needed if you did not install toleration APAR OA11573 on prior releases (prior to z/OS Version 1 Release 7) before installing z/OS Version 1 Release 7. You should, of course, install OA11573 on prior releases as soon as possible. Refer to “Usage” for information about using and combining the command’s options.

-verifyonly
: Directs the Salvager to verify the specified aggregate. The Salvager examines the structure of the aggregate to determine if it contains any inconsistencies, reporting any that it finds. Refer to “Usage” for information about using and combining the command’s options.

-salvageonly
: Directs the Salvager to salvage the specified aggregate. The Salvager attempts to repair any inconsistencies it finds on the aggregate. Refer to “Usage” for information about using and combining the command’s options.

-verbose
: Directs the Salvager to produce detailed information about the aggregate as it executes. The information is useful primarily for debugging purposes. It is displayed on standard output (which can be redirected). Use this option alone or with any combination of the available options.

-level
: Prints the level of the **ioeagslv** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **ioeagslv** utility invokes the Salvager on the zFS aggregate specified with the **-aggregate** option. You can run **ioeagslv** even if the zFS PFS is not active on the system. Following a system restart, the Salvager employs the zFS file system log mechanism to return consistency to a file system by running recovery on the aggregate on which the file system resides. Recovery is the replaying of the log on the aggregate; the log records all changes made to metadata as a result of operations such as file creation

and deletion. If problems are detected in the basic structure of the aggregate, if the log mechanism is damaged, or if the storage medium of the aggregate is suspect, the **ioeagslv** utility must be used to verify or repair the structure of the aggregate.

Use the utility's **-recoveronly**, **-verifyonly**, **-salvageonly**, and **-converttov3** options to indicate the operations the Salvager is to perform on the specified aggregate, as follows:

- Specify the **-recoveryonly** option

  To run recovery on the aggregate without attempting to find or repair any inconsistencies found on it. Recovery is the replaying of the log on the aggregate. Use this option to quickly return consistency to an aggregate that does not need to be salvaged; this represents the normal production use of the Salvager. Unless the contents of the log or the physical structure of the aggregate is damaged, replaying the log is an effective guarantee of a file system's integrity.
- Specify the **-converttov3** option

  To convert a zFS aggregate that is in version 1.4 format to version 1.3 format. The conversion will succeed only if all file systems and the aggregate are successful converted. If the conversion is interrupted before completion, it must be run again to completion. An attempt to mount or attach an aggregate that has been partially converted will be denied.
- Specify the **-verifyonly** option

  To determine whether the structure of the aggregate contains any inconsistencies without running recovery or attempting to repair any inconsistencies found on the aggregate. Use this option to assess the extent of the damage to an aggregate. The Salvager makes no modifications to an aggregate during verification. Note that it is normal for the Salvager to find errors when it verifies an aggregate that has not been recovered; the presence of an unrecovered log on an aggregate makes the findings of the Salvager, positive or negative, of dubious worth.
- Specify the **-recoveronly** and **-verifyonly** options

  To run recovery on the aggregate and then analyze its structure without attempting to repair any inconsistencies found on it. Use these options if you believe replaying the log can return consistency to the aggregate, but you want to verify the consistency of the aggregate after recovery is run. Recovering an aggregate and then verifying its structure represents a cautious application of the Salvager.
- Specify the **-salvageonly** option

  To attempt to repair any inconsistencies found in the structure of the aggregate without first running recovery on it. Use this option if you believe the log is damaged or replaying the log does not return consistency to the aggregate and may in fact further damage it. In most cases, you do not salvage an aggregate without first recovering it.
- Omit the **-recoveronly**, **-verifyonly**, and **-salvageonly** options

  To run recovery on the aggregate and then attempt to repair any inconsistencies found in the structure of the aggregate. Because recovery eliminates inconsistencies in an undamaged file system, an aggregate is typically recovered before it is salvaged. In general, it is good first to recover and then to salvage an aggregate if a system goes down or experiences a hardware failure.

  Omit these three options if you believe the log should be replayed before attempts are made to repair any inconsistencies found on the aggregate. (Omitting the three options is equivalent to specifying the **-recoveronly** and **-salvageonly** options.)

In some cases, when repairing an aggregate, it might be necessary to attempt the repair several times before the repair is complete. The following rule summarizes the interaction of the **-recoveronly**, **-verifyonly**, and **-salvageonly** options: The salvage command runs recovery on an aggregate and attempts to repair it unless one of the three salvage options is specified; once one of these options is specified, you must explicitly request any operation you want the Salvager to perform on the aggregate.

The basic function of the Salvager is similar to that of the **fsck** program in many z/OS UNIX systems. The Salvager recovers a zFS aggregate and repairs problems it detects in the structure of the aggregate. It does not verify or repair the format of user data contained in files on the aggregate. If it makes changes,

the Salvager displays the pathnames of the files affected by the modifications, when the pathnames can be determined. The owners of the files can then verify the files' contents, and the files can be restored from backups if necessary

The Salvager verifies the structure of an aggregate by examining all of the anodes, directories, and other metadata in each file system on the aggregate. An ***anode*** is an area on the disk that provides information used to locate data such as files, directories, ACLs, and other types of file system objects. Each file system contains an arbitrary number of anodes, all of which must reside on the same aggregate. By following the links between the various types of anodes, the Salvager can determine whether the organization of an aggregate and the file systems it contains is correct and make repairs if necessary.

Not all aggregates can be salvaged. In cases of extensive damage to the structure of the metadata on an aggregate or damage to the physical disk that houses an aggregate, the Salvager cannot repair inconsistencies. Also, the Salvager cannot verify or repair damage to user data on an aggregate. The Salvager cannot detect problems that modified the contents of a file but did not damage the structure of an aggregate or change the metadata of the aggregate.

Like the **fsck** command, the Salvager analyzes the consistency of an aggregate by making successive passes through the aggregate. With each successive pass, the Salvager examines and extracts a different type of information from the blocks and anodes on the aggregate. Later passes of the Salvager use information found in earlier passes to help in the analysis.

In general, the Salvager exits with an error code of at least 16 without analyzing a VSAM LDS that it is sure is not a zFS aggregate. It also exits with an error code of 16 if a file system on the aggregate to be recovered or salvaged is attached. (If necessary, you can use the **zfsadm detach** command to detach the aggregate.)

As the Salvager executes, it maintains a number of internal lists. Each list consists of anodes that failed verification in specific ways. When it initially scans an aggregate, the Salvager marks as ″unsafe″ anodes with which it encounters problems. The Salvager later attempts to determine the actual pathnames associated with these anodes to include the pathnames in the lists. When it has finished salvaging, the Salvager displays any non-empty lists.

Privilege Required

The user needs UPDATE authority for the specified VSAM LDS or the user must be uid 0 or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

Figure 10 shows an example of a job that invokes the **ioeagslv** utility.

```
//USERIDA  JOB ,'Salvage',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//SALVAGE  EXEC   PGM=IOEAGSLV,REGION=0M,
// PARM=('-aggregate OMVS.PRV.COMPAT.AGGR001 -verifyonly')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 10. Job to verify a zFS aggregate

MOUNT

Purpose

Mounts a file system into the z/OS UNIX hierarchy. This section only documents MOUNT options that are unique to zFS. For additional information on this command, refer to the *z/OS UNIX System Services Command Reference*.

Note: An attempt to mount a zFS file system that is contained in a zFS multi-file system aggregate running in a sysplex will be denied.

Format

```
MOUNT TYPE(file_system_type) [PARM(parameter_string)]
```

Options

TYPE (*file_system_type***)**

Specifies the file system type. In z/OS V1R7 and above, to aid migration from HFS, the TYPE option is generic. Specify **ZFS** or **HFS** and the correct file system type is determined for the file system that is located by the data set name. If you specify the wrong file type (for example, HFS instead of ZFS), any associated parameter string is ignored. For additional information, see Mounting considerations in *z/OS UNIX System Services Planning*.

PARM(*parameter_string***)**

Specifies a parameter string to be passed to zFS. Parameters are case sensitive and separated by a comma. Enclose the parameter string in quotes. If a parameter is specified multiple times, the last parameter is used.

The following parameters apply to both types of aggregates (compatibility mode aggregates and multi-file system aggregates):

FSFULL(*threshold,increment***)**

Specifies the threshold and increment for reporting file system quota error messages to the operator. The default is the **fsfull** specification in the **IOEFSPRM** file.

READAHEAD | NOREADAHEAD

Specifies whether this file system will be accessed sequentially or not and whether the zFS read ahead processing normally done should be enabled or disabled. NOREADAHEAD should be used for file systems that have random access patterns (for example, for file systems that are used like a database). The default is to do read ahead processing.

The following parameters apply to compatibility mode aggregates:

Note: These options are only effective when the mount causes an attach, which is normally the case. However, if the backup file system is mounted first, that is when the attach is done. A subsequent mount of the read-write file system would not cause an attach and any options specified (because these are all aggregate options) would have no effect.

AGGRFULL(*threshold,increment***)**

Specifies the threshold and increment for reporting aggregate full error messages to the operator. The default is the **aggrfull** specification in the **IOEFSPRM** file. This parameter only applies to compatibility mode aggregates/file systems.

AGGRGROW | NOAGGRGROW

Specifies whether the aggregate is eligible to be dynamically grown. The growth

will be based on the secondary allocation of the aggregate and will occur when the aggregate becomes full. The default is the **aggrgrow** specification in the **IOEFSPRM** file. This parameter only applies to compatibility mode aggregates/file systems.

NBS | NONBS
Specifies the new block security processing for this aggregate. The default is the nbs specification in the **IOEFSPRM** file. This parameter only applies to compatibility mode aggregates/file systems.

RW Specifies that the aggregate is to be attached R/W even though the file system is being mounted R/O. The default is to attach the aggregate R/O when the file system is mounted R/O. It would normally be used when the backup file system (.bak) is mounted before the read-write file system is mounted. This parameter only applies to compatibility mode aggregates/file systems.

The following parameters apply to multi-file system aggregates:

AGGREGATE(*aggregate_name***)**
Specifies the name of the aggregate that the file system resides in. This is normally used when the zFS file system you are mounting has the same name as a zFS file system in another aggregate. See also the **FILESYSTEM** parameter. This parameter only applies to multi-file system aggregates/file systems.

FILESYSTEM(*zFS_filesystem_name***)**
Specifies the name of the zFS file system that you are mounting. This is normally used when the zFS file system you are mounting has the same name as a zFS file system in another aggregate. If this is not specified, zFS assumes that the zFS file system name is the same as the z/OS UNIX file system name (specified in the **MOUNT FILESYSTEM** option). This parameter only applies to multi-file system aggregates/file systems. The FILESYSTEM parameter cannot be specified without the AGGREGATE parameter.

FSGROW(*increment,times***)**
Specifies that the file system quota is to be dynamically grown when the file system becomes full (that is, reaches its quota). The increment specifies how much the quota is to grow in K-bytes. The times specifies how many times the quota is to be grown before the file request is denied. The default is the **fsgrow** specification in the **IOEFSPRM** file. The maximum value that can be specified is 2147483647. If the physical space becomes enhausted, the **aggrgrow** specification in the **IOEFSPRM** file controls whether the aggregate is dynamically grown. This parameter only applies to multi-file system aggregates/file systems. It is not saved across attaches.

Usage

The **MOUNT** command mounts a zFS file system.

MOUNT of a compatibility mode aggregate is serialized with other **zfsadm commands** (because **MOUNT** of a compatibility mode aggregate does an implicit attach).

If you attempt to mount a compatibility mode aggregate/file system read-only and it fails because it needs to run recovery (return code EROFS (141) and reason code EFxx6271), you should temporarily mount it read-write (so it can complete the recovery process) and then mount it read-only.

If the DASD volume containing the zFS compatibility mode aggregate being mounted is read-only, you may receive message IOEZ00336I. This indicates that the zFS aggregate indicator could not be set in the Catalog (actually, in the VVDS on the volume). The zFS aggregate is successfully MOUNTed (and attached). DFSMSdss backup (DUMP) will not automatically quiesce and unquiesce the zFS aggregate

because it cannot determine that the VSAM Linear Data Set is a zFS aggregate. If the zFS aggregate can be MOUNTed with the DASD volume in read-write, the zFS aggregate indicator will be set.

You can determine if the zFS aggregate indicator is set by using IDCAMS LISTCAT ALL against the zFS aggregate and looking for the ZFS indicator in the output.

| Do not use a path entry as the file system name in the **MOUNT** command (See the topic on DEFINE
| PATH in *z/OS DFSMS Access Method Services for Catalogs*). The mount succeeds but the system issues
| messages similar to the following:

```
| IOEZ00412I Catalog search failed for aggregate PLEX.JMS.AGGR006.PATH. Shareoptions are not altered.
| IOEZ00336I PLEX.JMS.AGGR006.PATH could not be marked as a zFS aggregate in the catalog, rc=60 rsn=104
```

| Examples

The following TSO/E example mounts a zFS file system and specifies a threshold and increment to display a message when the file system becomes almost full:

```
MOUNT FILESYSTEM('OMVS.PRV.AGGR004.LDS0004') MOUNTPOINT('/etc/zfscompat1') TYPE(ZFS) MODE(RDWR)
      PARM('AGGRFULL(90,5)')
```

Here is the same example as an OMVS command:

```
/usr/sbin/mount -f OMVS.PRV.AGGR004.LDS0004 -t ZFS -o 'AGGRFULL(90,5)' /etc/zfscompat1
```

The following TSO/E example mounts a zFS file system and specifies a z/OS UNIX file system name that is different from the zFS file system name (because another zFS file system with the same name (in a different aggregate) has already been mounted):

```
MOUNT FILESYSTEM('OMVS.PRV.FS1.DUP1') MOUNTPOINT('/etc/zfsmntpt2') TYPE(ZFS) MODE(RDWR)
      PARM('AGGREGATE(OMVS.PRV.AGGR005.LDS0005),FILESYSTEM(OMVS.PRV.FS1)')
```

Here is the same example as an OMVS command:

```
/usr/sbin/mount -f OMVS.PRV.FS1.DUP1 -t ZFS -o 'AGGREGATE(OMVS.PRV.AGGR005.LDS0005),
FILESYSTEM(OMVS.PRV.FS1)' /etc/zfsmntpt2
```

The following TSO/E example mounts a clone of a zFS file system by specifying triple apostrophes to preserve the mixed case file system name.

```
MOUNT FILESYSTEM('''OMVS.PRV.FS3.bak''') TYPE(ZFS) MODE(READ) MOUNTPOINT('/etc/zfsmntpt3')
```

Here is the same example as an OMVS command:

```
| /usr/sbin/mount -f OMVS.PRV.FS3.bak -t ZFS -r /etc/zfsmntpt3
```

Related Information

Command:

UNMOUNT (For information on this command, refer to the *z/OS UNIX System Services Command Reference*.)

File:

IOEFSPRM

zfsadm

Purpose

Introduction to the **zfsadm** command suite.

Command Syntax

The **zfsadm** commands have the same general structure:

command {-option1 *argument...* | **-option2 {***argument1* | *argument2***}...} [-optional_information]**

The following example illustrates the elements of a **zfsadm** command:

zfsadm detach {-all | **-aggregate** *name***} [-help]**

The following list summarizes the elements of the **zfsadm** command:

- **Command** - A command consists of the command suite (**zfsadm** in the previous example) and the command name (**detach**). The command suite and the command name must be separated by a space. The command suite specifies the group of related commands.
- **Options** - Command options always appear in bold type in the text, are always preceded by a **-** (dash), and are often followed by arguments. In the previous example, **-aggregate** is an option, with *name* as its argument. An option and its arguments tell the program which entities to manipulate when executing the command (for example, which aggregate, or which file system). In general, the issuer should provide the options for a command in the order detailed in the documentation. The { | } (braces separated by a vertical bar) indicate that the issuer must enter either one option or the other (**-all** or **-aggregate** in the previous example).
- **Arguments** - Arguments for options always appear in italic type in the text. The { | } indicate that the issuer must enter either one argument or the other (**-all** or **-aggregate** in the preceding example). The ... (ellipsis) indicates that the issuer can enter multiple arguments.
- **Optional** information - Some commands have optional, as well as required, options and arguments. Optional information is enclosed in [ ] (brackets). All options except **-all** or **-aggregate** in the previous example are optional.

Options

The following options are used with many **zfsadm** commands. They are also listed with the commands that use them.

-filesystem *name*
: Specifies the file system to use with the command.

-aggregate *name*
: Specifies the aggregate name of the aggregate to use with the command.

-size *kbytes* Specifies the size in K-bytes for the *kbytes* argument.

-system *system name*
: Specifies the name of the system that the request will be sent to.

-help Prints the online help for this command. All other valid options specified with this option are ignored. For complete details about receiving help, refer to “Receiving Help” on page 77.

When an option is specified multiple times on one command, the first will be honored and the subsequent ones will be ignored. This may cause a subsequent argument to be interpreted as an option and be diagnosed as unrecognized.

Usage

Most **zfsadm** commands are administrative-level commands used by system administrators to manage file systems and aggregates. They apply to multi-file system aggregates although several apply to compatibility mode aggregates too (for example, **zfsadm grow** and **zfsadm quiesce**/**unquiesce**). They can be issued from OMVS or as a batch job. The descriptions of the **zfsadm aggrinfo** and the **zfsadm attach** commands show examples of issuing them as a batch job. The other **zfsadm** commands can be run as a batch job in a similar manner.

For a batch job, the **zfsadm** options are specified in the EXEC PARM as a single subparameter (a single character string enclosed in apostrophes with no commas separating the options). You cannot put the ending apostrophe in column 72. If it needs go to the next line, use a continuation character in column 72 (continuing in column 16 with the ending apostrophe on the second line). Remember that a JCL EXEC PARM is limited to 100 characters. See the topic on the EXEC PARM in *z/OS MVS JCL Reference*.

zfsadm commands are serialized with each other. That is, when a **zfsadm** command is in progress, a subsequent **zfsadm** command is delayed until the active **zfsadm** completes. This also includes MOUNT of a compatibility mode aggregate (since an implicit attach occurs). This does not include **zfsadm grow** or implicit aggregate grow. **zfsadm** commands do not delay normal file system activity (except when the **zfsadm** command requires it, such as **zfsadm quiesce**).

zfsadm commands only work on zFS file systems and aggregates. **zfsadm** commands can query and set information on zFS aggregates owned by the current system only. File system information from other systems will not show up in the command output. However, if all systems are running z/OS V1R7, all **zfsadm** commands work across sysplex members.

When supplying an argument to a **zfsadm** command, the option (for example **-aggregate**) associated with the argument (for example, OMVS.PRV.AGGR001.LDS0001) can be omitted if:

- All arguments supplied with the command are entered in the order in which they appear in the command's syntax. (The syntax for each command appears with its description in this chapter.)
- Arguments are supplied for all options that precede the option to be omitted.
- All options that precede the option to be omitted accept only a single argument.
- No options, either those that accept an argument or those that do not, are supplied before the option to be omitted.

In the case where two options are presented in { | } (braces separated by a vertical bar), the option associated with the first argument can be omitted if that argument is provided; however, the option associated with the second argument is required if that argument is provided.

If it must be specified, an option can be abbreviated to the shortest possible form that distinguishes it from other options of the command. For example, the **-aggregate** option found in many **zfsadm** commands can typically be omitted or abbreviated to be simply **-a**. (One exception is the **zfsadm attach** command since it has an **-aggrfull** option.)

It is also valid to abbreviate a command name to the shortest form that still distinguishes it from the other command names in the suite. For example, it is acceptable to shorten the **zfsadm grow** command to **zfsadm g** because no other command names in the **zfsadm** command suite begin with the letter **g**. However, there are three **zfsadm** commands that begin with **l**: **zfsadm lsaggr**, **zfsadm lsfs**, and **zfsadm lsquota**. To remain unambiguous, they can be abbreviated to **zfsadm lsa**, **zfsadm lsf**, and **zfsadm lsq**.

The following examples illustrate three acceptable ways to enter the same **zfsadm grow** command:

Complete command:

```
zfsadm grow -aggregate omvs.prv.aggr001.lds0001 -size 50000
```

Abbreviated command name and abbreviated options:

```
zfsadm g -a omvs.prv.aggr001.lds0001 -s 50000
```

Abbreviated command name and omitted options:

```
zfsadm g omvs.prv.aggr001.lds0001 50000
```

Note: The ability to abbreviate or omit options is intended for interactive use. If you imbed commands in a shell script, you should not omit options nor abbreviate them. If an option is added to a command in the future, it may increase the minimum unique abbreviation required for an existing option or change the order of options.

In general, **zfsadm** commands are processed on a worker thread while the zfsadm thread waits. If you cancel a **zfsadm** command that is taking a long time (for example, **zfsadm grow** or **zfsadm config** (to shrink a cache)), the zfsadm (waiting) thread is cancelled, but the worker thread continues to process the request to completion. In addition, most **zfsadm** commands require a common zfsadm lock while they are processing. If the **zfsadm** command cannot get the lock, it waits for it to become available. This means, if you issue another **zfsadm** command (after cancelling a previous one), it could be delayed by this common zfsadm lock, until the previous (possibly cancelled) command completes.

Receiving Help

There are several different ways to receive help about **zfsadm** commands. The following examples summarize the syntax for the different help options available:

zfsadm help Displays a list of commands in a command suite.

zfsadm help -topic *command*
Displays the syntax for one or more commands.

zfsadm apropos -topic *string*
Displays a short description of any commands that match the specified *string*.

Privilege Required

zfsadm commands that query information (for example, **lsfs**, **aggrinfo**) can be issued by any user that has READ authority to the data set that contains the **IOEFSPRM** file. **zfsadm** commands that modify (for example, **setquota**, **create**) additionally require that the issuer must be one of the following:

- UID of 0

  Note: If you are permitted READ to the BPX.SUPERUSER resource in the RACF facility class, you may become a UID of 0 by issuing the **su** command.
- Have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Specific privilege information is listed within each command's description.

Related Information

Commands:

zfsadm aggrinfo
zfsadm apropos
zfsadm attach
zfsadm clone
zfsadm clonesys
zfsadm config
zfsadm configquery
zfsadm create
zfsadm define
zfsadm delete

zfsadm

zfsadm detach
zfsadm format
zfsadm grow
zfsadm help
zfsadm lsaggr
zfsadm lsfs
zfsadm lsquota
zfsadm lssys
zfsadm query
zfsadm quiesce
zfsadm rename
zfsadm setquota
zfsadm unquiesce

Files:
IOEFSPRM

zfsadm aggrinfo

Purpose

Displays information about an aggregate, or all attached aggregates, if there is no specific aggregate specified.

Format

```
zfsadm aggrinfo [-aggregate name | -system system name]  [-fast | -long] [-level] [-help]
```

Options

-aggregate *name*
: Specifies the name of an aggregate about which information is to be displayed. The aggregate must be attached. The aggregate name is not case sensitive. It is translated to upper case. If this option is omitted, information is provided about all of the attached aggregates on the system. Compatibility mode aggregates are implicitly attached when they are mounted.

-system *system name*
: Specifies the name of the system the report request will be sent to, to retrieve the data requested.

-fast
: Causes the output of the command to be shortened to display only the aggregate name if it contains one or more file systems or a message indicating that there are no file systems contained in the aggregate.

-long
: Causes the output of the command to be extended to display the following additional information about space usage in an aggregate: the version of the aggregate, the number of free 8K blocks, the number of free 1K fragments, the size of the log file, the size of the filesystem table and the size of the bitmap file.

-level
: Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm aggrinfo** command lists information about the total amount of disk space and the amount of disk space currently available on attached aggregates. The **-aggregate** option can be used to specify a single aggregate about which information is to be displayed. If this option is omitted, information about all aggregates that are attached in the sysplex (if shared file systems are being used) or the system is displayed. In a shared file system environment, you can limit the display to a single system by using the **-system** option. Compatibility mode aggregates are implicitly attached when they are mounted.

This command displays a separate line for each aggregate. Each line displays the following information:

- The aggregate name.
- Whether the aggregate is read-write (R/W) or read-only (R/O), it is a compatibility mode aggregate (COMP), a multi-file system aggregate (MULT), or the aggregate is currently quiesced (QUIESCED) and/or disabled (DISABLED).
- The amount of space available in K-bytes.
- The total amount of space in the aggregate in K-bytes. (To grow an aggregate using the **zfsadm grow** command, specify a number larger than this number.)
- If **-long** is specified, the version of the aggregate, the number of free 8K blocks, the number of free 1 K fragments, the size of the log file, the size of the filesystem table and the size of the bitmap file.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The following example displays information about the disk space available on all aggregates attached on the system:

```
zfsadm aggrinfo -long
IOEZ00369I A total of 4 aggregates are attached to the sysplex.
PLEX.JMS.AGGR004.LDS0004 (R/W COMP): 4866 K free out of total 5040
version 1.4

           603 free 8k blocks;         42 free 1K fragments
           112 K log file;             24 K filesystem table
             8 K bitmap file

PLEX.JMS.AGGR003.LDS0003 (R/W MULT): 829 K free out of total 1440
version 1.4

           101 free 8k blocks;         21 free 1K fragments
           112 K log file;             16 K filesystem table
             8 K bitmap file

PLEX.JMS.AGGR002.LDS0002 (R/O MULT): 4886 K free out of total 5040
version 1.3

           609 free 8k blocks;         14 free 1K fragments
           112 K log file;             24 K filesystem table
             8 K bitmap file

PLEX.JMS.AGGR001.LDS0001 (R/W MULT QUIESCED): 2812 K free out of total 3600
version 1.4

           345 free 8k blocks;         52 free 1K fragments
           112 K log file;             24 K filesystem table
             8 K bitmap file
```

Figure 11 shows the same example as a job that invokes **zfsadm aggrinfo**.

```
//USERIDA  JOB ,'Zfsadm Aggrinfo',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//AGGRINFO EXEC   PGM=IOEZADM,REGION=0M,
// PARM=('aggrinfo -long')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 11. Job to display aggregate information

Related Information

Command:

zfsadm lsaggr

File:

IOEFSPRM

zfsadm apropos

Purpose

Shows each help entry containing a specified string.

Format

zfsadm apropos -topic *string* **[-level] [-help]**

Options

-topic Specifies the keyword string for which to search. If it is more than a single word, surround it with double quotes (″″) or other delimiters. Type all strings for **zfsadm** commands in all lowercase letters.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm apropos** command displays the first line of the online help entry for any **zfsadm** command containing the string specified by **-topic** in its name or short description.

To display the syntax for a command, use the **zfsadm help** command.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Results

The first line of an online help entry for a command lists the command and briefly describes its function. This command displays the first line for any **zfsadm** command where the string specified by **-topic** is part of the command name or first line.

Examples

The following command lists all **zfsadm** commands that have the word **list** in their names or short descriptions:

```
zfsadm apropos list
```

```
lsaggr: list aggregates
lsfs: list filesystem information
lsquota: list filesystem and aggregate space usage
```

Related Information

Command:

zfsadm help

zfsadm attach

Purpose

Attaches an aggregate to zFS as a multi-file system aggregate.

Note: Do not explicitly attach compatibility mode aggregates. They are implicitly attached when the file system is mounted.

Format

```
zfsadm attach {-aggregate name [-system system name] | -all} [-aggrfull threshold,increment]
[{-R/O | -ro | -rw}] [-nbs | -nonbs] [-aggrgrow | -noaggrgrow] [-level] [-help]
```

Options

-aggregate *name*

Specifies the name of the aggregate to be attached. The aggregate name is not case sensitive. It is translated to upper case. This aggregate does not need an entry in the **IOEFSPRM** file. If the aggregate is not contained in the **IOEFSPRM** file, it needs to be attached again if it is a multi-file system aggregate and the ZFS PFS is restarted.

Note: Compatibility mode aggregates do not need to be attached with the **zfsadm attach** command, nor do they need to be contained in the **IOEFSPRM** file. Compatibility mode aggregates are automatically attached on **MOUNT** of the compatibility mode file system.

-system *system name*

Specifies the name of the system that will be the zFS owner of the aggregate. The system name is not case sensitive. It is translated to upper case.

-all Specifies that all aggregates listed in the **IOEFSPRM** file available to this system that are not currently attached are to be attached.

-aggrfull *threshold,increment*

Specifies the threshold and increment for reporting aggregate full error messages to the operator. Both numbers must be specified. The first number is the threshold percentage and the second number is the increment percentage. For example, if 90,5 were specified, the operator would be notified when the aggregate became 90% full, then again at 95% full and again at 100% full. This overrides the **aggrfull** option in the **define_aggr** entry for this aggregate in the **IOEFSPRM** file and the global **aggrfull** entry in the **IOEFSPRM**. The default is the global **aggrfull** entry of the **IOEFSPRM** file.

-R/O | -ro Specifies that the aggregate should be opened in read-only mode. A read-only aggregate means that all file systems are read-only and can only be mounted as read-only. The default is read-write unless **R/O or -ro** is specified.

-rw Specifies that the aggregate should be opened in read-write mode. The default is read-write unless **R/O or -ro** is specified.

-nbs Specifies whether New Block Security is used for file systems in this aggregate. New block security refers to the guarantee made when a system fails. If **-nbs** is specified, then we guarantee that at the time of a failure. If a file was being extended or new blocks were being allocated for the file, but the user data has not yet made it to the disk when the failure occurred, then we show the newly allocated blocks as all binary 0's and not whatever was on disk in those blocks at time of failure. The default for this is the global **nbs** entry in the **IOEFSPRM** file.

-nonbs Specifies that the New Block Security guarantee is not required. Refer to the explanation of **-nbs** for a description of the New Block Security guarantee.

-aggrgrow Specifies that the aggregate should be dynamically grown if it runs out of physical space. The aggregate (that is, the VSAM Linear Data Set) must have a secondary allocation specified and there must be space available on the volume(s). The default is the **aggrgrow** option of the **IOEFSPRM** file.

-noaggrgrow Specifies that the aggregate should not be dynamically grown if it runs out of physical space. The default is the **aggrgrow** option of the **IOEFSPRM** file.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm attach** command attaches zFS aggregates on this system. File systems on attached aggregates are available to be mounted on the system or another system when **-system** is specified.

If the **-all** option is provided, the command attaches all aggregates listed in the **IOEFSPRM** file that is available to this system. If the **-aggregate** option is provided, only the aggregate specified is attached. The specified name need not be listed in the **IOEFSPRM** file.

When **zfsadm attach -all** executes, it reads the **IOEFSPRM** file that is available to this system to determine the aggregates to be attached. All aggregates will be attached. If an aggregate is already attached, this will be indicated. If the attach fails because log recovery is unsuccessful, you can run the **ioeagslv** command with the **-verifyonly** option on the aggregate to determine if there is an inconsistency. If this is the case, use the **ioeagslv** command to recover the aggregate that caused the failure and reissue the **zfsadm attach** command.

The **zfsadm lsaggr** command can be used to display a current list of all aggregates attached on this sysplex with the zFS owning system indicated, or this system when -system is used.

If the DASD volume containing the zFS multi-file system aggregate being attached is read-only, you may receive message IOEZ00336I. This indicates that the zFS aggregate indicator could not be set in the Catalog (actually, in the VVDS on the volume). The zFS aggregate is successfully attached. DFSMSdss backup (DUMP) will not automatically quiesce and unquiesce the zFS aggregate because it cannot determine that the VSAM Linear Data Set is a zFS aggregate. If the zFS aggregate can be attached with the DASD volume in read-write, the zFS aggregate indicator will be set.

You can determine if the zFS aggregate indicator is set by using IDCAMS LISTCAT ALL against the zFS aggregate and looking for the ZFS indicator in the output.

For multi-file system aggregates, **define_aggr** entries are generally included in the **IOEFSPRM** file for them rather than issuing **zfsadm attach** commands at the keyboard. Once included in the **IOEFSPRM** file, all aggregates listed in the **IOEFSPRM** file are attached whenever ZFS is started (or restarted) and **auto_attach=on** in the **IOEFSPRM** file.

Compatibility mode aggregates do not need to be separately attached since they are attached during **MOUNT** processing. Therefore, compatibility mode aggregates do not need **define_aggr** entries in **IOEFSPRM**, nor do they need to be attached with the **zfsadm attach** command.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the

issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command attaches all of the aggregates that have entries in the system's **IOEFSPRM** file.

```
zfsadm attach -all
```

The following command attaches an aggregate. No entry is needed in the system's **IOEFSPRM** file.

```
zfsadm attach -aggregate OMVS.PRV.AGGR001.LDS0001
```

Figure 12 shows the same example as a job that invokes **zfsadm attach**.

```
//USERIDA  JOB ,'Zfsadm Attach',
//         CLASS=A,MSGCLASS=X,MSGLEVEL=(1,1)
//AGGRINFO EXEC   PGM=IOEZADM,REGION=0M,
// PARM=('attach -aggregate OMVS.PRV.AGGR001.LDS0001')
//SYSPRINT DD     SYSOUT=H
//STDOUT   DD     SYSOUT=H
//STDERR   DD     SYSOUT=H
//SYSUDUMP DD     SYSOUT=H
//CEEDUMP  DD     SYSOUT=H
//*
```

Figure 12. Job to attach an aggregate

Note: If you want to specify the **R/O** option, you must specify a leading slash. Otherwise, Language Environment will treat the characters before the slash as Language Environment parameters. That is, you must use **PARM=('/attach OMVS.PRV.AGGR001.LDS0001 -R/O')**

zFS, by default, attaches aggregates listed in the **IOEFSPRM** file at start-up (or restart). This is based on the **auto_attach** option (default is **on**) of the **IOEFSPRM** file. The **zfsadm attach** command would be used if you had created and formatted a multi-file system aggregate after starting ZFS and you did not want to restart ZFS. A **define_aggr** entry for this multi-file system aggregate may be placed in the **IOEFSPRM** file so that it is attached the next time ZFS is started.

Related Information

Commands:

zfsadm create
zfsadm lsaggr

File:

IOEFSPRM

zfsadm clone

Purpose

Creates a backup version of a specific file system.

Format

zfsadm clone {-filesystem *name*| **-mfilesystem** *mount_name*} **[-aggregate** *name*] **[-level] [-help]**

Options

-filesystem *name*
Specifies the file system name of the read-write source file system.

-mfilesystem *mount_name*
Specifies the z/OS UNIX file system name of the file system that is to be cloned. The file system name is case sensitive. If it was specified in upper case when the file system was mounted, it must be specified in upper case here.

-aggregate *name*
Specifies the name of the aggregate where the zFS file system name resides. It is specified to qualify the zFS file system name (**-filesystem**) when there are multiple zFS file systems with the same name in different aggregates. The aggregate name is not case sensitive. It is always folded to upper case.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

This command creates a backup version, or clone, of the indicated read-write zFS file system. It names the new backup version by adding a **.bak** extension to the name of its read-write source file system. It places the backup version on the same aggregate as the read-write version. The aggregate that the read-write file system is contained in must be attached. The read-write file system may or may not be mounted when the clone operation is issued. The backup file system cannot be mounted when the clone operation is issued. File/directory operations against a mounted read-write file system are suspended during the clone operation. After the clone operation, the backup file system can be mounted read-only. The **zfsadm clone** command *cannot* clone non-zFS file systems.

If a backup version already exists, the new clone replaces it. If the read-write file system name is longer than 40 characters, the clone fails. If the clone operation takes longer than approximately 30 seconds, message IOEZ00588E is displayed on the operator console. It will be deleted (DOMed) when there are no clone operations in progress. You can determine if a clone operation is in progress on an aggregate by entering the **zfsadm lsfs -long** command, which shows the clone in progress for the backup file system.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be **root** or must have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command creates a backup version of the file system **OMVS.PRV.FS1**:

```
zfsadm clone OMVS.PRV.FS1
IOEZ00225I File system OMVS.PRV.FS1 successfully cloned.
```

Related Information

Command:

- **zfsadm clonesys**
- **zfsadm lsfs**
- **zfsadm delete**

zfsadm clonesys

Purpose

Creates backup versions of all indicated file systems.

Format

zfsadm clonesys [-prefix *string*] **[-aggregate** *name* | **-system** *system name*] **[-level] [-help]**

Options

-prefix *string*
Specifies a character string of any length. Every file system with a name matching this string is cloned. Include field separators (such as periods) if appropriate. This option can be combined with **-aggregate**. Omit all options to back up all file systems on the system or **-system**. The prefix name is case sensitive.

-aggregate *name*
Specifies the aggregate name of the aggregate where the read-write source file systems are stored. Omit all options to back up all file systems on the system. The aggregate name is not case sensitive. It is translated to upper case.

-system *system name*
Specifies the name of the system that will be used to subset the zFS aggregates (they are zFS owned by this system) containing zFS read-write file systems to be cloned.

-level
Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm clonesys** command creates a backup version, or clone, of each indicated read-write zFS file system. The file systems must be in aggregates that are attached. The read-write file systems may or may not be mounted when the clonesys operation is issued. The backup file systems cannot be mounted when the clonesys operation is issued. The command names each backup version by adding a **.bak** extension to the name of its read-write source file system. It places each backup version in the same aggregate as its read-write version. The **zfsadm clonesys** command *cannot* backup non-zFS file systems.

If a backup version of a file system already exists, the new clone replaces it.

By combining the **-prefix** and **-aggregate** options, you can create backup copies of different subsets of read-write file systems. To back up:

- All file systems in a sysplex, specify no options
- All file systems in a sysplex with a name beginning with the same character string (for example, **sys.** or **user.**), specify the string with the **-prefix** option
- File systems on a specific aggregate, specify the **-aggregate** option
- File systems with a certain prefix on a specific aggregate, specify the **-prefix** and **-aggregate** options
- File systems on a specific system, specify the **-system** option
- File systems with a certain prefix on a specific system, specify the **-prefix** and **-system** options

Use the **zfsadm clone** command to back up a single read-write zFS file system.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following example creates a backup version of each zFS file system on the DCEIMGVQ system that begins with THR:

```
zfsadm clonesys -p THR -system dceimgvq

IOEZ00368I A total of 1 aggregates are attached to system DCEIMGVQ.
IOEZ00219I Clonesys starting for aggregate PLEX.JMS.AGGR003.LDS0003, prefix THR
IOEZ00225I File system THREE successfully cloned.
IOEZ00216I Clone ending for aggregate PLEX.JMS.AGGR003.LDS0003 (Total: 1, Failed: 0, Time 0.833)
```

Related Information

Command:

zfsadm clone

File:

IOEFSPRM

zfsadm config

Purpose

Changes the value of zFS configuration (IOEFSPRM) options in memory. See Chapter 12, “zFS data sets,” on page 125 for a complete list of IOEFSPRM options.

Format

```
zfsadm config [-admin_threads number] [-user_cache_size number[,fixed]]
              [-meta_cache_size number[,fixed]] [-log_cache_size number[,fixed]]
              [-sync_interval number] [-vnode_cache_size number] [-nbs {on|off}]
              [-fsfull threshold,increment] [-aggrfull threshold,increment]
              [-trace_dsn PDSE_dataset_name] [-tran_cache_size number]
              [-msg_output_dsn Seq_dataset_name] [-user_cache_readahead {on|off}]
              [-metaback_cache_size number[,fixed]] [-fsgrow increment,times]
              [-aggrgrow {on|off}] [-vnode_cache_limit number]
              [-system system name] [-level] [-help]
```

Options

-admin_threads *number*
Specifies the number of threads defined to handle pfsctl or mount requests.

-user_cache_size *number* **[,fixed]**
Specifies the size, in bytes, of the cache used to contain file data. The fixed option reserves real storage for usage by ZFS only.

-meta_cache_size *number* **[,fixed]**
Specifies the size, in bytes, of the cache used to contain meta data. The fixed option reserves real storage for usage by ZFS only.

-log_cache_size *number* **[,fixed]**
Specifies the size, in bytes, of the cache used to contain buffers for log file pages. The fixed option reserves real storage for usage by ZFS only.

-sync_interval *number*
Specifies the number of seconds between syncs.

-vnode_cache_size *number*
Specifies the initial number of vnodes that will be cached by zFS.

-nbs on | off Controls whether new block security is globally off or on by default.

-fsfull *threshold,increment*
Specifies the threshold and increment for reporting file system quota full error messages to the operator.

-aggrfull *threshold,increment*
Specifies the threshold and increment for reporting aggregate full error messages to the operator.

-trace_dsn *PDSE_dataset_name*
Specifies the name of a data set that contains the output of any operator MODIFY ZFS,TRACE,PRINT commands or the trace output if ZFS abends.

-tran_cache_size *number*
Specifies the number of transactions in the transaction cache.

-msg_output_dsn *Seq_dataset_name*
Specifies the name of a data set that contains any output messages that come from the ZFS PFS.

-user_cache_readahead on | off
Specifies whether zFS should attempt to read ahead or not.

-metaback_cache_size *number* **[,fixed]**
Specifies the size of the backing cache for meta data. The fixed option reserves real storage for usage by ZFS only.

-fsgrow *increment,times*
Specifies the increment in k-bytes and the number of times that a file system's quota should be increased when it becomes full.

-aggrgrow on | off
Specifies whether an aggregate should be dynamically extended when it runs out of physical space.

-vnode_cache_limit *size*
Specifies the maximum number of vnodes that will be cached by zFS. It is related to the vnode_cache_size option which specifies the initial vnode cache size. The vnode cache will start at the vnode_cache_size and potentially grow up to the vnode_cache_limit.

-system *system name*
Specifies the name of the system that the configuration option change request will be sent to.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm config** command changes the configuration options (in memory) that were specified in the IOEFSPRM file (or defaulted). The IOEFSPRM file is not changed. If you want the configuration specification to be permanent, you need to modify the IOEFSPRM file since ZFS reads the IOEFSPRM file to determine the configuration values the next time ZFS is started. The values that can be specified for each option are the same as the values that can be specified for that option in the IOEFSPRM file. You can specify that the configuration option change request should be sent to another system by using the **-system** option.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following example changes the size of the user cache:

```
zfsadm config -user_cache_size 64M

IOEZ00300I Successfully set -user_cache_size to 64M
```

Related Information

Command:
zfsadm configquery

File:
IOEFSPRM

zfsadm configquery

Purpose

Queries the current value of zFS configuration options.

Format

```
zfsadm configquery [-system system name] [-adm_threads] [-aggrfull] [-aggrgrow] [-all]
                   [-auto_attach] [-cmd_trace] [-debug_dsn] [-fsfull] [-fsgrow]
                   [-group] [-log_cache_size] [-meta_cache_size] [-metaback_cache_size]
                   [-msg_input_dsn] [-msg_output_dsn] [-nbs] [-sync_interval] [-sysplex_state]
                   [-trace_dsn] [-trace_table_size] [-tran_cache_size] [-user_cache_readahead]
                   [-user_cache_size] [-vnode_cache_limit] [-vnode_cache_size]
                   [-level] [-help]
```

Options

-system *system name*
Specifies the name of the system the report request will be sent to, to retrieve the data requested.

-adm_threads
Displays the number of threads defined to handle pfsctl or mount requests.

-aggrfull Displays the threshold and increment for reporting aggregate full error messages to the operator.

-aggrgrow Displays whether an aggregate should be dynamically extended when it runs out of physical space.

-all Displays the full set of configuration options.

-auto_attach Displays whether aggregates defined and listed in the IOEFSPRM file are attached when ZFS is started.

-cmd_trace Displays whether command tracing is active.

-debug_dsn Displays the name of the debug input parameters data set.

-fsfull Displays the threshold and increment for reporting file system quota full error messages to the operator.

-fsgrow Displays the increment in k-bytes and the number of times that a file system's quota should be increased when it becomes full.

-group Displays the XCF group used by zFS for communication between sysplex members.

-log_cache_size
Displays the size, in bytes, of the cache used to contain buffers for log file pages.

-meta_cache_size
Displays the size, in bytes, of the cache used to contain meta data.

-metaback_cache_size
Displays the size of the backing cache for meta data.

-msg_input_dsn
Displays the name of the data set that contains translated zFS messages.

-msg_output_dsn
Displays the name of a data set that contains any output messages that come from the ZFS PFS.

-nbs Displays whether new block security is globally off or on by default.

-sync_interval
Displays the number of seconds in the interval that zFS flushes data in the buffers to disk.

-sysplex_state
Displays the sysplex state of zFS.

- Zero (0) indicates that zFS is not in a shared file system environment (normal for V1R6 and prior releases and for single system configurations including monoplex and xcflocal).
- One (1) indicates that zFS is in a shared file system environment (normal for V1R7, V1R8, and V1R9).

-token_cache_size
Displays the current token size cache.

-trace_dsn Displays the name of the data set that contains the output of any operator MODIFY ZFS,TRACE,PRINT commands or the trace output if ZFS abends.

-trace_table_size
Displays the size, in bytes, of the internal trace table.

-tran_cache_size
Displays the number of transactions in the transaction cache.

-user_cache_readahead
Displays whether zFS should attempt to read ahead or not.

-user_cache_size
Displays the size, in bytes, of the cache used to contain file data.

-vnode_cache_limit
Specifies the maximum number of vnodes that will be cached by zFS. It is related to the vnode_cache_size option which specifies the initial vnode cache size. The vnode cache will start at the vnode_cache_size and potentially grow up to the vnode_cache_limit.

-vnode_cache_size
Specifies the initial number of vnodes that will be cached by zFS.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm configquery** command displays the current value of zFS configuration options. The value is retrieved from ZFS address space memory rather than from the IOEFSPRM file. You can specify that the configuration option query request should be sent to another system by using the **-system** option.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The following example displays the current value of the user_cache_size option:

```
zfsadm configquery -user_cache_size

IOEZ00317I The value for config option -user_cache_size is 64M.
```

If you want to display all the zFS configuration options from each member, you can use something like the following:

```
zfsadm lssys | grep -v IOEZ00361I | xargs -n 1 zfsadm configquery -all -system
```

Related Information

Command:

zfsadm config

File:

IOEFSPRM

zfsadm create

Purpose

Creates a read-write zFS file system in an aggregate. This is for multi-file system aggregates only.

Format

```
zfsadm create -filesystem name -aggregate name -size kbytes[-owner {name | uid}]
              [-group { name | gid}]
              [-perms permbits] [-level] [-help]
```

Options

-filesystem *name*

Specifies a name for the read/write file system. The file system name is case sensitive. That is, if you specify the file system name in lower case on the **zfsadm create** command, you must specify the file system name in lower case when you **MOUNT** it. The TSO/E MOUNT command translates the file system name to upper case even if it is within quotes. You can avoid this translation to upper case if you specify the file system name on the TSO/E MOUNT command within triple quotes. For example, if you specify FILESYSTEM('''lower.case.example'''), the file system name is not translated to upper case. However, you may find it simpler to specify the file system name in upper case on the **zfsadm create** command. The name must be unique within the system, and it should be indicative of the file system's contents. The following characters can be included in the name of a file system:

- All uppercase and lowercase alphabetic characters (a to z, A to Z)
- All numerals (0 to 9)
- The . (period)
- The - (dash)
- The _ (underscore)
- The @ (at sign)
- The # (number sign)
- The $ (dollar).

The name can be no longer than 44 characters. This includes the **.bak** extension, which is added automatically when a backup version of the file system is created (for example, by using **zfsadm clone**). If you intend to clone this file system, you may want to limit the file system name to 40 characters. Note that the **.bak** extension is reserved for use with backup file systems so you cannot specify a file system name that ends with this extension.

If you are using both multi-file system aggregates and compatibility mode aggregates, do not name any file systems in multi-file system aggregates with the same name as any of your compatibility mode aggregates. If you do this, you will get a different file system mounted depending on whether an aggregate is attached or not. For example, suppose you have compatibility mode aggregate A.B.C and you have multi-file system aggregate D.E.F that contains file system A.B.C. When you mount file system A.B.C, you will get the one in aggregate D.E.F mounted if D.E.F is attached. If D.E.F is not attached, you will get compatibility mode aggregate A.B.C mounted.

However, you can create file systems with the same name in different multi-file system aggregates. The **zfsadm** commands and the **MOUNT** command can specify a zFS file system name that is qualified by its aggregate name.

-aggregate *name*

Specifies the name of the aggregate where the read-write file system is to be stored. The aggregate name is not case sensitive. It is translated to upper case.

-size *kbytes* Specifies the initial maximum quota for the file system in K-bytes. The minimum value is 128 (for 128 K bytes).

-owner *name* | *uid*
Specifies the owner of the root directory of the file system. This can be specified as a z/OS user ID or as a numeric *uid*. The default is the *uid* of the issuer of the command.

-group *name* | *gid*
Specifies the group of the root directory of the file system. This can be specified as a z/OS group ID or a numeric *gid*. The default is the group of the issuer of the command. If only **-owner** is specified, the group is the owner's default group.

-perms *permbits*
Specifies the permissions for the root directory of the file system. The number can be specified as octal (for example, o755), as hexadecimal (for example, x1ED), or as decimal (for example, 493). The default is o755 (owner read/write/execute, group read/execute, other read/execute).

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm create** command creates a read-write zFS file system, names it as specified by **-filesystem**, and places it in the multi-file system aggregate specified by **-aggregate**. The aggregate must be attached. (This is accomplished by issuing the **zfsadm attach** command or by placing a **define_aggr** entry for the aggregate in the **IOEFSPRM** file and starting (or restarting) ZFS.)

If this command succeeds, the file system can be made available for use by **MOUNT**ing it into the z/OS UNIX hierarchy. The command creates an empty root directory in the file system, which becomes visible when the file system is mounted.

Note: You cannot create another file system in a mounted compatibility mode aggregate. If you really want to do this, you must unmount it, attach the aggregate and then create the file system. This will, however, change the compatibility mode aggregate into a multi-file system aggregate.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are instead using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command creates the read-write file system **OMVS.USER.PAT**, with an initial quota of 5000 1K blocks in aggregate OMVS.PRV.AGGR001.LDS0001.

```
zfsadm create OMVS.USER.PAT omvs.prv.aggr001.lds0001 5000

IOEZ00099I File system OMVS.USER.PAT created successfully
```

Related Information

Commands:

zfsadm delete
zfsadm lsfs

File:

IOEFSPRM

zfsadm define

Purpose

Defines a VSAM Linear Data Set (VSAM LDS) in preparation to be formatted as a zFS aggregate.

Format

```
zfsadm define -aggregate name  [-dataclass SMS_data_class]
                               [-managementclass SMS_management_class]
                               [-storageclass SMS_storage_class] [-catalog catalog]
                               [-system system name] [-model model [catalog]]
                               [-volumes volume [volume ...]]
                               [-cylinders primary [secondary]] [-kilobytes primary [secondary]]
                               [-megabytes primary [secondary]] [-records primary [secondary]]
                               [-tracks primary [secondary]] [-level] [-help]
```

Options

-aggregate *name*
Specifies the aggregate name of the aggregate to be defined. This will be the name of the VSAM LDS that is defined. The aggregate name is not case sensitive. It is translated to upper case.

-dataclass *SMS_data_class*
Specifies the name of the data class to be used when the VSAM LDS is defined.

-managementclass *SMS_management_class*
Specifies the name of the management class to be use when the VSAM LDS is defined.

-storageclass *SMS_storage_class*
Specifies the name of the storage class to be used when the VSAM LDS is defined.

-catalog *catalog*
Specifies the name of the catalog in which the VSAM Linear Data Set is to be defined.

-system *system name*
Specifies the name of the system that the define request will be sent to.

-model *model* **[***catalog***]**
Specifies the name of the model and optionally, the model entry's catalog to be used when the VSAM LDS is defined.

-volumes *volume*
Specifies the volume(s) on which the VSAM LDS may have space.

-cylinders *primary* **[***secondary***]**
Specifies the primary and optionally, the secondary allocation size for the VSAM LDS in cylinders. The VSAM Linear Data Set must have a secondary allocation size specified, if you want to use dynamic grow. See "Dynamically growing a compatibility mode aggregate" on page 13 or "Dynamically growing a multi-file system aggregate" on page 31 for additional information.

-kilobytes *primary* **[***secondary***]**
Specifies the primary and optionally, the secondary allocation size for the VSAM LDS in kilobytes. The VSAM Linear Data Set must have a secondary allocation size specified, if you want to use dynamic grow. See "Dynamically growing a compatibility mode aggregate" on page 13 or "Dynamically growing a multi-file system aggregate" on page 31 for additional information.

-megabytes *primary* **[***secondary***]**
Specifies the primary and optionally, the secondary allocation size for the VSAM LDS in megabytes. The VSAM Linear Data Set must have a secondary allocation size specified, if

you want to use dynamic grow. See “Dynamically growing a compatibility mode aggregate” on page 13 or “Dynamically growing a multi-file system aggregate” on page 31 for additional information.

-records *primary* **[***secondary***]**
Specifies the primary and optionally, the secondary allocation size for the VSAM LDS in records. When **records** is specified, the record size is assumed to be 4089 bytes. The VSAM Linear Data Set must have a secondary allocation size specified, if you want to use dynamic grow. See “Dynamically growing a compatibility mode aggregate” on page 13 or “Dynamically growing a multi-file system aggregate” on page 31 for additional information.

-tracks *primary* **[***secondary***]**
Specifies the primary and optionally, the secondary allocation size for the VSAM LDS in tracks. The VSAM Linear Data Set must have a secondary allocation size specified, if you want to use dynamic grow. See “Dynamically growing a compatibility mode aggregate” on page 13 or “Dynamically growing a multi-file system aggregate” on page 31 for additional information.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm define** command defines a VSAM LDS. The VSAM LDS is available to be formatted as a zFS aggregate. The command creates a DEFINE CLUSTER command string for a VSAM LDS with SHAREOPTIONS(3) and passes it to the IDCAMS utility. If a failure occurs, the **zfsadm define** command may display additional messages from IDCAMS indicating the reason for the failure.

Privilege Required

The issuer of the **zfsadm define** command requires sufficient authority to create the VSAM LDS.

Examples

The following command defines a VSAM LDS.

```
zfsadm define -aggregate omvs.prv.aggr001.lds0001 -volumes prv000 prv001 -cylinders 10 5
```

Related Information

Commands:

zfsadm format

zfsadm delete

Purpose

Removes a file system. This is for deleting a backup file system in a compatibility mode aggregate (sometimes referred to as unclone) or for deleting file systems in a multi-file system aggregate.

Format

zfsadm delete -filesystem *name* **[-aggregate** *name***] [-level] [-help]**

Options

-filesystem *name*
: Specifies the name of the read-write or backup file system to be removed. Include the **.bak** extension if specifying the name of a backup file system. The file system name is case sensitive.

-aggregate *name*
: Specifies the name of the aggregate where the zFS file system name resides. It is specified to qualify the zFS file system name (**-filesystem**) when there are multiple zFS file systems with the same name in different aggregates. The aggregate name is not case sensitive. It is always folded to upper case.

-level
: Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm delete** command removes the read-write or backup zFS file system indicated by the **-filesystem** option from its aggregate. The aggregate containing the file system to be deleted must be attached. Read-write file systems and backup file systems are related during removal as follows:

- Removing a read-write file system automatically removes its associated backup version (if the backup version exists).
- Removing a backup file system does not remove the read-write file system.

File/directory operations against a mounted read-write file system are suspended during the delete of the backup file system. If the delete of a backup operation takes longer than approximately 30 seconds, message IOEZ00588E is displayed on the operator console. The message is deleted (DOMed) when there are no clone delete operations in progress. You can determine if a delete of a clone operation is in progress on an aggregate by using the **zfsadm lsfs -long** command, which shows the delete in progress for the backup file system.

If the zFS file system to be removed is also mounted, you must unmount it before you delete it. The **zfsadm delete** command cannot be used to delete a file system that is mounted. You can delete a compatibility mode file system (and its aggregate) by using the IDCAMS DELETE operation. This deletes the VSAM Linear Data Set. For more information on renaming or deleting a compatibility mode aggregate, see “Renaming or deleting a compatibility mode aggregate” on page 15.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are instead using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command deletes the read-write file system named **OMVS.USER.PAT** and its backup version (if it exists) from its aggregate:

```
zfsadm delete OMVS.USER.PAT
```

```
IOEZ00105I File system OMVS.USER.PAT deleted successfully
```

Related Information

Commands:

- **zfsadm clone**
- **zfsadm create**
- **zfsadm lsfs**

File:

- **IOEFSPRM**

zfsadm detach

Purpose

Detaches one or more aggregates from zFS. This makes any file systems contained in the aggregate unavailable to zFS. This is for multi-file system aggregates only.

Format

| **zfsadm detach [{-aggregate** *aggregate name*| **-all [-system** *system name*]}] **[-level] [-help]**

Options

-all Specifies that all attached aggregates in the sysplex are to be detached. Use this option or use **-aggregate** but not both.

| **-aggregate** *aggregate name*
| Specifies the aggregate name of the aggregate to be detached. Use this option or use **-all**, but not both. The aggregate name is not case sensitive. It is always translated to upper case.

| **-system** *system name*
| Specifies the name of the system where the aggregates to be detached reside. It cannot be specified without the -all option.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm detach** command is used to detach an aggregate. Detaching an aggregate makes it unavailable to the system. To detach one or more aggregates, use the **-all** or the **-aggregate** option to specify the aggregates to be detached. Use the **-system** option to limit the detach to a single system.

Before detaching an aggregate, all file systems in the aggregate must be unmounted. Therefore, **zfsadm**
| **detach -all** will not detach compatibility mode aggregates. The **-system** option cannot be specified without
| the -all option.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be logged in as **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following is an example of a **zfsadm detach** command that detaches the aggregate OMVS.PRV.AGGR001.LDS0001.

```
zfsadm detach -aggregate omvs.prv.aggr001.lds0001

IOEZ00122I Aggregate OMVS.PRV.AGGR001.LDS0001 detached successfully
```

Related Information

Commands:

zfsadm attach

zfsadm detach

Files:
IOEFSPRM

zfsadm format

Purpose

Formats a VSAM Linear Data Set (VSAM LDS) as a zFS aggregate.

Format

```
zfsadm format -aggregate name [-initialempty blocks] [-size blocks] [-logsize blocks]
                              [-owner {uid | name}] [-group {gid | name}]
                              [-perms decimal | octal | hex_number] [-grow blocks]
                              [-system system name] [-compat] [-overwrite] [-level] [-help]
```

Options

-aggregate *name*

Specifies the aggregate name of the aggregate to be formatted. This will be the name of the zFS aggregate that is formatted. The aggregate name is not case sensitive. It is translated to upper case.

-initialempty *blocks*

Specifies the number of 8K blocks that will be left empty at the beginning of the aggregate. The default is 1. If you specify 0, you will get 1 block. This option is not normally specified.

-size *blocks* Specifies the number of 8K blocks that should be formatted to form the zFS aggregate. The default is the number of blocks that will fit in the primary allocation of the VSAM LDS. If a number less than the default is specified, it is rounded up to the default. If a number greater than the default is specified, a single extend of the VSAM LDS is attempted after the primary allocation is formatted unless the **-grow** option is specified. In that case, multiple extensions of the amount specified in the **-grow** option will be attempted until the **-size** is satisfied. Space must be available on the volume(s).

-logsize *blocks*

Specifies the number of 8K blocks reserved for the aggregate log. The default is 1% of the aggregate size or 128 megabytes, whichever is smaller. This is normally sufficient. However, a small aggregate that is grown to be very large will still have a small log. You might want to specify a larger log if you expect the aggregate to grow very large.

-owner {*uid* **|** *name***}**

Specifies the owner of the root directory of the file system. This is used with the **-compat** option, otherwise it is ignored. It may be specified as a z/OS user ID or as a uid. The default is the uid of the issuer of the **zfsadm format** command.

-group {*gid* **|** *name***}**

Specifies the group owner of the root directory of the file system. This is used with the **-compat** option, otherwise it is ignored. It may be specified as a z/OS group ID or as a gid. The default is the gid of the issuer of the **zfsadm format** command. If only owner is specified, the group is that owner's default group.

-perms *number*

Specifies the permissions of the root directory of the file system. This is used with the **-compat** option, otherwise it is ignored. It may be specified as an octal number (for example, o755), as a hexadecimal number (for example, x1ED), or as a decimal number (for example, 493). The default is o755 (owner read/write/execute, group read/execute, and other read/execute.

-grow *blocks* Specifies the number of 8K blocks that zFS will use as the increment for extension when the **-size** option specifies a size greater than the primary allocation.

-system *system name*
Specifies the system that the format request will be sent to.

-compat Specifies that the zFS aggregate should be formatted as a compatibility mode aggregate. That is, it should be formatted as an aggregate and then a zFS file system should be created in the aggregate. The zFS file system will have the same name as the aggregate.

-overwrite Specifies that an existing zFS aggregate should be overlaid. All existing data will be lost. Use this option with caution. This option is not usually specified.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm format** command formats a VSAM LDS as a zFS aggregate. All zFS aggregates must be formatted before use (including HFS compatibility mode aggregates). The **zfsadm format** command requires the ZFS PFS to be active on the system. The size of the aggregate is as many 8K blocks as fits in the primary allocation of the VSAM LDS or as specified in the **-size** option. To extend it, use the **zfsadm grow** command. If **-overwrite** is specified, all existing primary and secondary allocations are formatted and the size includes all of that space.

Privilege Required

The issuer of the **zfsadm format** command must have ALTER authority to the VSAM LDS and must be UID 0 or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command formats the VSAM LDS as a compatibility mode aggregate.

```
zfsadm format -aggregate omvs.prev.aggr001.lds0001 -compat -owner usera -group audit -perms o750
```

Related Information

Commands:
zfsadm define

Files:
IOEFSPRM

zfsadm grow

Purpose

Makes the physical size of an aggregate larger.

Format

zfsadm grow -aggregate *name* **-size** ***kbytes*** **[-level] [-help]**

Options

-aggregate *name*
: Specifies the aggregate name of the aggregate to be grown. The aggregate name is not case sensitive. It is always translated to upper case.

-size *kbytes*
: Specifies the new total size in kilobytes of the aggregate after the grow operation. The size is rounded up to a control area (CA)[3] boundary. If zero is specified, the secondary allocation size will be used.

-level
: Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm grow** command attempts to extend the size of an aggregate when the size specified is greater than the current size of the aggregate or when the size is specified as zero. If the extend fails (for example, if there is no space on the volume(s), or if size zero is specified and there is no secondary allocation specified for the VSAM Linear Data Set), the grow operation fails. If the size specified is less than or equal to the current size of the aggregate, no extend is attempted and the command successfully returns. An aggregate cannot be made smaller than its current size. In any case, if the aggregate's high used value is less than the aggregate's high allocated value, the aggregate will be formatted up to the high allocated value (making the high used value equal to the high allocated value). The current (formatted) size of an aggregate can be determined by using the **zfsadm aggrinfo** command. The high used value (HI-U-RBA) and the high allocated value (HI-A-RBA) can be determined by using the **IDCAMS LISTCAT ALL** command.

For a compatibility mode aggregate, the size of the file system quota will be increased by the amount of additional space available. For a multi-file system aggregate, the size of the file system quotas is not changed.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be logged in as **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command displays the online help entry for the **zfsadm grow** command:

3. A Control Area is normally a cylinder or less and is based on the primary and secondary allocation units. Refer to *z/OS DFSMS Using Data Sets* for more information on allocation size.

zfsadm grow

```
zfsadm grow -help

Usage: zfsadm grow -aggregate <name> -size <size in K bytes> [-level] [-help]
```

Related Information

Command:

zfsadm aggrinfo

zfsadm help

Purpose

Shows syntax of specified **zfsadm** commands or lists functional descriptions of all **zfsadm** commands.

Format

zfsadm help [-topic *command*...**] [-level] [-help]**

Options

-topic *command*
: Specifies each command whose syntax is to be displayed. Provide only the second part of the command name (for example, **lsfs**, not **zfsadm lsfs**). Multiple topic strings can be specified. If this option is omitted, the output provides a short description of all **zfsadm** commands.

-level
: Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm help** command displays the first line (name and short description) of the online help entry for every **zfsadm** command if **-topic** is not provided. For each command name specified with **-topic**, the output lists the entire help entry.

The online help entry for each **zfsadm** command consists of the following two lines:
- The first line names the command and briefly describes its function.
- The second line, which begins with `Usage:`, lists the command options in the prescribed order.

Use the **zfsadm apropos** command to show each help entry containing a specified string.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The following command displays the online help entry for the **zfsadm lsfs** command and the **zfsadm lsaggr** command:

```
zfsadm help -topic lsfs lsaggr
```

```
zfsadm lsfs: list filesystem information
Usage: zfsadm lsfs [-aggregate <aggregate name>] [{-fast | -long}] [-level] [-help]
zfsadm lsaggr: list aggregates
Usage: zfsadm lsaggr [-level] [-help]
```

Related Information

Command:
zfsadm apropos

zfsadm lsaggr

Purpose

Lists all currently attached aggregates for zFS.

Format

zfsadm lsaggr [-system *system name*] **[-level] [-help]**

Options

-system *system name*
: Specifies the name of the system that owns the attached aggregates to be displayed.

-level
: Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm lsaggr** command displays information about all attached aggregates.

This command displays a separate line for each aggregate. Each line displays the following information:

- The aggregate name
- The name of the system that is the zFS owner of the aggregate. If the aggregate is unowned, `*UNOWNED` is displayed.
- The mode of the aggregate
- The status of the aggregate (for example, QUIESCED and/or DISABLED).

You can use the **zfsadm aggrinfo** command to display information about the amount of disk space available on a specific aggregate or on all aggregates on a system.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The following example shows that five aggregates are attached to the system (or the entire sysplex when all systems are running z/OS V1R7 and above):

```
zfsadm lsaggr
OMVS.PRV.AGGR004.LDS0004                    JS000END    R/W
OMVS.PRV.AGGR003.LDS0002                    JS000END    R/O
OMVS.PRV.AGGR003.LDS0001                    JS000END    R/W
OMVS.PRV.AGGR002.LDS0002                    JS000END    R/W
OMVS.PRV.AGGR001.LDS0001                    JS000END    R/W
```

Related Information

Command:

zfsadm aggrinfo

File:

IOEFSPRM

zfsadm lsfs

Purpose

Lists all the file systems on a given aggregate or all attached aggregates.

Format

zfsadm lsfs [-aggregate *name*| **-system** *system name*] **[-fast** | **-long] [-level] [-help]**

Options

-aggregate *name*
: Specifies an aggregate name that is used to retrieve file system information. The aggregate name is not case sensitive. It is always translated to upper case. If this option is not specified, the command displays information for all attached aggregates.

-system *system name*
: Specifies the name of the system that owns the aggregates that contain the file systems to be displayed.

-fast
: Causes the output of the command to be shortened to display only the aggregate name if it contains one or more file systems or a message indicating that there are no file systems contained in the aggregate.

-long
: Causes the output of the command to be extended to display the following additional information about space usage in an file system: the allocation limit, the quota limit, the size of the inode table, the number of file requests, the version of the file system, the creation date and time and the last update date and time.

-level
: Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm lsfs** command displays information about file systems in an aggregate. The file systems do not need to be mounted to use this command.

The **zfsadm lsfs** command displays the following information for a specified aggregate or all attached aggregates on a system or all attached aggregates in the sysplex:

- The total number of file systems contained in the aggregate.
- The file system's name (with a **.bak** extension, if appropriate).
- The type (RW for read-write, or BK for backup).
- If it is mounted or not.
- The allocation usage and the quota usage, in kilobytes.
- If the file system is on-line or not.
- If the file system is being cloned or if the backup is being deleted. (This status is shown on the backup file system entry. The read-write file system is indicated as return code EBUSY (114) with reason code EFxx6246.)
- The total number of file systems on-line, off-line, busy, and mounted appear at the end of the output for all file systems. If the file system is being cloned or if the backup is being deleted, the totals only include the backup file system.

If **-fast** is specified, it only displays the file system names. If the file system is being cloned or if the backup is being deleted, the read-write file system is indicated as return code EBUSY (114) with reason code EFxx6246.

If **-long** is specified, the following is displayed:

- The total number of file systems contained in the aggregate.
- The file system's name.
- The file system's ID.
- The type (RW for read-write, or BK for backup).
- If it is mounted or not.
- The state vector of the file system.
- If the file system is on-line or not.
- If the file system is being cloned or if the backup is being deleted. (This status is shown on the backup file system entry. The read-write file system is indicated as return code EBUSY (114) with reason code EFxx6246.)
- The allocation limit and allocation usage.
- The quota limit and quota usage.
- The size of the Filesystem Inode Table and the number of file requests.
- The version of the file system
- The day, date, and time when the file system was created (backed up for a backup file system).
- The day, date, and time when the contents of the file system were last updated (same as the creation time for a backup file system).
- The total number of file systems on-line, off-line, busy and mounted appears at the end of the output for all file systems. If the file system is being cloned or if the backup is being deleted, the totals only include the backup file system.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The following example displays information for the aggregate **OMVS.PRV.AGGR001.LDS0001**:

```
zfsadm lsfs -aggregate omvs.prv.aggr001.lds0001 -long
IOEZ00129I Total of 2 file systems found for aggregate OMVS.PRV.AGGR001.LDS0001
OMVS.PRV.FS1 100000,,5 RW (Not Mounted)      states 0x10010005 On-line
    4294967232 K alloc limit;          9 K alloc usage
         25000 K quota limit;          9 K quota usage
         8 K Filesystem Inode Table    0 file requests

    version 1.4
    Creation Thu Aug  9 17:17:03 2001
    Last Update Thu Aug  9 17:17:03 2001

OMVS.PRV.FS2 100000,,6 RW (Not Mounted)      states 0x10010005 On-line
    4294967232 K alloc limit;          9 K alloc usage
         45000 K quota limit;          9 K quota usage
         8 K Filesystem Inode Table    0 file requests

    version 1.4
    Creation Thu Aug  9 17:26:54 2001
    Last Update Thu Aug  9 17:26:54 2001

Total file systems on-line 2; total off-line 0; total busy 0; total mounted 0
```

Related Information

Commands:

zfsadm create
zfsadm clone

zfsadm lsquota

Purpose

Shows quota information about file systems and aggregates.

Format

zfsadm lsquota {-filesystem *name* **| -mfilesystem** *mount_name***} [-aggregate** *name***] [-level] [-help]**

Options

-filesystem *name*
Specifies the name of the zFS file system about which quota and usage information is to be displayed. The file system name is case sensitive. If it was specified in upper case when the file system was created, it must be specified in upper case here.

-mfilesystem *mount_name*
Specifies the z/OS UNIX file system name of the file system about which quota and usage information is to be displayed. The file system name is case sensitive. If it was specified in upper case when the file system was mounted, it must be specified in upper case here.

-aggregate *name*
Specifies the name of the aggregate where the zFS file system name resides. It is specified to qualify the zFS file system name (**-filesystem**) when there are multiple zFS file systems with the same name in different aggregates. The aggregate name is not case sensitive. It is always folded to upper case.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm lsquota** command displays quota and usage information about a file system. The command also provides usage information on the aggregate in which the file system resides. The file system does not need to be mounted to use this command. The aggregate containing the file system must be attached.

The **zfsadm lsquota** command displays the name of the file system, the quota and the quota used (in kilobytes) of the file system, and the percentage of the quota in use. It also displays the information about the percentage of the aggregate in use, the number of kilobytes in use on the aggregate and the number of available kilobytes on the aggregate in which the file system resides. It also reports that the file system is zFS.

The size of a compatibility mode file system is equal to the size of the aggregate on which it resides. Therefore, the size and usage information displayed for the aggregate in the output of the **zfsadm lsquota** command equals the quota and quota usage information of the file system in the aggregate.

This command displays the following information about each specified file system:

- The name of the file system.
- The quota, in kilobytes, of the file system.
- The number of kilobytes of the quota currently in use on the file system.
- The percentage of the quota currently in use on the file system.
- The percentage of available disk space currently in use on the aggregate on which the file system resides.

- The number of kilobytes of disk space in use on the aggregate and the total number of kilobytes on the aggregate on which the file system resides.
- The file system type of the aggregate (zFS).

If the file system quota usage rises above 90% or the aggregate usage rises above 97%, the appropriate percentage is indicated with << and the message <<**WARNING** is displayed after the aggregate usage information at the end of the output line. (The 90% and the 97% are not related to the **FSFULL** and **AGGRFULL** options on **MOUNT** and in the **IOEFSPRM** file. Those are used to determine when to report to the operator.)

Note: Because each compatibility mode aggregate contains a single file system, the information displayed for a compatibility mode aggregate applies to the single file system it houses.

The **zfsadm aggrinfo** command can be used to display the total disk space on an aggregate and the amount currently available.

Every newly created zFS file system has a quota specification. The **zfsadm setquota** command can be used to increase or decrease the quota of a zFS file system. Because the quota of a zFS file system does not represent the amount of physical data space allocated to the file system, it can be larger than the size of the aggregate on which the file system resides. Similarly, the combined quotas of all file systems on an aggregate can be larger than the size of the aggregate. It cannot be changed to smaller than the usage of the file system.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The command that follows lists quota and usage information for the file system **OMVS.PRV.FS1**. It also displays the size and usage information for the aggregate that contains this file system.

```
zfsadm lsq OMVS.PRV.FS1

Filesys Name          Quota    Used  Percent Used  Aggregate
OMVS.PRV.FS1          25000       9     0     1 = 1891/177992 (zFS)
```

The following command lists quota and usage information for the zFS file system named **OMVS.PRV.AGGR004.LDS0004**, and size and usage information for the aggregate on which the file system resides. The <<**WARNING** message directs the issuer's attention to the fact that the percentage of the quota in use on the indicated file system is above the warning level of 90% or the aggregate usage is above 97%.

```
zfsadm lsq -f OMVS.PRV.AGGR004.LDS0004

Filesys Name              Quota    Used  Percent Used  Aggregate
OMVS.PRV.AGGR004.LDS0004   1300    1266    97<< 100<< = 1412/1412 (zFS)    <<WARNING
```

Related Information

Commands:

zfsadm aggrinfo
zfsadm lsfs
zfsadm setquota

zfsadm lssys

Purpose

Shows the names of the members in a sysplex.

Format

```
zfsadm lssys [-level] [-help]
```

Options

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm lssys** command displays the names of the members in a sysplex.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The command that follows shows the current list of system names in the XCF group for zFS.

```
zfsadm lssys

IOEZ00361I A total of 3 systems are in the XCF group for zFS
DCEIMGVM
DCEIMGVQ
DCEIMGVN
```

Related Information

Commands:

zfsadm lsaggr

zfsadm query

Purpose

Displays internal zFS statistics (counters and timers) maintained in the zFS Physical File System (PFS).

Format

```
zfsadm query [-system system name] [-locking] [-reset] [-storage] [-usercache] [-trancache]
             [-iocounts] [-iobyaggregate] [-iobydasd] [-knpfs] [-metacache]
             [-dircache] [-vnodecache] [-logcache] [-level] [-help]
```

Options

-system *system name*
: Specifies the name of the system the report request will be sent to, to retrieve the data requested.

-locking
: Specifies that the locking statistics report should be displayed.

-reset
: Specifies the report counters should be reset to zero. Should be specified with a report type.

-storage
: Specifies that the storage report should be displayed.

-usercache
: Specifies that the user cache report should be displayed.

-trancache
: Specifies that the transaction cache counters report should be displayed.

-iocounts
: Specifies that the I/O count report should be displayed.

-iobyaggregate
: Specifies that the I/O count by aggregate report should be displayed.

-iobydasd
: Specifies that the I/O count by Direct Access Storage Device (DASD) report should be displayed.

-knpfs
: Specifies that the kernel counters report should be displayed.

-metacache
: Specifies that the metadata cache counters report should be displayed.

-dircache
: Specifies that the directory cache counters report should be displayed.

-vnodecache
: Specifies that the vnode cache counters report should be displayed.

-logcache
: Specifies that the log cache counters report should be displayed.

-level
: Prints the level of the zfsadm command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help
: Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm query** command is used to display performance statistics maintained by the zFS Physical File System.

Privilege Required

If you are using an **IOEFSPRM** file in your ZFS PROC, the issuer must have READ authority to the data set that contains the IOEFSPRM file. If you are using parmlib (IOEPRMxx), the issuer does not need special authorization.

Examples

The following example is one of the queries that displays performance statistics.

```
zfsadm query -iobyaggr
                    zFS I/O by Currently Attached Aggregate
DASD   PAV
VOLSER IOs Mode  Reads       K bytes     Writes      K bytes     Dataset Name
------ --- ----  ----------  ----------  ----------  ----------  ------------
CFC000   1  R/W           13          92        7641       30564  PLEX.JMS.AGGR001.LDS0001
CFC000   1  R/O            9          60           0           0  PLEX.JMS.AGGR002.LDS0002
CFC000   1  R/W           26         188        4483       17952  PLEX.JMS.AGGR004.LDS0004
------ --- ----  ----------  ----------  ----------  ----------  ------------
     3                   48         340       12124       48516  *TOTALS*

Total number of waits for I/O:         52
Average I/O wait time:                 3.886 (msecs)
```

Related Information

Commands:

zfsadm lsaggr

zfsadm quiesce

Purpose

Specifies that an aggregate and all the file systems contained in it should be quiesced.

Format

zfsadm quiesce {-all | -aggregate *name***} [-level] [-help]**

Options

-all Specifies that all attached aggregates are to be quiesced. Use this option or use **-aggregate**.

-aggregate *name*
Specifies the name of the aggregate that is to be quiesced. The aggregate name is not case sensitive. It is always translated to upper case. An aggregate must be attached to be quiesced. All current activity against the aggregate is allowed to complete but no new activity is started. Any mounted file systems are quiesced.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm quiesce** command is used to temporarily drain activity to the aggregate. During this time:

- No file systems in the aggregate can be created, deleted, renamed, or cloned.
- No quotas for file systems contained in the aggregate can be modified.
- The aggregate cannot be detached, or grown
- No activity can occur against mounted file systems.
- If a quiesced compatibility mode file system is unmounted, zFS will indicate success. (The aggregate is detached when the unquiesce is issued.)

The aggregate can be the target of **lsaggr**, **aggrinfo**, **lsfs** (file systems are indicated as busy). While at least one aggregate remains quiesced, message IOEZ00581E is displayed on the zFS owning system's console.

The aggregate would normally be quiesced prior to backing up the aggregate. After the backup is complete, the aggregate can be unquiesced.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be logged in as **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command quiesces the aggregate **OMVS.PRV.AGGR001.LDS0001**.

```
zfsadm quiesce -aggregate omvs.prv.aggr001.lds0001

IOEZ00163I Aggregate OMVS.PRV.AGGR001.LDS0001 successfully quiesced
```

Related Information

Commands:

zfsadm unquiesce

zfsadm rename

Purpose

Renames a file system. This is for multi-file system aggregates only. If you want to rename a compatibility mode aggregate see “Renaming or deleting a compatibility mode aggregate” on page 15.

Format

zfsadm rename -oldname *oldname* **-newname** *newname* **[-aggregate** *name***][-level] [-help]**

Options

-oldname *oldname*

Specifies the current zFS file system name of the read-write file system. It is case sensitive.

-newname *newname*

Specifies the new zFS file system name for the read-write file system. The name must be unique within the aggregate and it should be indicative of the file system's contents. The following characters can be included in the name of a file system:

- All uppercase and lowercase alphabetic characters (a to z, A to Z)
- All numerals (0 to 9)
- The . (period)
- The - (dash)
- The _ (underscore)
- The @ (at sign)
- The # (number sign)
- The $ (dollar).

The name can be no longer than 44 characters. This length includes the **.bak** extension, which is added automatically when a read-only or backup version of the file system is created. If you intend to clone this file system, you may want to limit the file system name to 40 characters. Note that the **.bak** extensions are reserved for use with backup zFS file systems, so you cannot specify a file system name that ends with that extension.

Note: The file system name is case sensitive. That is, if you specify the file system name in lower case as the **-newname** on the **zfsadm rename** command, you must specify the file system name in lower case when you mount it. The TSO/E MOUNT command translates the file system name to upper case even if it is within quotes. It is not translated to upper case if you specify the file system name on the TSO/E MOUNT command within triple quotes. For example, you can specify FILESYSTEM('''lower.case.example''') and the file system name is not translated to upper case. However, you may find it simpler to specify the file system name in upper case on the **zfsadm rename** command.

-aggregate *name*

Specifies the name of the aggregate where the zFS file system name resides. It is specified to qualify the zFS file system name (**-oldname**) when there are multiple zFS file systems with the same name in different aggregates. The aggregate name is not case sensitive. It is always folded to upper case.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm rename** command changes the name of the read-write file system specified with **-oldname** to the name specified with **-newname**. The name of the read-write file system's backup copy, if any, automatically changes to match. The aggregate that the file system is contained in must be attached. The file system cannot be mounted.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be logged in as **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command changes the file system name **OMVS.PRV.FS2** to the file system name **OMVS.PRV.FS9**:

```
zfsadm rename -oldname OMVS.PRV.FS2 -newname OMVS.PRV.FS9

IOEZ00108I File system OMVS.PRV.FS2 renamed to OMVS.PRV.FS9
IOEZ00108I File system OMVS.PRV.FS2.bak renamed to OMVS.PRV.FS9.bak
```

Related Information

Commands:

- **zfsadm create**
- **zfsadm clone**

zfsadm setquota

Purpose

Sets the quota for a filesystem. This is for multi-file system aggregates only.

Format

```
zfsadm setquota {-filesystem name | -mfilesystem mount_name} -size kbytes [ -aggregate name]
                [-level] [-help]
```

Options

-filesystem *name*
Specifies the file system name of the read-write file system whose quota is to be set. The file system name is case sensitive.

-mfilesystem *mount_name*
Specifies the z/OS UNIX file system name of the file system which the quota is to be set. The file system name is case sensitive. If it was specified in upper case when the file system was created, it must be specified in upper case here.

-size *kbytes* Specifies the maximum amount of disk space that all of the files and directories in the read-write file system can occupy. This includes files and directories in the read-write version of the file system that are actually pointers to disk blocks in the backup version of the file system. Specify the value in 1-kilobyte blocks. (A value of 1024 kilobytes is 1 megabyte.) The minimum specification is 128 (that is, 128K bytes).

-aggregate *name*
Specifies the name of the aggregate where the zFS file system name resides. It is specified to qualify the zFS file system name (**-filesystem**) when there are multiple zFS file systems with the same name in different aggregates. The aggregate name is not case sensitive. It is always folded to upper case.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm setquota** command sets the quota limit for a read-write zFS file system. (It cannot be used to set the quota for a non-zFS file system or for a backup zFS file system.) The file system whose quota is to be set is indicated by specifying the file system name with the **-filesystem** option.

Quota refers to the amount of disk space occupied by all of the files and directories in the read-write version of the file system. This includes files and directories in the read-write version of the file system that are actually pointers to disk blocks in the backup version of the file system. Do not confuse quota with allocation; the latter identifies the amount of disk space occupied by the data that a file system actually houses; excluding those files and directories that are pointers to disk blocks in the backup version of the file system.

This command increases or decreases a file system's quota to be the number of kilobytes specified with the **-size** option. Because it does not represent the amount of physical data the file system contains, a file system's quota can be larger than the size of the aggregate on which it resides. Similarly, the sum of the quotas of all file systems on an aggregate can exceed the size of the aggregate.

The **zfsadm lsfs** and **zfsadm lsquota** commands display, among other things, the current quota for a file system.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be logged in as **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command sets the quota for the file system named **OMVS.PRV.FS1** to be 15,000 kilobytes:

```
zfsadm setquota -filesystem OMVS.PRV.FS1 -size 15000

zfsadm lsquota OMVS.PRV.FS1

Filesys Name          Quota    Used  Percent Used  Aggregate
OMVS.PRV.FS1          15000       9     0     1 = 1907/177992 (zFS)
```

Related Information

Commands:

- **zfsadm lsfs**
- **zfsadm lsquota**

zfsadm unquiesce

Purpose

Makes an aggregate (and all the file systems contained in the aggregate) available to be accessed.

Format

zfsadm unquiesce {-all | -aggregate *name***} [-level] [-help]**

Options

-all Specifies that all attached aggregates are to be unquiesced. Use this option or use **-aggregate**.

-aggregate *name*
Specifies the name of the aggregate that is to be unquiesced. The aggregate name is not case sensitive. It is always translated to upper case. An aggregate must be attached to be unquiesced. All current activity against the aggregate is allowed to resume. Any mounted file systems are unquiesced.

-level Prints the level of the **zfsadm** command. This is useful when you are diagnosing a problem. All other valid options specified with this option are ignored.

-help Prints the online help for this command. All other valid options specified with this option are ignored.

Usage

The **zfsadm unquiesce** command allows activity that has been suspended by **zfsadm quiesce**, to be resumed.

The aggregate would normally be quiesced prior to backing up the aggregate. After the backup is complete, the aggregate can be unquiesced.

Privilege Required

The issuer must have READ authority to the data set that contains the **IOEFSPRM** file and must be logged in as **root** or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class. If you are not using **IOEFSPRM** but instead, you are using parmlib (IOEPRMxx), the issuer is required to be logged in as **root** or to have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Examples

The following command unquiesces the aggregate **OMVS.PRV.AGGR001.LDS0001**.

```
zfsadm unquiesce -aggregate omvs.prv.aggr001.lds0001

IOEZ00166I Aggregate OMVS.PRV.AGGR001.LDS0001 successfully unquiesced
```

Related Information

Command:
zfsadm quiesce

Chapter 12. zFS data sets

The following data sets are used during zFS processing.

IOEFSPRM

Purpose

This file lists the processing options for the ZFS PFS and the definitions of the multi-file system aggregates. There is no mandatory information in this file, therefore it is not required. The options all have defaults. Aggregates can all be compatibility mode aggregates (which do not need definitions). Multi-file system aggregates can be attached by using the **zfsadm attach** command. They do not need definitions in IOEFSPRM to be attached using **zfsadm attach**. However, if you need to specify any options (for tuning purposes, for example) or if you want to have any multi-file system aggregates automatically attached when ZFS is started, you need to have an IOEFSPRM file.

The location of the IOEFSPRM file is specified by the IOEZPRM DD statement in the ZFS PROC. The IOEFSPRM file is normally a PDS member, so the IOEZPRM DD might look like the following:

```
//IOEZPRM  DD  DSN=SYS4.PVT.PARMLIB(IOEFSPRM),DISP=SHR
```

If you need to have separate IOEFSPRM files and you want to share the ZFS PROC in a sysplex, you can use a system variable in the ZFS PROC so that it points to different IOEFSPRM files. The IOEZPRM DD might look like the following:

```
//IOEZPRM  DD  DSN=SYS4.PVT.&SYSNAME..PARMLIB(IOEFSPRM),DISP=SHR
```

Your IOEFSPRM file might reside in SYS4.PVT.SY1.PARMLIB(IOEFSPRM) on system SY1; in SYS4.PVT.SY2.PARMLIB(IOEFSPRM) on system SY2; and others.

If you want to share a single **IOEFSPRM** file, you can use system symbols in data set names in the **IOEFSPRM** file. For example, **msg_output_dsn=USERA.&SYSNAME..ZFS.MSGOUT** would result in USERA.SY1.ZFS.MSGOUT on system SY1 and **define_aggr cluster(USERA.&SYSNAME..AGGR001)** would result in **define_aggr cluster(USERA.SY1.AGGR001)** on system SY1. Each system has a single (possibly shared) **IOEFSPRM** file.

Any line beginning with # or * is considered a comment. The text in the IOEFSPRM file is case insensitive. Any option or value can be upper or lower case. Blank lines are allowed. You should not have any sequence numbers in the IOEFSPRM file. If you specify an invalid text value, the default value will be assigned. If you specify an invalid numeric value, and it is smaller than the minimum allowed value, the minimum value will be assigned. If you specify an invalid numeric value, and it is larger than the maximum allowed value, the maximum value will be assigned.

Using PARMLIB (IOEPRMxx)

As an alternative to the IOEZPRM DDNAME specification, the **IOEFSPRM** member can be specified as a true PARMLIB member. In this case, the member has the name IOEPRMxx, where xx is specified in the parmlib member list.

When the **IOEFSPRM** is specified in the IOEZPRM DD statement of the ZFS PROC, there can only be one IOEFSPRM file for each member of a sysplex. Using PARMLIB, zFS configuration options can be specified in a list of configuration parm files. This allows an installation to specify configuration options that are common among all members of the sysplex (for example, adm_threads) in a shared IOEPRMxx member and configuration options that are system specific (for example, define_aggr) in a separate, system specific IOEPRMxx member. If a configuration option is specified more than once, the first one found is taken. For more information about PARMLIB, see *z/OS MVS Initialization and Tuning Reference*.

The yy's are specified in the PARM option of the FILESYSTYPE statement for ZFS (in the BPXPRMxx). The only valid value that can be specified on the PARM option for zFS is the parmlib search parameter PRM=. The PARM string is case sensitive. You must enter the string in upper case. For example,

```
FILESYSTYPE TYPE(ZFS) ENTRYPOINT(IOEFSCM)
ASNAME(ZFS,'SUB=MSTR')
PARM('PRM=(01,02,03)')
```

Up to 32 member suffixes may be specified. You can also use any system symbol that resolves to two characters. For example,

```
FILESYSTYPE TYPE(ZFS) ENTRYPOINT(IOEFSCM)
ASNAME(ZFS,'SUB=MSTR')
PARM('PRM=(01,&SYSCLONE.)')
```

If &SYSCLONE.=AB, this specifies that parmlib member IOEPRMAB should be searched after parmlib member IOEPRM01. IOEPRM01 could contain common configuration options and IOEPRMAB could contain configuration options that are specific to system AB. If a parmlib member is not found, the search for the configuration option will continue with the next parmlib member.

If no PRM suffix list is specified (and no IOEZPRM DD is specified in the ZFS PROC), then member IOEPRM00 is read. PARMLIB support is only used when the IOEZPRM DD statement is not specified in the ZFS PROC. When a IOEZPRM DD is specified in the ZFS PROC, the single IOEFSPRM file specified in the DD is used, as previously.

To specify 32 members, type member suffixes up to column 71 and then continue them in column 1 on the next line. For example,

```
                                                                col 72
                                                                   |
                                                                   V
FILESYSTYPE TYPE(ZFS) ENTRYPOINT(IOEFSCM) ASNAME(ZFS,'SUB=MSTR')
               PARM('PRM=(00,01,02,03,04,05,06,07,08,09,10,11,12,13,14,
15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31)')
^
|
col 1
```

Coexistence between IOEFSPRM and IOEPRMxx

| The FILESYSTYPE PARM PRM specification is ignored in releases prior to z/OS V1R6. Therefore, if you
| specify it in a BPXPRMxx member that is shared between z/OS V1R6 and previous releases (and no
| IOEZPRM DD is specified in the ZFS PROC), the PRM specification is honored in z/OS V1R6 but is
| ignored in previous releases. This means that the IOEPRMxx members are searched for zFS configuration
| parameters in z/OS V1R6, but defaults are taken in previous releases. Also, if the ZFS FILESYSTYPE
| PARM has no PRM specification (and no IOEZPRM DD is specified in the ZFS PROC), then ZFS attempts
| to use the IOEPRM00 member in z/OS V1R6, but takes defaults in the previous releases. If IOEPRM00 is
| not found, then defaults are used.

Usage

The following options are used as processing options for the ZFS PFS:

adm_threads

Specifies the number of threads defined to handle pfsctl or mount requests.

Default Value	10
Expected Value	A number in the range of 1 - 256.
Example	`adm_threads=5`

aggrfull

Specifies the threshold and increment for reporting aggregate full error messages to the operator.

Default Value	Off
Expected Value	Two numbers in the range of 1 - 99 within parentheses separated by a comma.
Example	`aggrfull(90,5)`

aggrgrow

Specifies whether aggregates can be dynamically extended when they become full. The aggregate (that is, the VSAM Linear Data Set) must have a secondary allocation specified to be dynamically extended and there must be space on the volume(s). This global value can be overridden in the

define_aggr option or the zfsadm attach command for multi-file system aggregates and on the MOUNT command for compatibility mode aggregates.

Default Value Off
Expected Value On or off
Example `aggrgrow=on`

auto_attach

Controls whether aggregates defined and listed in the **IOEFSPRM** file are attached by default when ZFS is started (or restarted). When the value is on, you can add new multi-file system aggregates (with the define_aggr option) to the IOEFSPRM file and they are attached automatically the next time ZFS is started.

Default Value On
Expected Value On or off
Example `auto_attach=on`

dir_cache_size

Specifies the size of the directory buffer cache.

Default Value 32M
Expected Value A number in the range of 2M - 512M
Example `dir_cache_size=32M`

fsfull Specifies the threshold and increment for reporting file system quota full error messages to the operator.

Default Value Off
Expected Value Two numbers in the range of 1 - 99 within parentheses separated by a comma.
Example `fsfull(85,5)`

fsgrow

Specifies whether file systems in multi-file system aggregates can have their quota be dynamically extended when they reach their quota limit. The first number specifies the number of k-bytes that the file system quota should be increased. The second number specifies the number of times the quota should be extended. This global value can be overridden on the MOUNT command for multi-file system aggregates.

Default Value Off
Expected Value Two numbers in the range of 0 - 2147483648, within parentheses and separated by a comma.
Example `fsgrow(100,16)`

group Specifies the XCF group that zFS uses to communicate between sysplex members. The *Expected Value* characters must be acceptable to XCF. Generally, the characters A-Z, 0-9 and the national characters ($, # and @) are acceptable. For more detail, see the **GRPNAME** parameter of the IXCJOIN macro in *z/OS MVS Programming: Sysplex Services Reference*.

Default Value IOEZFS
Expected Value 1 to 8 characters
Example `group=IOEZFS1`

log_cache_size

Specifies the size of the cache used to contain buffers for log file pages. You can also specify a fixed option which indicates that the pages are permanently fixed for performance. Note, the **fixed** option reserves real storage for usage by ZFS only.

Default Value 16M
Expected Value A number in the range of 2M - 1024M. A 'K' or 'M' can be appended to the value to mean kilobytes or megabytes, respectively.
Example `log_cache_size=32M,fixed`

meta_cache_size
Specifies the size of the cache used to contain metadata. You can also specify a fixed option which indicates that the pages are permanently fixed for performance. Note, the **fixed** option reserves real storage for usage by ZFS only.

Default Value	32M
Expected Value	A number in the range of 1M - 1024M. A 'K' or 'M' can be appended to the value to mean kilobytes or megabytes, respectively.
Example	`meta_cache_size=64M,fixed`

metaback_cache_size
Specifies the size of the backing cache used to contain metadata. This resides in a data space and can optionally be used to extend the size of the metadata cache. You can also specify a fixed option which indicates that the pages are permanently fixed for performance. Note, the **fixed** option reserves real storage for usage by ZFS only.

Default Value	None
Expected Value	A number in the range of 1M - 2048M. A 'K' or 'M' can be appended to the value to mean kilobytes or megabytes, respectively.
Example	`metaback_cache_size=64M,fixed`

msg_input_dsn
Specifies the name of a data set containing translated zFS messages. It is specified when the installation uses non-English messages. (When you use English messages, you should not specify this option.) It is read when zFS is started (or restarted). Currently, Japanese messages are supported.

Default Value	None
Expected Value	The name of a data set containing translated zFS messages.
Example	`msg_input_dsn=usera.sioemjpn`

nbs Controls whether new block security is globally on by default or off by default for any aggregate. New block security refers to the guarantee made when a system fails. Refer to "zfsadm attach" on page 82 for an explanation of the **nbs** option.

Default Value	On
Expected Value	On or off
Example	`nbs=on`

recovery_max_storage
Indicates the maximum amount of zFS address space storage to use for concurrent log recovery during multiple concurrent aggregate mounts (attaches). This allows multiple concurrent mounts to occur when sufficient storage is available for multiple concurrent log recovery processing.

Default Value	256M
Expected Value	A number in the range of 128M - 512M.
Example	`recovery_max_storage=128M`

sync_interval
Specifies the number of seconds between syncs.

Default Value	30
Expected Value	A number in the range of 11 - 21474836.
Example	`sync_interval=45`

tran_cache_size
Specifies the initial number of transactions in the transaction cache.

Default Value	2000
Expected Value	A number in the range of 200 - 10000000.
Example	`tran_cache_size=4000`

user_cache_readahead
Specifies whether zFS does read ahead for sequential access. Normally, this should be left on.

Readahead can be disabled for a particular file system that has mostly random access by specifying NOREADAHEAD in the MOUNT PARM.

Default Value On
Expected Value On or off
Example `user_cache_readahead=off`

user_cache_size

Specifies the size, in bytes, of the cache used to contain file data. You can also specify a **fixed** option which indicates that the pages are permanently fixed for performance. Note, the **fixed** option reserves real storage for usage by zFS only.

Default Value 256M
Expected Value A number in the range of 10M - 65536M (64G). A 'K' or 'M' can be appended to the value to mean kilobytes or megabytes.
Example `user_cache_size=64M,fixed`

vnode_cache_size

Specifies the initial number of vnodes that will be cached by zFS. The number of vnodes with vnode extensions will not exceed this number.

Default Value 32768 (will grow if z/OS UNIX needs more than this number)
Expected Value A number in the range 32 to min(500000, vnode_cache_limit)

Note: The vnode_cache_size specification cannot be larger than the vnode_cache_limit. In that case, the vnode_cache_size is set to the vnode_cache_limit.

Example `vnode_cache_size=131072`

vnode_cache_limit

Specifies the maximum number of vnodes that will be cached by zFS. It is related to the vnode_cache_size option which specifies the initial vnode cache size. The vnode cache will start at the vnode_cache_size and potentially grow up to the vnode_cache_limit. This is the maximum number of base vnodes (the vnode without a vnode extension).

Default Value 500000
Expected Value The current vnode_cache_size 32 to 7340032.

Note: The vnode_cache_size specification cannot be larger than the vnode_cache_limit. In that case, the vnode_cache_size is set to the vnode_cache_limit.

Example `vnode_cache_limit=800000`

The following option is used to define multi-file system aggregates so that they are attached at ZFS start (or restart):

define_aggr

Defines a multi-file system aggregate, its corresponding data set name (which is the same as the aggregate name), and any processing suboptions for that aggregate. The **define_aggr** option can be contained on multiple lines and is complete when the next option is encountered or the end of the file is reached. Suboptions include:

aggrfull Specifies the threshold and increment for reporting aggregate full messages for this aggregate to the operator. The default is the global **aggrfull** option (refer to page 127).

aggrgrow or noaggrgrow Indicates whether the multi-file system aggregate should dynamically grow when it runs out of physical space. The aggregate (that is, the VSAM Linear Data Set) must have secondary allocation specified and there must be space on the volume(s). The default is the global **aggrgrow** option (refer to page 127).

attach or noattach Indicates whether this aggregate is attached automatically when ZFS is started (or restarted). Aggregates that are not automatically attached must be attached with the **zfsadm attach** command. The default is the global **auto_attach** option (refer to page 128).

cluster Specifies the VSAM Linear Data Set Cluster name. This is also the aggregate name. This option is required.

nbs or nonbs Indicates if new block security algorithms should be used for this aggregate. The default is the global **nbs** option (refer to page 129).

R/O or R/W **R/O** specifies that the aggregate should be opened in read-only mode. A **R/O** aggregate means that all file systems in the aggregate are read-only and can only be mounted read-only. This allows sharing of an aggregate among multiple systems.
R/W specifies that the aggregate should be opened in read-write mode. **R/W** is the default.

Example

- `define_aggr R/W attach nonbs aggrfull(85,5) aggrgrow cluster(OMVS.PRV.AGGR0001.LDS0001)`

The following options are used during debugging of the ZFS PFS:

debug_settings_dsn
Specifies the name of a data set containing debug classes to enable when zFS starts up. It is read when zFS is started (or restarted).

Default Value	None
Expected Value	The name of a data set containing debug classes to enable.
Example	`debug_settings_dsn=usera.zfs.debug.input(file1)`

msg_output_dsn
Specifies the name of a data set that contains any output messages that come from the ZFS PFS during initialization. Refer to Chapter 9, “Performance and debugging,” on page 35. This is not a required parameter.

Default Value	None
Expected Value	The name of a data set that contains ZFS PFS messages issued.
Example	`msg_output_dsn=usera.zfs.msg.out`

trace_dsn
Contains the output of any operator **MODIFY ZFS,TRACE,PRINT** commands or the trace output if the ZFS PFS abends. Each trace output creates a member in the PDSE. Traces that come from the ZFS PFS kernel have member names of ZFSKNTnn. nn starts with 01 and increments for each trace output. nn is reset to 01 when ZFS is started (or restarted). Refer to Chapter 9, “Performance and debugging,” on page 35. This is not a required parameter.

Default Value	None
Expected Value	The name of a PDSE data set.
Example	`trace_dsn=usera.zfs.trace.out`

trace_table_size
Specifies the size, in bytes, of the internal trace table. This is the size of the wrap-around trace table in the ZFS address space that is used for internal tracing that is always on. The trace can be sent to the **trace_dsn** by using the operator **MODIFY ZFS,TRACE,PRINT** command.

Default Value	16M
Expected Value	A number in the range of 1M - 2048M.
Example	`trace_table_size=1M`

xcf_trace_table_size
Specifies the size of the XCF trace table.

Default Value 4M
Expected Value A number in the range of 1M - 2048M.
Example `xcf_trace_table_size=8M`

The next two options are obsolete in z/OS Version 1 Release 3 and later and are ignored. **storage_details** is always on and output from the MODIFY ZFS,QUERY, STORAGE,DETAILS goes into the system log. **storage_details_dsn** is not used.

storage_details
Indicates whether or not the ZFS internal storage tracking mechanisms are active. The results can be sent to the **storage_details_dsn** with the operator **MODIFY ZFS,QUERY,STORAGE,DETAILS** command.
Default Value Off
Expected Value On or off.
Example `storage_details=on`

storage _details_dsn
Indicates where the storage map is written if **storage_details** is on and the operator **MODIFY ZFS,QUERY,STORAGE,DETAILS** command is run.
Default Value None
Expected Value The name of a data set.
Example `storage_details_dsn=usera.zfs.storage.output(file1)`

Examples

The following IOEFSPRM sample file lists every program option.

```
+ + + + Beginning of sample file + + + +

************************************************************************
* zSeries File System (zFS) Sample Parameter File:  ioefsprm
* For a description of these and other zFS parameters, refer to the
* zSeries File System Administration document.
* Notes:
*  1. The ioefsprm file and parameters in the file are optional but it
*     is recommended that the parameter file be created in order to be
*     referenced by the DDNAME=IOEZPRM statement the PROCLIB JCL for
*     the zFS started task.
*  2. An asterisk in column 1 identifies a comment line.
*  3. A parameter specification must begin in column 1.
************************************************************************
* The following msg_output_dsn parameter defines the optional output
* message data set. If this parameter is not specified, or if the data
* set is not found, messages will be written to the system log.
* You must delete the * from a line to activate the parameter.
************************************************************************
*msg_output_dsn=usera.zfs.msg.out
************************************************************************
* The following msg_input_dsn parameter is ONLY required if the optional
* NLS feature (e.g J0H232J) is installed. The parameter specifies the
* message input data set containing the NLS message text which is
* supplied by the NLS feature. If this parameter is not specified or if
* the data set is not found, English language messages will be generated
* by zFS. You must delete the * from a line to activate the parameter.
************************************************************************
*msg_input_dsn=usera.sioemjpn
************************************************************************
* The following are examples of some of the optional parameters that
* control the sizes of caches, tuning options, and program operation.
* You must delete the * from a line to activate a parameter.
************************************************************************
*adm_threads=5
*aggrfull(90,5)
*aggrgrow=on
```

```
| *dir_cache_size=32M
  *fsfull(85,5)
  *fsgrow(100,16)
  *group=IOEZFS1
  *log_cache_size=32M
  *meta_cache_size=64M
  *metaback_cache_size=64M
  *nbs=on
| *recovery_max_storage=128M
  *sync_interval=45
  *tran_cache_size=4000
  *user_cache_readahead=off
  *user_cache_size=64M
  *vnode_cache_size=131072
  *vnode_cache_limit=800000
  ********************************************************************
  * The following are examples of some of the options that control zFS
  * debug facilities. These parameters are not required for normal
  * operation and should only be specified on the recommendation of IBM.
  * You must delete the * column from a line to activate a parameter.
  ********************************************************************
  *debug_settings_dsn=usera.zfs.debug(file1)
  *trace_dsn=usera.zfs.trace.out
  *trace_table_size=1M
  *xcf_trace_table_size=8M
```

Chapter 13. zFS application programming interfaces

This section contains programming interface information.

This chapter describes the zFS Application Programming Interface (API), **pfsctl** (BPX1PCT). It describes the ZFS commands: ZFSCALL_AGGR (0x40000005), ZFSCALL_FILESYS (0x40000004), ZFSCALL_CONFIG (0x40000006) and ZFSCALL_STATS (0x40000007) and their subcommands. These APIs are used to manage zFS aggregates and file systems and to query and set configuration options.

In z/OS V1R8 and above, the z/OS UNIX pfsctl (command X'C000000B') can also retrieve zFS reason code text. For additional information, see the description of the **PC#ErrorText pfsctl** command in the usage notes for the BPX1PCT service in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

pfsctl (BPX1PCT)

Purpose

The **pfsctl** (BPX1PCT) application programming interface is used to send physical file system specific requests to a physical file system. It is documented in a general manner in the *z/OS UNIX System Services Programming: Assembler Callable Services Reference*. ZFS is a physical file system and supports several (ZFS specific) pfsctl functions. These are documented in this section.

Format

```
BPX1PCT (File_system_type,
         Command,
         Argument_Length,
         Argument,
         Return_value,
         Return_code,
         Reason_code);
```

Parameters

File_system_type
An eight character field. In the case of ZFS, it contains the characters ZFS followed by five blanks.

Command
An integer. There are four major ZFS commands:

- ZFSCALL_AGGR (0x40000005)
- ZFSCALL_FILESYS (0x40000004)
- ZFSCALL_CONFIG (0x40000006)
- ZFSCALL_STATS (0x40000007)

Each of these commands has a set of subcommands. The general format of the **Argument** for all subcommands is:

```
Subcommand operation code     int
Parameter0                    int
Parameter1                    int
Parameter2                    int
Parameter3                    int
Parameter4                    int
Parameter5                    int
Parameter6                    int
Buffer[n]                     char[n]
```

where *n* depends on the particular subcommand.

Argument_Length
An integer that contains the length of the argument.

Argument
A structure that has the pfsctl parameters followed by the subcommand parameters.

The definitions of any structures that have padding bytes added by the compiler, have the padding bytes explicitly declared in the examples.

Return_value
An integer that contains 0 if the request is successful or -1 if it is not successful.

Return_Code
An integer in which the return code is stored. Refer to the *z/OS UNIX System Services Messages and Codes* document for these codes.

Reason_Code
An integer in which the reason code is stored. If this code is of the form 0xEFnnxxxx, refer to the

z/OS Distributed File Service Messages and Codes document. Otherwise, refer to the *z/OS UNIX System Services Messages and Codes* document.

Usage

There are four major commands: ZFSCALL_AGGR (0x40000005) and its subcommands, ZFSCALL_FILESYS (0x40000004) and its subcommands, ZFSCALL_CONFIG (0x40000006) and ZFSCALL_STATS (0x40000007) and its subcommands. zFS pfsctl APIs do not work across sysplex members. zFS pfsctl APIs can query and set information on zFS aggregates owned by the current system only. File system information from other systems will not show up. However, if all systems are running z/OS Version 1 Release 7 and above, zFS pfsctl APIs will work across sysplex members.

Note: In z/OS V1R7 and above, the z/OS UNIX pfsctl (command X'C000000B') can also retrieve zFS reason code text. For additional information, see the description of the **PC#ErrorText pfsctl** command in the usage notes for the BPX1PCT service in *z/OS UNIX System Services Programming: Assembler Callable Services Reference*.

Aggregate commands

The Aggregate command code is ZFSCALL_AGGR (0x40000005). The following subcommands and their subcommand opcodes are supported:

- Attach Aggregate (105)
- Create File System (131)
- Define Aggregate (139)
- Delete File System (136)
- Detach Aggregate (104)
- Format Aggregate (134)
- Grow Aggregate (129)
- List Aggregate Status (137)
- List Aggregate Status (Version 2) (146)
- List Attached Aggregate Names (135)
- List Attached Aggregate Names (Version 2) (140)
- List File System Names (138)
- List File System Names (Version 2) (144)
- Quiesce Aggregate (132)
- Unquiesce Aggregate (133).

File System commands

The File System command code is ZFSCALL_FILESYS (0x40000004). The following subcommands and their subcommand opcodes are supported:

- Clone File System (143)
- List File System Status (142)
- Rename File System (140)
- Set File System Quota (141).

Configuration commands

The Configuration command code is ZFSCALL_CONFIG (0x40000006). The following subcommands and their subcommand opcodes are supported:

- List Systems (174)
- Query adm_threads setting (180)
- Query aggrfull setting (181)
- Query aggrgrow setting (182)
- Query auto_attach setting (183)
- Query cmd_trace (184)
- Query debug_settings_dsn setting (186)
- Query fsfull setting (187)
- Query fsgrow setting (188)
- Query group setting (214)

- Query log_cache_size setting (193)
- Query meta_cache_size setting (198)
- Query metaback_cache_size setting (199)
- Query msg_input_dsn setting (200)
- Query msg_output_dsn setting (201)
- Query nbs setting (202)
- Query sync_interval setting (205)
- Query sysplex_state (215)
- Query trace_dsn setting (206)
- Query trace_table_size setting (207)
- Query tran_cache_size setting (208)
- Query user_cache_readahead setting (209)
- Query user_cache_size setting (210)
- Query vnode_cache_size setting (212)
- Query vnode_cache_limit (227)
- Set adm_threads (150)
- Set aggrfull (158)
- Set aggrgrow (171)
- Set fsfull (157)
- Set fsgrow (172)
- Set log_cache_size (153)
- Set meta_cache_size (152)
- Set metaback_cache_size (163)
- Set msg_output_dsn (161)
- Set nbs (156)
- Set sync_interval (154)
- Set trace_dsn (159)
- Set tran_cache_size (160)
- Set user_cache_readahead (162)
- Set user_cache_size (151)
- Set vnode_cache_size (155)
- Set vnode_cache_limit (226)

Statistics commands

The statistics command code is ZFSCALL_STATS (0x40000007). The following subcommands and their subcommand codes are supported:

- Statistics directory cache information (249)
- Statistics iobyaggr information (244)
- Statistics iobydasd information (245)
- Statistics iocounts information (243)
- Statistics kernel information (246)
- Statistics locking information (240)
- Statistics log cache information (247)
- Statistics metadata cache information (248)
- Statistics storage information (241)
- Statistics transaction cache information (250)
- Statistics user data cache information (242)
- Statistics vnode cache information (251)

Attach Aggregate

Purpose

The Attach Aggregate subcommand call is an aggregate operation that attaches a multi-file system aggregate to a system. This makes the aggregate and all its file systems known to the ZFS Physical File System running on that system.

Format

```
syscall_parmlist
   opcode                         105      AGOP_ATTACH_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       offset to AGGR_ATTACH
   parms[2]                       offset to system name (optional)
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0
AGGR_ATTACH
   at_eye                         char[4]    "AGAT"
   at_len                         short      sizeof(AGGR_ATTACH)
   at_ver                         char       1
   at_res1                        int        0
   at_threshold                   char       90
   at_increment                   char       5
   at_flags                       char       0x80
     ATT_MONITOR                    0x80    Monitor aggregate full
     ATT_RO                         0x40    Attach aggregate as read-only
     ATT_NBS                        0x20    Use New Block Security
     ATT_NONBS                      0x10    Do not use new block security
     ATT_GROW                       0x04    Allow dynamic grow
     ATT_NOGROW                     0x02    Disallow dynamic grow
   at_res2                        char       0
   at_reserved                    int[64]    0
systemname                        char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EEXIST        Aggregate already attached
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

This function is used to attach multi-file system aggregates. Compatibility mode aggregates are attached during mount, so a separate attach is not necessary.

ATT_NBS and ATT_NONBS are mutually exclusive. If neither is specified, the default is the **nbs** setting in the **IOEFSPRM** file. Refer to the “zfsadm attach” on page 82 for a description of the **nbs** parameter.

ATT_GROW and ATT_NOGROW are mutually exclusive. If neither is specified, the default is the **aggrgrow** setting in the **IOEFSPRM** file. See “Dynamically growing a compatibility mode aggregate” on page 13 and “Dynamically growing a multi-file system aggregate” on page 31 for a description of dynamic grow.

`at_threshold` and `at_increment` are ignored unless ATT_MONITOR is set.

Reserved fields and undefined flags must be set to binary zeros.

Offset to systemname in parms[2] can be specified in z/OS V1R7 and above. The systemname can only refer to a system running z/OS V1R7 and above.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Delete Aggregate

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_ATTACH_PARMDATA  105

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye Catcher               */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure  */
  char aid_ver;                       /* Version                   */
#define AID_VER_INITIAL 1             /* Initial version           */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* aggr name, null terminated */
  char aid_reserved[33];              /* Reserved for the future   */
} AGGR_ID;

typedef struct aggr_attach_t
{
  char  at_eye[4];                    /* Eye catcher               */
#define AT_EYE "AGAT"
  short at_len;                       /* Length of structure       */
  char  at_ver;                       /* Structure version         */
#define AT_VER_INITIAL  1             /* Version 1                 */
  char  at_res1;                      /* Reserved for internal use */
  char  at_threshold;                 /* Threshold for monitoring  */
  char  at_increment;                 /* Increment                 */
  char  at_flags;                     /* Processing flags          */
```

```
| #define ATT_MONITOR   0x80            /* aggrfull monitoring should */
|                                       /* be used                    */
| #define ATT_RO        0x40            /* aggr should be attached ro */
| #define ATT_NBS       0x20            /* aggr should be attached    */
|                                       /* with full NBS              */
| #define ATT_NONBS     0x10            /* aggr should be attached    */
|                                       /* with no NBS                */
| #define ATT_GROW      0x04            /* allow dynamic grow         */
| #define ATT_NOGROW    0x02            /* disallow dynamic grow      */
|   char  at_res2;                      /* Reserved for future use    */
|   int   at_reserved[64];              /* Reserved for future use    */
| } AGGR_ATTACH;
|
| struct parmstruct
| {
|  syscall_parmlist myparms;
|  AGGR_ID aggr_id;
|  AGGR_ATTACH myaggr;
|  char  systemname[9];                /* System to attach on */
| } ;
|
| int main(int argc, char **argv)
| {
| int bpxrv;
| int bpxrc;
| int bpxrs;
| char aggrname[45] = "PLEX.JMS.AGGR001.LDS0001";   /* aggregate name to attach */
|
| struct parmstruct myparmstruct;
|
| AGGR_ID *idp = &(myparmstruct.aggr_id);
| AGGR_ATTACH *atp = &(myparmstruct.myaggr);
| char *asp = myparmstruct.systemname;
|
| myparmstruct.myparms.opcode = AGOP_ATTACH_PARMDATA;
| myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
| myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
| myparmstruct.myparms.parms[2] = 0;
|
| /* Only specify a non-zero offset for the next field (parms[2]) if           */
| /* you are running z/OS 1.7 and above, and                                   */
| /* you want the owner of the aggregate to be a different system than this one */
| /* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(AGGR_ID) + sizeof(AGGR_ATTACH);*/
|
| myparmstruct.myparms.parms[3] = 0;
| myparmstruct.myparms.parms[4] = 0;
| myparmstruct.myparms.parms[5] = 0;
| myparmstruct.myparms.parms[6] = 0;
|
| memset(idp,0,sizeof(AGGR_ID));                 /* Ensure reserved fields are 0 */
| memset(atp,0,sizeof(AGGR_ATTACH));             /* Ensure reserved fields are 0 */
| memset(asp,0,sizeof(myparmstruct.systemname)); /* Ensure reserved fields are 0 */
|
| memcpy(&myparmstruct.aggr_id.aid_eye,AID_EYE,4);
| myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
| myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
| strcpy(myparmstruct.aggr_id.aid_name,aggrname);
|
| memcpy(&myparmstruct.myaggr.at_eye[0], AT_EYE, 4);
| myparmstruct.myaggr.at_len = sizeof(AGGR_ATTACH);
| myparmstruct.myaggr.at_ver = AT_VER_INITIAL;
| myparmstruct.myaggr.at_threshold = 90;         /* 90 percent threshold */
| myparmstruct.myaggr.at_increment = 5;          /*  5 percent increment */
| myparmstruct.myaggr.at_flags = 0;
| myparmstruct.myaggr.at_flags |= ATT_MONITOR;   /* Use threshold and */
|                                               /* increment         */
| myparmstruct.myaggr.at_flags |= ATT_GROW;      /* allow dynamic growing */
|
| /* This next field should only be set if parms[2] is non-zero */
```

Attach Aggregate

```
| /* strcpy(myparmstruct.systemname,"DCEIMGVQ");  */
|
|      BPX1PCT("ZFS     ",
|              ZFSCALL_AGGR,             /* Aggregate operation     */
|              sizeof(myparmstruct),     /* Length of Argument      */
|              (char *) &myparmstruct,   /* Pointer to Argument     */
|              &bpxrv,                   /* Pointer to Return_value */
|              &bpxrc,                   /* Pointer to Return_code  */
|              &bpxrs);                  /* Pointer to Reason_code  */
|
| if (bpxrv < 0)
|      {
|      printf("Error attaching aggregate %s on system %s\n", aggrname,myparmstruct.systemname);
|      printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
|      return bpxrc;
|      }
|    else /* Return from attach was successful  */
|      {
|      printf("Aggregate %s attached successfully on system %s\n",aggrname,myparmstruct.systemname);
|      }
| return 0;
| }

|
```

Clone File System

Purpose

The Clone File System subcommand call is a file system operation that creates (or replaces) a backup file system from the specified read-write file system. This is referred to as cloning a file system. The backup file system is stored in the same aggregate as the read-write file system.

You can use an FS_ID or an FS_ID2 as input.

Format

```
syscall_parmlist
   opcode                         143      FSOP_CLONE_PARMDATA
   parms[0]                       offset to FS_ID or FS_ID2
   parms[1]                       0
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
FS_ID or FS_ID2
   fsid_eye                       char[4]    "FSID"
   fsid_len                       char       sizeof(FS_ID)
   fsid_ver                       char       1
   fsid_res1                      char       0
   fsid_res2                      char       0
   fsid_id
     high                         unsigned long  0
     low                          unsigned long  0
   fsid_aggrname                  char[45]   0
   fsid_name                      char[45]   "OMVS.PRV.FS3"
   fsid_reserved                  char[32]   0
   fsid_reserved2                 char[2]    0
FS_ID2 or FS_ID
   fsid_eye                       char[4]    "FSID"
   fsid_len                       char       sizeof(FS_ID2)
   fsid_ver                       char       2
   fsid_res1                      char       0
   fsid_res2                      char       0
   fsid_id
     high                         unsigned long  0
     low                          unsigned long  0
   fsid_aggrname                  char[45]   0
   fsid_name                      char[45]   "OMVS.PRV.FS3"
   fsid_mtname                    char[45]   0
   fsid_reserved                  char[49]   0


Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate containing file system is quiesced
  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request
  EROFS         Aggregate is attached as read only

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate containing the read-write file system to be cloned must be attached. The backup file system name is the same as the read-write file system's name with **.bak** appended. After the clone operation, the backup file system can be mounted read-only.

After the backup file system is mounted read-only, users can access this point-in-time copy of the data until the backup file system is deleted or the read-write file system is recloned.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Delete File System

Restrictions

The aggregate cannot be attached as read-only. The file system name of the read-write file system to be cloned must be less than or equal to 40 characters. If the backup file system already exists, it cannot be mounted. The aggregate containing the read-write file system cannot be quiesced.

Examples

Example 1 - Using FS_ID

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_CLONE_PARMDATA  143

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                   /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                      /* Length of this structure */
  char fsid_ver;                      /* Version */
#define FSID_VER_INITIAL 1            /* Initial version            */
  char fsid_res1;                     /* Reserved.                  */
  char fsid_res2;                     /* Reserved.                  */
  hyper fsid_id;                      /* Internal identifier        */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];             /* Reserved for the future  */
```

```
  char fsid_reserved2[2];              /* Reserved for the future  */
} FS_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID fsid;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";

struct parmstruct myparmstruct;

FS_ID *idp = &(myparmstruct.fsid);

myparmstruct.myparms.opcode = FSOP_CLONE_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID);
myparmstruct.fsid.fsid_ver = FSID_VER_INITIAL;
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error cloning file system %s\n",filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from clone file system was successful  */
     {
     printf("File system %s cloned successfully\n",filesystemname);
     }
return 0;
}
```

Example 2 - Using FS_ID2

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_CLONE_PARMDATA  143
```

```
typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
#define FSID_VER_INITIAL 1             /* Initial version            */
  char fsid_res1;                      /* Reserved.                  */
  char fsid_res2;                      /* Reserved.                  */
  hyper fsid_id;                       /* Internal identifier        */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];              /* Reserved for the future  */
  char fsid_reserved2[2];              /* Reserved for the future  */
} FS_ID;

typedef struct fs_id2_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                  */
  char fsid_res2;                      /* Reserved.                  */
  hyper fsid_id;                       /* Internal identifier        */
#define FSID_VER_2       2              /* Second version  */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated     */
  char fsid_reserved[49];              /* Reserved for the future  */
} FS_ID2;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID2 fsid;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";

struct parmstruct myparmstruct;

FS_ID2 *idp = &(myparmstruct.fsid);

myparmstruct.myparms.opcode = FSOP_CLONE_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
```

```
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID2));                   /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID2);
myparmstruct.fsid.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error cloning file system %s\n",filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from clone file system was successful  */
     {
     printf("File system %s cloned successfully\n",filesystemname);
     }
return 0;
}
```

Create File System

Purpose

The Create File System subcommand call is an aggregate operation that creates a new read-write file system in a multi-file system aggregate on a system.

You can use an FS_ID or an FS_ID2 as input.

Format

```
syscall_parmlist
   opcode                        131      AGOP_CREATEFILESYS_PARMDATA
   parms[0]                      offset to FS_ID or FS_ID2
   parms[1]                      offset to FILESYS_DATA
   parms[2]                      0
   parms[3]                      0
   parms[4]                      0
   parms[5]                      0
   parms[6]                      0
FS_ID or FS_ID2
   fsid_eye                      char[4]    "FSID"
   fsid_len                      char       sizeof(FS_ID)
   fsid_ver                      char       1
   fsid_res1                     char       0
   fsid_res2                     char       0
   fsid_id                       hyper
      high                         long     0
      low                          long     0
   fsid_aggrname                 char[45]   "OMVS.PRV.AGGR001.LDS0001"
   fsid_name                     char[45]   "OMVS.PRV.FS3"
   fsid_reserved                 char[32]   0
   fsid_reserved2                char[2]    0
FS_ID2 or FS_ID
   fsid_eye                      char[4]    "FSID"
   fsid_len                      char       sizeof(FS_ID2)
   fsid_ver                      char       2
   fsid_res1                     char       0
   fsid_res2                     char       0
   fsid_id
     high                        unsigned long  0
     low                         unsigned long  0
   fsid_aggrname                 char[45]   0
   fsid_name                     char[45]   "OMVS.PRV.FS3"
   fsid_mtname                   char[45]   0
   fsid_reserved                 char[49]   0
FILESYS_DATA
   fd_eye                        char[4]    "FSDT"
   fd_len                        short      sizeof(FILESYS_DATA)
   fd_ver                        char       1
   fd_flags                      char
     FD_OWNER_SPECIFIED            0x80
     FD_PERMS_SPECIFIED            0x40
   fd_owner                      int        612
   fd_group                      int        10
   fd_perms                      int        0755
   fd_quotah                     short      0
   fd_reserved1                  char[2]    0
   fd_quota                      long       5000
   fd_reserved                   char[64]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code
```

```
  EBUSY         Aggregate containing file system is quiesced
  EXIST         File system already exists
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  EPERM         Permission denied to perform request
  EROFS         Aggregate is attached as read only

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate that is to contain the new read-write file system must be attached. The file system name can be no longer than 44 characters. If this file system is to be cloned, a file system name extension of **.bak** will be added to the end of the read-write file system name to create the backup file system name. If you intend to clone this read-write file system, you may want to limit the read-write file system name to 40 characters.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Clone File System
Delete File System

Restrictions

The aggregate cannot be quiesced or attached as read-only. You cannot create a file system that already exists. You cannot create a file system that ends with **.bak.** The fd_quota must be at least 128 (for 128 K bytes).

Examples

Example 1 - Using FS_ID

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_CREATEFILESYS_PARMDATA  131

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
```

```
  char fsid_eye[4];                     /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                        /* Length of this structure */
  char fsid_ver;                        /* Version */
#define FSID_VER_INITIAL 1              /* Initial version           */
  char fsid_res1;                       /* Reserved.                 */
  char fsid_res2;                       /* Reserved.                 */
  hyper fsid_id;                        /* Internal identifier       */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];               /* Reserved for the future  */
  char fsid_reserved2[2];               /* Reserved for the future  */
} FS_ID;

typedef struct filesys_t {
  char fd_eye[4];                      /* eye catcher               */
#define FD_EYE "FSDT"
  short fd_len;                        /* Length                    */
  char  fd_ver;                        /*                           */
#define FD_VER_INITIAL 1               /* Initial version           */
  char  fd_flags;                      /* Flag bits                 */
#define FD_OWNER_SPECIFIED 0x80        /* Owner & group specified   */
#define FD_PERMS_SPECIFIED 0x40        /* Permissions specified     */
  int   fd_owner;                      /* Owner id for root         */
                                       /* filesystem                */
  int   fd_group;                      /* Group id for root         */
                                       /* filesystem                */
  int   fd_perms;                      /* Permissions for root      */
                                       /* filesystem                */
#define FD_DEFAULT_PERMS 0755          /* Default permissions if not specified  */
  short fd_quotah;                     /* High portion of quota, in  */
                                       /* K bytes                   */
  char  fd_reserved1[2];               /* Reserved bytes            */
  long  fd_quota;                      /* Low portion of quota in   */
                                       /* K bytes                   */
  char  fd_reserved[64];               /* More reserved bytes       */
} FILESYS_DATA;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID fsid;
 FILESYS_DATA myfilesystem;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";

struct parmstruct myparmstruct;

FS_ID *idp = &(myparmstruct.fsid);
FILESYS_DATA *fdp = &(myparmstruct.myfilesystem);

myparmstruct.myparms.opcode = AGOP_CREATEFILESYS_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(FS_ID);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;
```

```
memset(idp,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */
memset(fdp,0,sizeof(FILESYS_DATA));           /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID);
myparmstruct.fsid.fsid_ver = FSID_VER_INITIAL;
strcpy(myparmstruct.fsid.fsid_aggrname,aggrname);
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

memcpy(&myparmstruct.myfilesystem.fd_eye[0], FD_EYE, 4);
myparmstruct.myfilesystem.fd_len = sizeof(FILESYS_DATA);
myparmstruct.myfilesystem.fd_ver = FD_VER_INITIAL;
myparmstruct.myfilesystem.fd_flags = FD_OWNER_SPECIFIED | FD_PERMS_SPECIFIED;
myparmstruct.myfilesystem.fd_owner = 612;
myparmstruct.myfilesystem.fd_group = 10;
myparmstruct.myfilesystem.fd_perms = 0755;        /* permissions (in octal)         */
myparmstruct.myfilesystem.fd_quotah = 0;
myparmstruct.myfilesystem.fd_quota = 5000;        /* Size of file system in K-bytes */

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error creating file system %s in aggregate %s\n",filesystemname,aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from create file system was successful  */
     {
     printf("File system %s in Aggregate %s created successfully\n",filesystemname,aggrname);
     }
return 0;
}
```

Example 2 - Using FS_ID2

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_CREATEFILESYS_PARMDATA  131

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
```

```
#define FSID_EYE "FSID"
  char fsid_len;                        /* Length of this structure */
  char fsid_ver;                        /* Version */
#define FSID_VER_INITIAL 1              /* Initial version            */
  char fsid_res1;                       /* Reserved.                  */
  char fsid_res2;                       /* Reserved.                  */
  hyper fsid_id;                        /* Internal identifier        */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];               /* Reserved for the future  */
  char fsid_reserved2[2];               /* Reserved for the future  */
} FS_ID;

typedef struct fs_id2_t {
  char fsid_eye[4];                     /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                        /* Length of this structure */
  char fsid_ver;                        /* Version */
  char fsid_res1;                       /* Reserved.                  */
  char fsid_res2;                       /* Reserved.                  */
  hyper fsid_id;                        /* Internal identifier        */
#define FSID_VER_2       2              /* Second version  */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated     */
  char fsid_reserved[49];               /* Reserved for the future  */
} FS_ID2;

typedef struct filesys_t {
  char fd_eye[4];                      /* eye catcher               */
#define FD_EYE "FSDT"
  short fd_len;                        /* Length                    */
  char  fd_ver;                        /*                           */
#define FD_VER_INITIAL 1               /* Initial version           */
  char  fd_flags;                      /* Flag bits                 */
#define FD_OWNER_SPECIFIED 0x80        /* Owner & group specified   */
#define FD_PERMS_SPECIFIED 0x40        /* Permissions specified     */
  int   fd_owner;                      /* Owner id for root         */
                                       /* filesystem                */
  int   fd_group;                      /* Group id for root         */
                                       /* filesystem                */
  int   fd_perms;                      /* Permissions for root      */
                                       /* filesystem                */
#define FD_DEFAULT_PERMS 0755          /* Default permissions if not specified  */
  short fd_quotah;                     /* High portion of quota, in  */
                                       /* K bytes                   */
  char  fd_reserved1[2];               /* Reserved bytes            */
  long  fd_quota;                      /* Low portion of quota in   */
                                       /* K bytes                   */
  char  fd_reserved[64];               /* More reserved bytes       */
} FILESYS_DATA;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID2 fsid;
 FILESYS_DATA myfilesystem;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";
```

```
struct parmstruct myparmstruct;

FS_ID2 *idp = &(myparmstruct.fsid);
FILESYS_DATA *fdp = &(myparmstruct.myfilesystem);

myparmstruct.myparms.opcode = AGOP_CREATEFILESYS_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(FS_ID2);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID2));                  /* Ensure reserved fields are 0 */
memset(fdp,0,sizeof(FILESYS_DATA));           /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID2);
myparmstruct.fsid.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fsid.fsid_aggrname,aggrname);
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

memcpy(&myparmstruct.myfilesystem.fd_eye[0], FD_EYE, 4);
myparmstruct.myfilesystem.fd_len = sizeof(FILESYS_DATA);
myparmstruct.myfilesystem.fd_ver = FD_VER_INITIAL;
myparmstruct.myfilesystem.fd_flags = FD_OWNER_SPECIFIED | FD_PERMS_SPECIFIED;
myparmstruct.myfilesystem.fd_owner = 612;
myparmstruct.myfilesystem.fd_group = 10;
myparmstruct.myfilesystem.fd_perms = 0755;        /* permissions (in octal)         */
myparmstruct.myfilesystem.fd_quotah = 0;
myparmstruct.myfilesystem.fd_quota = 5000;        /* Size of file system in K-bytes */

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error creating file system %s in aggregate %s\n",filesystemname,aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from create file system was successful  */
     {
     printf("File system %s in Aggregate %s created successfully\n",filesystemname,aggrname);
     }
return 0;
}
```

Define Aggregate

Purpose

The Define Aggregate subcommand call is an aggregate operation that defines (creates) a VSAM Linear Data Set (VSAM LDS). This VSAM LDS can then be formatted as a zFS aggregate.

Format

```
syscall_parmlist
   opcode                          139      AGOP_DEFINE_PARMDATA
   parms[0]                        offset to AGGR_DEFINE
   parms[1]                        size of Buffer
   parms[2]                        offset to Buffer
   parms[3]                        offset to system name (optional)
   parms[4]                        0
   parms[5]                        0
   parms[6]                        0
AGGR_DEFINE
   an_eye                         char[4]    "AGDF"
   an_len                         char       sizeof(AGGR_DEFINE)
   an_ver                         char       1
   an_aggrName                    char[45]   "OMVS.PRV.AGGR001.LDS0001"
   an_dataClass                   char[9]    0
   an_managementClass             char[9]    0
   an_storageClass                char[9]    0
   an_model                       char[45]   0
   an_modelCatalog                char[45]   0
   an_volumes[59]                 char[7]    "PRV000"
   an_reservedChars1              char       0
   an_numVolumes                  int        1
   an_spaceUnit                   int        1     /* 1 = cylinders */
   an spacePrimary                int        10    /* 10  cylinders */
   an_spaceSecondary              int        1     /*  1  cylinder  */
   an_reservedIntsl               char[32]   0
systemname                        char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameters
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must have sufficient authority to create the VSAM LDS.

Related Services

Format Aggregate

Restrictions

The VSAM LDS to be defined cannot already exist

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_DEFINE_PARMDATA  139

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

#define ZFS_MAX_SMSID 8
#define ZFS_MAX_VOLID 6
typedef struct aggr_define_t
{
  char eye[4];                      /* Eye catcher */
#define ADEF_EYE "AGDF"
  short len;                        /* Length of this structure */
  char ver;                         /* Version */
#define ADEF_VER_INITIAL 1          /* Initial version */
  char aggrName[ZFS_MAX_AGGRNAME+1];
  char dataClass[ZFS_MAX_SMSID+1];
  char managementClass[ZFS_MAX_SMSID+1];
  char storageClass[ZFS_MAX_SMSID+1];
  char model[ZFS_MAX_AGGRNAME+1];
  char modelCatalog[ZFS_MAX_AGGRNAME+1];
  char catalog[ZFS_MAX_AGGRNAME+1];
  char volumes[59][ZFS_MAX_VOLID+1];
  char reservedChars1;
  int  numVolumes;
  int  spaceUnit;
#define ZFS_SPACE_CYLS 1
#define ZFS_SPACE_KILO 2
#define ZFS_SPACE_MEGA 3
#define ZFS_SPACE_RECS 4
#define ZFS_SPACE_TRKS 5
  unsigned int  spacePrimary;
  unsigned int  spaceSecondary;
  int  reservedInts1[32];
} AGGR_DEFINE;

struct parmstruct {
  syscall_parmlist myparms;
  AGGR_DEFINE aggdef;
  char Buffer[1024];
  char systemname[9];
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "PLEX.JMS.AGGR007.LDS0007";   /* aggregate name to define */
char dataclass[9] = "";
```

```
char managementclass[9] = "";
char storageclass[9] = "";
char model[45] = "";
char modelcatalog[45] = "";
char catalog[45] = "";
char volumes[7] = "CFC000";


struct parmstruct myparmstruct;

AGGR_DEFINE *agp  = &(myparmstruct.aggdef);
char        *bufp = &(myparmstruct.Buffer[0]);

/* This next field should only be set if parms[3] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVN"); */     /* set system to run define on */

myparmstruct.myparms.opcode = AGOP_DEFINE_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(myparmstruct.Buffer);
myparmstruct.myparms.parms[2] = myparmstruct.myparms.parms[0]+sizeof(AGGR_DEFINE); /* offset to Buffer */

myparmstruct.myparms.parms[3] = 0;

/* Only specify a non-zero offset for the next field (parms[3]) if            */
/* you are running z/OS 1.7 and above, and                                     */
/* you want the define to run on a different system than this one             */

/* myparmstruct.myparms.parms[3] =                                            */
/* myparmstruct.myparms.parms[0]+sizeof(AGGR_DEFINE)+sizeof(myparmstruct.Buffer); */

myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(agp,0,sizeof(*agp));
strcpy(agp->eye,ADEF_EYE);
agp->ver=ADEF_VER_INITIAL;
agp->len=sizeof(AGGR_DEFINE);

memset(bufp,0,sizeof(myparmstruct.Buffer));

strcpy(agp->aggrName,aggrname);

strcpy(agp->model,model);                         /* If included next 4 can be null */
strcpy(agp->dataClass,modelcatalog);
strcpy(agp->managementClass,managementclass);
strcpy(agp->storageClass,storageclass);
strcpy(agp->modelCatalog,modelcatalog);
strcpy(agp->volumes[0],(char *)volumes);
agp->numVolumes=1;
agp->spaceUnit=ZFS_SPACE_CYLS;
agp->spacePrimary=10;
agp->spaceSecondary=1;

    BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,
             sizeof(myparmstruct),
             (char *) &myparmstruct,
             &bpxrv,
             &bpxrc,
             &bpxrs);
if (bpxrv < 0) {
     printf("define: Error defining LDS %s\n", aggrname);
     printf("define: BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     printf("define: job output:\n\n%s\n",myparmstruct.Buffer);
    return bpxrc;
     }
```

```
else{
     printf("define: LDS %s defined successfully\n",aggrname);
    }
return 0;
}
```

Delete File System

Purpose

The Delete File System subcommand call is an aggregate operation that deletes an existing read-write file system from a multi-file system aggregate on a system. It can also be used to delete an existing backup file system.

You can use an FS_ID or an FS_ID2 as input.

Format

```
syscall_parmlist
   opcode                          136      AGOP_DELETEFILESYS_PARMDATA
   parms[0]                        offset to FS_ID or FS_ID2
   parms[1]                        0
   parms[2]                        0
   parms[3]                        0
   parms[4]                        0
   parms[5]                        0
   parms[6]                        0
FS_ID or FS_ID2
   fsid_eye                        char[4]    "FSID"
   fsid_len                        char       sizeof(FS_ID)
   fsid_ver                        char       1
   fsid_res1                       char       0
   fsid_res2                       char       0
   fsid_id                         hyper
      high                           long     0
      low                            long     0
   fsid_aggrname                   char[45]   0
   fsid_name                       char[45]   "OMVS.PRV.FS3"
   fsid_reserved                   char[32]   0
   fsid_reserved2                  char[2]    0
FS_ID2 or FS_ID
   fsid_eye                        char[4]    "FSID"
   fsid_len                        char       sizeof(FS_ID2)
   fsid_ver                        char       2
   fsid_res1                       char       0
   fsid_res2                       char       0
   fsid_id
     high                          unsigned long  0
     low                           unsigned long  0
   fsid_aggrname                   char[45]   0
   fsid_name                       char[45]   "OMVS.PRV.FS3"
   fsid_mtname                     char[45]   0
   fsid_reserved                   char[49]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate containing file system is quiesced
  EXIST         File system does not exist
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  EPERM         Permission denied to perform request
  EROFS         Aggregate is attached as read only

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate that contains the file system to be deleted must be attached. Read-write file systems and backup file systems are related during removal as follows:

- Removing a read-write file system automatically removes its associated backup version (if the backup version exists).
- Removing a backup file system does not remove the read-write file system.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Clone File System
Create File System

Restrictions

The aggregate cannot be quiesced or attached as read-only. You cannot delete a file system that is mounted. If you are removing a read-write file system and it has a backup file system, neither the read-write nor the backup file systems can be mounted.

When using an FS_ID2 as input, you cannot specify the file system with the z/OS UNIX file system name (fsid_mtname) since the file system cannot be mounted. You must use the zFS file system name (fsid_name).

Examples

Example 1 - Using FS_ID

```
#pragma linkage(BX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_DELETEFILESYS_PARMDATA  136

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                   /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                      /* Length of this structure */
  char fsid_ver;                      /* Version */
#define FSID_VER_INITIAL 1            /* Initial version           */
  char fsid_res1;                     /* Reserved.                 */
```

```
  char fsid_res2;                      /* Reserved.                 */
  hyper fsid_id;                       /* Internal identifier       */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];  /* Name, null terminated     */
  char fsid_reserved[32];              /* Reserved for the future   */
  char fsid_reserved2[2];              /* Reserved for the future   */
} FS_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID fsid;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";

struct parmstruct myparmstruct;

FS_ID *idp = &(myparmstruct.fsid);

myparmstruct.myparms.opcode = AGOP_DELETEFILESYS_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID);
myparmstruct.fsid.fsid_ver = FSID_VER_INITIAL;
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,            /* Aggregate operation     */
             sizeof(myparmstruct),    /* Length of Argument      */
             (char *) &myparmstruct,  /* Pointer to Argument     */
             &bpxrv,                  /* Pointer to Return_value */
             &bpxrc,                  /* Pointer to Return_code  */
             &bpxrs);                 /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error deleting file system %s\n",filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from delete file system was successful  */
     {
     printf("File system %s deleted successfully\n",filesystemname);
     }
return 0;
}
```

Example 2 - Using FS_ID2

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);
```

```
#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_DELETEFILESYS_PARMDATA  136

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                     /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                        /* Length of this structure */
  char fsid_ver;                        /* Version */
#define FSID_VER_INITIAL 1              /* Initial version            */
  char fsid_res1;                       /* Reserved.                  */
  char fsid_res2;                       /* Reserved.                  */
  hyper fsid_id;                        /* Internal identifier        */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];               /* Reserved for the future  */
  char fsid_reserved2[2];               /* Reserved for the future  */
} FS_ID;

typedef struct fs_id2_t {
  char fsid_eye[4];                     /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                        /* Length of this structure */
  char fsid_ver;                        /* Version */
  char fsid_res1;                       /* Reserved.                  */
  char fsid_res2;                       /* Reserved.                  */
  hyper fsid_id;                        /* Internal identifier        */
#define FSID_VER_2       2               /* Second version  */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated     */
  char fsid_reserved[49];               /* Reserved for the future  */
} FS_ID2;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID2 fsid;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";

struct parmstruct myparmstruct;

FS_ID2 *idp = &(myparmstruct.fsid);
```

Delete File System

```
myparmstruct.myparms.opcode = AGOP_DELETEFILESYS_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID2));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID2);
myparmstruct.fsid.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error deleting file system %s\n",filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from delete file system was successful  */
     {
     printf("File system %s deleted successfully\n",filesystemname);
     }
return 0;
}
```

Detach Aggregate

Purpose

The Detach Aggregate subcommand call is an aggregate operation that detaches a multi-file system aggregate from a system. This makes the aggregate and all its file systems unavailable to the ZFS Physical File System running on that system.

Format

```
syscall_parmlist
   opcode                         104      AGOP_DETACH_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       0
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate could not be detached due to mounted file system
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

This function is used to detach multi-file system aggregates. Compatibility mode aggregates are detached during unmount.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Attach Aggregate

Restrictions

All file systems in the aggregate must be unmounted before the aggregate can be detached.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_DETACH_PARMDATA  104

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye catcher */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure */
  char aid_ver;                       /* Version */
#define AID_VER_INITIAL 1             /* Initial version */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* Name, null terminated    */
  char aid_reserved[33];              /* Reserved for the future  */
} AGGR_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";

struct parmstruct myparmstruct;

myparmstruct.myparms.opcode = AGOP_DETACH_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(&myparmstruct.aggr_id,0,sizeof(AGGR_ID));     /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.aggr_id,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */

            sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
```

```
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error detaching aggregate %s\n", aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from detach was successful  */
     {
     printf("Aggregate %s detached successfully\n",aggrname);
     }
return 0;
}
```

Format Aggregate

Purpose

The Format Aggregate subcommand call is an aggregate operation that formats a VSAM Linear Data Set (VSAM LDS) as a zFS aggregate.

Format

```
syscall_parmlist
   opcode                         134      AGOP_FORMAT_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       offset to AGGR_FORMAT
   parms[2]                       offset to system name (optional)
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0
AGGR_FORMAT
   af_eye                         char[4]    "AGFM"
   af_len                         short      sizeof(AGGR_FORMAT
   af_ver                         char       1
   af_res1                        char       0
   af_size                        long       0
   af_logsize                     long       0
   af_initialempty                long       0     /* 0 gives 1 block              */
   af_overwrite                   int        0     /* Use caution if you specify 1 */
   af_compat                      int        1     /* compat aggr desired          */
   af_owner                       int        0     /* no uid specified             */
   af_ownerSpecified              int        0     /* use uid of issuer            */
   af_group                       int        0     /* no guid specified            */
   af_groupSpecified              int        0     /* gid set to issuer default group */
   af_perms                       int        0     /* no perms specified           */
   af_reserved                    char[64]   0
systemname                        char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate is busy or otherwise unavailable
  EINTR         ZFS is shutting down
  EINVAL        Invalid parameters
  EMVSERR       Internal error using an osi service
  ENOENT        No aggregate by this name is found
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must have ALTER authority on the VSAM Linear Data Set to be formatted and must be logged in as root or have READ authority to the SUPERUSER.FILESYS.PFSCTL profile in the z/OS UNIXPRIV class.

Related Services

Define Aggregate

Restrictions

The VSAM LDS to be formatted cannot be attached.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_FORMAT_PARMDATA  134

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye catcher */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure */
  char aid_ver;                       /* Version */
#define AID_VER_INITIAL 1             /* Initial version */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* Name, null terminated    */
  char aid_reserved[33];              /* Reserved for the future  */
} AGGR_ID;

typedef struct aggr_format_t
{
  char  af_eye[4];                    /* Eye catcher               */
#define AF_EYE "AGFM"
  short af_len;                       /* Length of structure       */
  char  af_ver;                       /* Version of cb */
#define AF_VER_INITIAL 1
  char  af_res1;                      /* For future use          */
  long  af_size;                      /* Amount to format of aggr */
#define AF_DEFAULT_SIZE    0        /* If set, we use default of entire primary partition of LDS */
  long  af_logsize;                   /* Size of logfile in aggr  */
#define AF_DEFAULT_LOGSIZE 0        /* If set, we use default of 1% of aggr size */
  long  af_initialempty;              /* Initial empty blocks     */
#define AF_DEFAULT_INITIALEMPTY  1    /* This is the default & minumum too */
  int   af_overwrite;                 /* Overwrite aggr if its not empty */
#define AF_OVERWRITE_OFF 0            /* Overwrite off, that means if aggr not empty it will */
                                      /* NOT be formatted, th default */
#define AF_OVERWRITE_ON  1            /* Overwrite in effect */
  int   af_compat;                    /* HFS-compat aggr desired */
#define AF_MULT    0                  /* Multi-file sys aggr desired */
#define AF_HFSCOMP 1                  /* HFS-compat aggr desired */
  int   af_owner;                     /* Owner for HFS-compat */
  int   af_ownerSpecified;            /* Indicates an owner was provided */
```

```
#define AF_OWNER_USECALLER 0          /* Owner gets set to pfsctl issuer uid */
#define AF_OWNER_SPECIFIED 1          /* Use owner uid set in af_owner */
  int   af_group;                     /* Group for HFS-compat */
  int   af_groupSpecified;            /* Indicates if group specified */
#define AF_GROUP_USECALLER 0          /* Group gets set to pfsctl issuer default group */
#define AF_GROUP_SPECIFIED 1          /* Use group gid set in af_group */
  int   af_perms;                     /* Perms for HFS-compat */
#define AF_DEFAULT_PERMS   0755       /* The default perms to use */
  int   af_permsSpecified;            /* Indicates if perms provided */
#define AF_PERMS_DEFAULT   0          /* Perms not specified, use default */
#define AF_PERMS_SPECIFIED 1          /* Use perms set in af_perms */
  char  af_reserved[64];              /* For future use */
} AGGR_FORMAT;

struct parmstruct {
  syscall_parmlist myparms;
  AGGR_ID aid;
  AGGR_FORMAT aggformat;
  char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "PLEX.JMS.AGGR007.LDS0007";   /* aggregate name to format */

AGGR_FORMAT *aggptr = &(myparmstruct.aggformat);
AGGR_ID *idp = &(myparmstruct.aid);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVN"); */     /* set system to change */

myparmstruct.myparms.opcode = AGOP_FORMAT_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist)+sizeof(AGGR_ID);
myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if            */
/* you are running z/OS 1.7 and above, and                                     */
/* you want the format to be run on a different system than this one          */
/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist)+sizeof(AGGR_ID)+sizeof(AGGR_FORMAT);*/

myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(AGGR_ID));
memcpy(idp->aid_eye,AID_EYE,4);
idp->aid_ver=1;
strcpy(idp->aid_name,aggrname);
idp->aid_len=(int) sizeof(AGGR_ID);

memset(aggptr,0,sizeof(myparmstruct.aggformat));
memcpy(aggptr->af_eye,AF_EYE,4);

aggptr->af_len = sizeof(myparmstruct.aggformat);
aggptr->af_ver = AF_VER_INITIAL;
aggptr->af_size = AF_DEFAULT_SIZE;
aggptr->af_compat = AF_HFSCOMP;       /* I want an HFS compatibility mode aggregate */
aggptr->af_ownerSpecified = AF_OWNER_USECALLER;
/* aggptr->af_owner = owner;  */
aggptr->af_groupSpecified=AF_GROUP_USECALLER;
/* aggptr->af_group = group;  */
aggptr->af_permsSpecified=AF_PERMS_DEFAULT;
```

```
/* aggptr->af_perms = perms;  */

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */
  if (bpxrv < 0) {
     printf("Error formatting, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
  }
  else {
     printf("Formatted aggregate %s\n",aggrname);
  }
  return 0;
}
```

Grow Aggregate

Purpose

The Grow Aggregate subcommand call is an aggregate operation that extends the physical size of an aggregate. It can also be used to extend compatibility mode aggregates and multi-file system aggregates.

Format

```
syscall_parmlist
   opcode                         129      AGOP_GROW_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       new size of aggregate
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  8             DFSMS did not extend the aggregate
  EBUSY         Aggregate containing file system is quiesced
  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request
  EROFS         Aggregate is attached as read only

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate to be grown must be attached. The size specified is the new total size (in 1 K-byte blocks) being requested. The size may be rounded up by DFSMS. If a zero is specified for the new size, the aggregate is grown by a secondary allocation. The determination of whether to extend to another volume is made by DFSMS. Requests that write to files and need aggregate blocks that are not available yet and other requests that access those files will wait. Other requests will not wait during the grow.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

List Aggregate Status

Restrictions

The aggregate to be grown cannot already be quiesced and cannot be attached as read-only. An aggregate cannot be made smaller.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>
/* #include <stdlib.h>  */

#define ZFSCALL_AGGR   0x40000005

#define AGOP_GROW_PARMDATA  129

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye catcher */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure */
  char aid_ver;                       /* Version */
#define AID_VER_INITIAL 1             /* Initial version */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* Name, null terminated    */
  char aid_reserved[33];              /* Reserved for the future  */
} AGGR_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";

struct parmstruct myparmstruct;

memset(&myparmstruct.aggr_id,0,sizeof(AGGR_ID));    /* Ensure reserved fields are 0 */

myparmstruct.myparms.opcode = AGOP_GROW_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 70000;           /* New size of aggregate in K-bytes */
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memcpy(&myparmstruct.aggr_id.aid_eye,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);
```

Grow Aggregate

```
     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error growing aggregate %s\n", aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from grow was successful  */
     {
     printf("Aggregate %s grown succssfully\n",aggrname);
     }
return 0;
}
```

List Aggregate Status

Purpose

The List Aggregate Status subcommand call is an aggregate operation that returns information about a specified attached aggregate on this system.

Format

```
syscall_parmlist
   opcode                         137      AGOP_GETSTATUS_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       offset to AGGR_STATUS
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0
AGGR_STATUS
   as_eye                         char[4]    "AGST"
   as_len                         short      sizeof(AGGR_STATUS)
   as_ver                         char       1
   as_res1                        char       0
   as_aggrId                      long       Aggregate ID
   as_nFileSystems                long       Number of File Systems
   as_threshold                   char       Aggrfull threshold
   as_increment                   char       Aggrfull increment
   as_flags                       char
     AS_MONITOR                     0x80
     AS_RO                          0x40
     AS_NBS                         0x20
     AS_COMPAT                      0x10
     AS_GROW                        0x08
   as_res2                        char       0
   as_blocks                      unsigned long
   as_fragSize                    long
   as_blockSize                   long
   as_totalUsable                 unsigned long
   as_realFree                    unsigned long
   as_minFree                     unsigned long
   as_reserved                    char[128]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

This call returns information about a specified aggregate. The aggregate must be attached.

To grow an aggregate, you would need to specify a number larger than the sum of as_totalUsable and as_minFree.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Attached Aggregate Names

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_GETSTATUS_PARMDATA  137

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                      /* Eye Catcher               */
#define AID_EYE "AGID"
  char aid_len;                         /* Length of this structure  */
  char aid_ver;                         /* Version                   */
#define AID_VER_INITIAL 1               /* Initial version           */
  char aid_name[ZFS_MAX_AGGRNAME+1];    /* aggr name, null terminated */
  char aid_reserved[33];                /* Reserved for the future   */
} AGGR_ID;

typedef unsigned long   u_long;

typedef struct aggr_status_t {
  char  as_eye[4];                      /* Eye catcher               */
#define AS_EYE "AGST"
  short as_len;                         /* Length of structure       */
  char  as_ver;
#define AS_VER_INITIAL 1                /* Initial version */
  char  as_res1;                        /* Reserved.                 */
  long  as_aggrId;                      /* Internal identifier       */
  long  as_nFileSystems;                /* Number of filesystems in aggregate */
  char  as_threshold;                   /* Threshold for aggrfull monitoring   */
  char  as_increment;                   /* Increment for aggrfull monitoring   */
  char  as_flags;                       /* Aggregate flags */
#define AS_MONITOR 0x80                 /* Aggr monitored for aggr full */
#define AS_RO      0x40                 /* Aggr attached Read-only */
#define AS_NBS     0x20                 /* Aggr should guarantee NBS */
#define AS_COMPAT  0x10                 /* Aggr is HFS compatible */
#define AS_GROW    0x08                 /* Aggr can be dynamically grown */
  char  as_res2;                        /* Reserved                  */
```

```
  u_long  as_blocks;                  /* Number of fragments in aggregate */
  long    as_fragSize;                /* Size of fragment in aggregate (normally 1K) */
  long    as_blockSize;               /* Size of blocks on aggregate (normally 8K) */
  u_long  as_totalUsable;             /* Total available blocks on aggregate (normally 8K) */
  u_long  as_realFree;                /* Total kilobytes free */
  u_long  as_minFree;                  /* Minimum kilobytes free */
  char  as_reserved[128];             /* Reserved for future */
} AGGR_STATUS;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
 AGGR_STATUS aggr_status;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";   /* aggregate name to getstatus */

struct parmstruct myparmstruct;

AGGR_ID *idp = &(myparmstruct.aggr_id);
AGGR_STATUS *asp = &(myparmstruct.aggr_status);

myparmstruct.myparms.opcode = AGOP_GETSTATUS_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(AGGR_ID));                 /* Ensure reserved fields are 0 */
memset(asp,0,sizeof(AGGR_STATUS));             /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.aggr_status.as_eye[0], AS_EYE, 4);
myparmstruct.aggr_status.as_len = sizeof(AGGR_STATUS);
myparmstruct.aggr_status.as_ver = AS_VER_INITIAL;

memcpy(&myparmstruct.aggr_id,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error getstatus aggregate %s\n", aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from getstatus was successful  */
     {
     printf("Aggregate %s getstatus successful\n",aggrname);
     printf("getstatus: aggr_id=%d, no_of_filesystems=%d, aggr_flags=%x\n",
```

```
                     myparmstruct.aggr_status.as_aggrId,
                                myparmstruct.aggr_status.as_nFileSystems,
                                                    myparmstruct.aggr_status.as_flags);
     printf("getstatus: threshold=%d, increment=%d\n",
                     myparmstruct.aggr_status.as_threshold,
                                  myparmstruct.aggr_status.as_increment);
     printf("getstatus: blocks=%d, frag_size=%d, block_size=%d\n",
                     myparmstruct.aggr_status.as_blocks,
                               myparmstruct.aggr_status.as_fragSize,
                                           myparmstruct.aggr_status.as_blockSize);
     printf("getstatus: total_usable=%d, real_free=%d, min_free=%d\n",
                     myparmstruct.aggr_status.as_totalUsable,
                                    myparmstruct.aggr_status.as_realFree,
                                                 myparmstruct.aggr_status.as_minFree);
     }
return 0;
}
```

List Aggregate Status (Version 2)

Purpose

The List Aggregate Status subcommand call is an aggregate operation that returns information about a specified attached aggregate on this system. Version 2 returns additional flags and fields.

Format

```
syscall_parmlist
   opcode                          146      AGOP_GETSTATUS2_PARMDATA
   parms[0]                        offset to AGGR_ID
   parms[1]                        offset to AGGR_STATUS2
   parms[2]                        0
   parms[3]                        0
   parms[4]                        0
   parms[5]                        0
   parms[6]                        0
AGGR_ID
   aid_eye                         char[4]    "AGID"
   aid_len                         char       sizeof(AGGR_ID)
   aid_ver                         char       1
   aid_name                        char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                    char[33]   0
AGGR_STATUS
   as_eye                          char[4]    "AGST"
   as_len                          short      sizeof(AGGR_STATUS2)
   as_ver                          char       2
   as_res1                         char       0
   as_aggrId                       long       Aggregate ID
   as_nFileSystems                 long       Number of File Systems
   as_threshold                    char       Aggrfull threshold
   as_increment                    char       Aggrfull increment
   as_flags                        char
     AS_MONITOR                      0x80
     AS_RO                           0x40
     AS_NBS                          0x20
     AS_COMPAT                       0x10
     AS_GROW                         0x08
     AS_QUIESCED                     0x01
   as_flags2                       char
     AS_DISABLED                     0x80

   as_blocks                       unsigned long
   as_fragSize                     long
   as_blockSize                    long
   as_totalUsable                  unsigned long
   as_realFree                     unsigned long
   as_minFree                      unsigned long
   as_reserved2                    int[3]
as_freeblocks              unsigned long
as_freefrags               unsigned long
as_directLog               unsigned long
as_indirectLog             unsigned long
as_fstbl                   unsigned long
as_bitmap                  unsigned long
as_diskFormatMajorVersion    unsigned long
as_diskFormatMinorVersion    unsigned long
as_reserved                  char[84]
Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
```

```
  ENOENT        Aggregate is not attached

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

This call returns information about a specified aggregate. The aggregate must be attached.

To grow an aggregate, you would need to specify a number larger than the sum of as_totalUsable and as_minFree.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Attached Aggregate Names

Restrictions

None.

Examples

```
| #pragma linkage(BPX1PCT, OS)
| extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);
|
| #include <stdio.h>
|
| #define ZFSCALL_AGGR   0x40000005
| #define AGOP_GETSTATUS2_PARMDATA  146
|
| typedef struct syscall_parmlist_t {
|   int opcode;               /* Operation code to perform             */
|   int parms[7];             /* Specific to type of operation,        */
|                             /* provides access to the parms          */
|                             /* parms[4]-parms[6] are currently unused*/
| } syscall_parmlist;
|
| #define ZFS_MAX_AGGRNAME 44
|
| typedef struct aggr_id_t {
|   char aid_eye[4];                    /* Eye Catcher               */
| #define AID_EYE "AGID"
|   char aid_len;                       /* Length of this structure  */
|   char aid_ver;                       /* Version                   */
| #define AID_VER_INITIAL 1             /* Initial version           */
|   char aid_name[ZFS_MAX_AGGRNAME+1];  /* aggr name, null terminated */
|   char aid_reserved[33];              /* Reserved for the future   */
| } AGGR_ID;
|
| typedef unsigned long   u_long;
|
| typedef struct aggr_status_t {
|   char  as_eye[4];                    /* Eye catcher               */
| #define AS_EYE "AGST"
|   short as_len;                       /* Length of structure       */
|   char  as_ver;
| #define AS_VER_2 2                    /* version 2 */
|   char  as_res1;                      /* Reserved.                 */
```

```
|    long  as_aggrId;                    /* Internal identifier        */
|    long  as_nFileSystems;              /* Number of filesystems in aggregate */
|    char  as_threshold;                 /* Threshold for aggrfull monitoring   */
|    char  as_increment;                 /* Increment for aggrfull monitoring   */
|    char  as_flags;                     /* Aggregate flags */
|  #define AS_MONITOR 0x80               /* Aggr monitored for aggr full */
|  #define AS_RO      0x40               /* Aggr attached Read-only */
|  #define AS_NBS     0x20               /* Aggr should guarantee NBS */
|  #define AS_COMPAT  0x10               /* Aggr is HFS compatible */
|  #define AS_GROW    0x08               /* Aggr can be dynamically grown */
|  /* The following flags are for AS_VER_2 */
|  #define AS_DYNAMIC_MOVE    0x04       /* 1=aggrmove is on, 0=aggrmove is off */
|  #define AS_QUIESCED   0x01            /* 1 = Aggr is quiesced, 0 = Aggr is unquiesced */
|    char  as_flags2;                    /* Aggregate flags2                 */
|  #define AS_DISABLED   0x80            /* 1 = Aggr is disabled  */
|    u_long  as_blocks;                  /* Number of fragments in aggregate */
|    long    as_fragSize;                /* Size of fragment in aggregate (normally 1K) */
|    long    as_blockSize;               /* Size of blocks on aggregate (normally 8K) */
|    u_long  as_totalUsable;             /* Total available blocks on aggregate (normally 8K) */
|    u_long  as_realFree;                /* Total kilobytes free */
|    u_long  as_minFree;                 /* Minimum kilobytes free */
|    int     as_reserved2[3];            /* reserved */
|    u_long as_freeblocks;               /*Number of k available in free 8k blocks*/
|    u_long as_freefrags;                /*Number of k available in free 1k fragments*/
|    u_long as_directLog;                /*Number of k used on the log*/
|    u_long as_indirectLog;              /*Number of k used indirectly on the log*/
|    u_long as_fstbl;                    /*Number of k used for the filesystem table*/
|    u_long as_bitmap;                   /*Number of k used for the bitmap file*/
|    u_long as_diskFormatMajorVersion;   /* disk format major version */
|    u_long as_diskFormatMinorVersion;   /* disk format minor version */
|
|    char  as_reserved[84];             /* Reserved for future */
|  } AGGR_STATUS2;
|
|  struct parmstruct
|  {
|   syscall_parmlist myparms;
|   AGGR_ID aggr_id;
|   AGGR_STATUS2 aggr_status;
|  } ;
|
|  int main(int argc, char **argv)
|  {
|  int bpxrv;
|  int bpxrc;
|  int bpxrs;
|  char aggrname[45] = "PLEX.JMS.AGGR001.LDS0001";   /* aggregate name to getstatus */
|
|  struct parmstruct myparmstruct;
|
|  AGGR_ID *idp = &(myparmstruct.aggr_id);
|  AGGR_STATUS2 *asp = &(myparmstruct.aggr_status);
|
|  myparmstruct.myparms.opcode = AGOP_GETSTATUS2_PARMDATA;
|  myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
|  myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
|  myparmstruct.myparms.parms[2] = 0;
|  myparmstruct.myparms.parms[3] = 0;
|  myparmstruct.myparms.parms[4] = 0;
|  myparmstruct.myparms.parms[5] = 0;
|  myparmstruct.myparms.parms[6] = 0;
|
|  memset(idp,0,sizeof(AGGR_ID));                /* Ensure reserved fields are 0 */
|  memset(asp,0,sizeof(AGGR_STATUS2));            /* Ensure reserved fields are 0 */
|
|  memcpy(&myparmstruct.aggr_status.as_eye[0], AS_EYE, 4);
|  myparmstruct.aggr_status.as_len = sizeof(AGGR_STATUS2);
```

List Aggregate Status (Version 2)

```
| myparmstruct.aggr_status.as_ver = AS_VER_2;
|
| memcpy(&myparmstruct.aggr_id,AID_EYE,4);
| myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
| myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
| strcpy(myparmstruct.aggr_id.aid_name,aggrname);
|
|      BPX1PCT("ZFS     ",
|              ZFSCALL_AGGR,             /* Aggregate operation     */
|              sizeof(myparmstruct),     /* Length of Argument      */
|              (char *) &myparmstruct,   /* Pointer to Argument     */
|              &bpxrv,                   /* Pointer to Return_value */
|              &bpxrc,                   /* Pointer to Return_code  */
|              &bpxrs);                  /* Pointer to Reason_code  */
|
| if (bpxrv < 0)
|      {
|      printf("Error getstatus aggregate %s\n", aggrname);
|      printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
|      return bpxrc;
|      }
|    else /* Return from getstatus was successful  */
|      {
|      printf("Aggregate %s getstatus successful\n",aggrname);
|      printf("getstatus: aggr_id=%d, no_of_filesystems=%d, aggr_flags=%2.2x, aggr_flags2=%2.2x\n",
|                        myparmstruct.aggr_status.as_aggrId,
|                                    myparmstruct.aggr_status.as_nFileSystems,
|                                                          myparmstruct.aggr_status.as_flags,
|                                                          myparmstruct.aggr_status.as_flags2);
|
|      printf("getstatus: threshold=%d, increment=%d\n",
|                        myparmstruct.aggr_status.as_threshold,
|                                     myparmstruct.aggr_status.as_increment);
|      printf("getstatus: blocks=%d, frag_size=%d, block_size=%d\n",
|                        myparmstruct.aggr_status.as_blocks,
|                                   myparmstruct.aggr_status.as_fragSize,
|                                              myparmstruct.aggr_status.as_blockSize);
|      printf("getstatus: total_usable=%d, real_free=%d, min_free=%d\n",
|                        myparmstruct.aggr_status.as_totalUsable,
|                                       myparmstruct.aggr_status.as_realFree,
|                                                    myparmstruct.aggr_status.as_minFree);
|      printf("getstatus: free_8K_blocks=%d, free_1K_fragments=%d\n",
|                        myparmstruct.aggr_status.as_freeblocks/8,
|                                         myparmstruct.aggr_status.as_freefrags);
|      printf("getstatus: direct_Log=%d, indirect_Log=%d\n",
|                        myparmstruct.aggr_status.as_directLog,
|                                      myparmstruct.aggr_status.as_indirectLog);
|      printf("getstatus: filesystem_table=%d, bitmap=%d\n",
|                        myparmstruct.aggr_status.as_fstbl,
|                                         myparmstruct.aggr_status.as_bitmap);
|      printf("getstatus: version=%d.%d\n",
|                        myparmstruct.aggr_status.as_diskFormatMajorVersion,
|                                   myparmstruct.aggr_status.as_diskFormatMinorVersion);
|      }
| return 0;
| }

|
```

List Attached Aggregate Names

Purpose

The List Attached Aggregate Names subcommand call is an aggregate operation that returns a list of the names of all attached aggregates on a system.

Format

```
syscall_parmlist
   opcode                         135      AGOP_LISTAGGRNAMES_PARMDATA
   parms[0]                       buffer length or 0
   parms[1]                       offset to AGGR_ID or 0
   parms[2]                       offset to size
   parms[3]                       offset to system name (optional)
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID[n]                        Array of AGGR_IDs (n can be 0)
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0
size needed                       long       0
systemname                        char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  E2BIG         List is too big for buffer supplied

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

This call returns an array of AGGR_IDs - one for each attached aggregate on the system. Each AGGR_ID structure is 84 bytes. You can specify a buffer that you think might hold all of them or you can specify a buffer length and offset of zero. If you get a return code of E2BIG, the required size for the buffer is contained in the size field.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Aggregate Status
List File System Names

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_LISTAGGRNAMES_PARMDATA  135
#define E2BIG  145

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye Catcher               */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure  */
  char aid_ver;                       /* Version                   */
#define AID_VER_INITIAL 1             /* Initial version           */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* aggr name, null terminated */
  char aid_reserved[33];              /* Reserved for the future   */
} AGGR_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 /* Real malloc'd structure will have an array of AGGR_IDs here */
 long size;
 char systemname[9];
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;

struct parmstruct myparmstruct;
AGGR_ID *aggPtr;
int aggSize = sizeof(AGGR_ID);
int buflen = sizeof(AGGR_ID);
struct parmstruct *myp = &myparmstruct;
int mypsize;
char *systemp;
int count_aggrs, total_aggrs;

myparmstruct.myparms.opcode = AGOP_LISTAGGRNAMES_PARMDATA;
myparmstruct.myparms.parms[0] = 0;
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

BPX1PCT("ZFS     ",
        ZFSCALL_AGGR,             /* Aggregate operation     */
        sizeof(myparmstruct),     /* Length of Argument      */
        (char *) &myparmstruct,   /* Pointer to Argument     */
        &bpxrv,                   /* Pointer to Return_value */
```

```
        &bpxrc,                  /* Pointer to Return_code  */
        &bpxrs);                 /* Pointer to Reason_code  */

if (bpxrv < 0)
{
      if (bpxrc == E2BIG)
      {
          buflen = myp->size;          /* Get buffer size needed  */
          mypsize = buflen + sizeof(syscall_parmlist) + sizeof(long) + 9;
          myp = (struct parmstruct *) malloc ((long) mypsize);
          memset(myp, 0, mypsize);

      /* This next field should only be set if parms[3] is non-zero */
      /*  systemp = (char *)myp + buflen + sizeof(syscall_parmlist) + sizeof(long); */
      /*  strcpy(systemp,"DCEIMGVN");  */  /* set system to get lsaggr info from */

          myp->myparms.opcode = AGOP_LISTAGGRNAMES_PARMDATA;
          myp->myparms.parms[0] = buflen;
          myp->myparms.parms[1] = sizeof(syscall_parmlist);
          myp->myparms.parms[2] = sizeof(syscall_parmlist) + buflen;
          myp->myparms.parms[3] = 0;

/* Only specify a non-zero offset for the next field (parms[3]) if           */
/* you are running z/OS 1.7 and above, and                                    */
/* you want lsaggr aggregates owned on a single system                       */

/*        myp->myparms.parms[3] = sizeof(syscall_parmlist) + buflen + sizeof(long); */

          myp->myparms.parms[4] = 0;
          myp->myparms.parms[5] = 0;
          myp->myparms.parms[6] = 0;

          BPX1PCT("ZFS     ",
                  ZFSCALL_AGGR,            /* Aggregate operation     */
                  mypsize,                 /* Length of Argument      */
                  (char *) myp,            /* Pointer to Argument     */
                  &bpxrv,                  /* Pointer to Return_value */
                  &bpxrc,                  /* Pointer to Return_code  */
                  &bpxrs);                 /* Pointer to Reason_code  */
          if (bpxrv == 0)
          {
              total_aggrs = buflen/aggSize;
              count_aggrs = 1;
              for(aggPtr = (AGGR_ID *) &(myp->size) ; count_aggrs <= total_aggrs ;
              aggPtr++, count_aggrs++)
              {
                  if (strlen(aggPtr->aid_name) != 0)
                    printf("%-64.64s\n",aggPtr->aid_name);
              }
              free(myp);
          }
          else  /* lsaggr names failed with large enough buffer */
          {
              printf("Error on ls aggr with large enough buffer\n");
              printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
              free(myp);
              return bpxrc;
          }
      }
      else  /* error was not E2BIG */
      {
          printf("Error on ls aggr trying to get required size\n");
          printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
          free(myp);
          return bpxrc;

      }
```

```
}
else /* asking for buffer size gave rv = 0; maybe there are no aggregates */
{
    if (myparmstruct.size == 0)
    {
        printf("No attached aggregates\n");
    }
    else   /* No, there was some other problem with getting the size needed */
    {
        printf("Error getting size required\n");
    }
}
return 0;
}
```

List Attached Aggregate Names (Version 2)

Purpose

The List Attached Aggregate Names subcommand call is an aggregate operation that returns a list of the names of all attached aggregates on a system with the system name.

Format

```
syscall_parmlist
   opcode                         140      AGOP_LISTAGGRNAMES2_PARMDATA
   parms[0]                       buffer length or 0
   parms[1]                       offset to AGGR_ID2 or 0
   parms[2]                       offset to size
   parms[3]                       offset to system name (optional)
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID[2]                        Array of AGGR_ID2s (n can be 0)
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       2
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_sysname                    char[9]    "DCEIMGVN"
   aid_reserved                   char[24]   0
size needed                       long       0
systemname                        char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  E2BIG         List is too big for buffer supplied

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

This call returns an array of AGGR_ID2s - one for each attached aggregate on the system. Each AGGR_ID structure is 84 bytes. You can specify a buffer that you think might hold all of them or you can specify a buffer length and offset of zero. If you get a return code of E2BIG, the required size for the buffer is contained in the size field.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Aggregate Status
List File System Names

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_LISTAGGRNAMES2_PARMDATA 140 /* list attached aggregates with system name */
#define E2BIG  145

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44
#define SYS_MAX_NAMELEN         8     /* Max. z/OS system name length*/

typedef struct aggr_id2_t {
  char aid_eye[4];                    /* Eye Catcher               */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure  */
  char aid_ver;                       /* Version                   */
#define AID_VER_2     2               /* version 2                 */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* aggr name, null terminated */
  char aid_sysname[SYS_MAX_NAMELEN+1]; /* system name, NULL terminated */
  char aid_reserved[24];              /* Reserved for the future   */
} AGGR_ID2;

struct parmstruct
{
 syscall_parmlist myparms;
 /* Real malloc'd structure will have an array of AGGR_ID2s here */
 long size;
 char systemname[9];
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;

struct parmstruct myparmstruct;
AGGR_ID2 *aggPtr;
int aggSize = sizeof(AGGR_ID2);
int buflen = sizeof(AGGR_ID2);
struct parmstruct *myp = &myparmstruct;
int mypsize;
char *systemp;
int count_aggrs, total_aggrs;

myparmstruct.myparms.opcode = AGOP_LISTAGGRNAMES2_PARMDATA;
myparmstruct.myparms.parms[0] = 0;
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

BPX1PCT("ZFS     ",
        ZFSCALL_AGGR,             /* Aggregate operation     */
        sizeof(myparmstruct),     /* Length of Argument      */
```

```
        (char *) &myparmstruct,   /* Pointer to Argument     */
        &bpxrv,                   /* Pointer to Return_value */
        &bpxrc,                   /* Pointer to Return_code  */
        &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
{
      if (bpxrc == E2BIG)
      {
          buflen = myp->size;          /* Get buffer size needed  */
          mypsize = buflen + sizeof(syscall_parmlist) + sizeof(long) + 9;
          myp = (struct parmstruct *) malloc ((long) mypsize);
          memset(myp, 0, mypsize);

          /* This next field should only be set if parms[3] is non-zero */
          /*  systemp = (char *)myp + buflen + sizeof(syscall_parmlist) + sizeof(long); */
          /*  strcpy(systemp,"DCEIMGVN");  */  /* set system to get lsaggr info from */

          myp->myparms.opcode = AGOP_LISTAGGRNAMES2_PARMDATA;
          myp->myparms.parms[0] = buflen;
          myp->myparms.parms[1] = sizeof(syscall_parmlist);
          myp->myparms.parms[2] = sizeof(syscall_parmlist) + buflen;
          myp->myparms.parms[3] = 0;

/* Only specify a non-zero offset for the next field (parms[3]) if           */
/* you are running z/OS 1.7 and above, and                                    */
/* you want lsaggr aggregates owned on a single system                       */

       /* myp->myparms.parms[3] = sizeof(syscall_parmlist) + buflen + sizeof(long); */

          myp->myparms.parms[4] = 0;
          myp->myparms.parms[5] = 0;
          myp->myparms.parms[6] = 0;

          BPX1PCT("ZFS     ",
                  ZFSCALL_AGGR,            /* Aggregate operation     */
                  mypsize,                 /* Length of Argument      */
                  (char *) myp,            /* Pointer to Argument     */
                  &bpxrv,                  /* Pointer to Return_value */
                  &bpxrc,                  /* Pointer to Return_code  */
                  &bpxrs);                 /* Pointer to Reason_code  */
          if (bpxrv == 0)
          {
              total_aggrs = buflen/aggSize;
              count_aggrs = 1;
              for(aggPtr = (AGGR_ID2 *) &(myp->size) ; count_aggrs <= total_aggrs ;
               aggPtr++, count_aggrs++)
              {
                  if (strlen(aggPtr->aid_name) != 0)
                    printf("%-64.64s    %-8.8s\n",aggPtr->aid_name,
                     aggPtr->aid_sysname);
              }
              free(myp);
          }
          else  /* lsaggr names failed with large enough buffer */
          {
              printf("Error on ls aggr with large enough buffer\n");
              printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
              free(myp);
              return bpxrc;
          }
      }
      else  /* error was not E2BIG */
      {
          printf("Error on ls aggr trying to get required size\n");
          printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
          free(myp);
```

```
          return bpxrc;

      }
}
else /* asking for buffer size gave rv = 0; maybe there are no aggregates */
{
    if (myparmstruct.size == 0)
    {
        printf("No attached aggregates\n");
    }
    else   /* No, there was some other problem with getting the size needed */
    {
        printf("Error getting size required\n");
    }
}
return 0;
}
```

List File System Names

Purpose

The List File System Names subcommand call is an aggregate operation that returns the names of the file systems contained in a specified aggregate on this system.

Format

```
syscall_parmlist
   opcode                         138      AGOP_LISTFSNAMES_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       buffer length or 0
   parms[2]                       offset to buffer or 0
   parms[3]                       offset to size
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0
FS_ID[n]                          Array of FS_IDs (n can be zero)
   fsid_eye                       char[4]    "FSID"
   fsid_len                       char       sizeof(FS_ID)
   fsid_ver                       char       1
   fsid_res1                      char       0
   fsid_res2                      char       0
   fsid_id
     high                         unsigned long
     low                          unsigned long
   fsid_aggrname                  char[45]
   fsid_name                      char[45]
   fsid_reserved                  char[32]
   fsid_reserved2                 char[2]
size                              long

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  E2BIG         List is too big for buffer supplied

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate specified must be attached.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Attached Aggregate Names
List File System Status

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_LISTFSNAMES_PARMDATA  138
#define E2BIG  145

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye Catcher               */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure  */
  char aid_ver;                       /* Version                   */
#define AID_VER_INITIAL 1             /* Initial version           */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* aggr name, null terminated */
  char aid_reserved[33];              /* Reserved for the future   */
} AGGR_ID;

typedef struct hyper {             /* This is a 64 bit integer to zFS */
  unsigned long high;
  unsigned long low;
} hyper;

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                 */
  char fsid_res2;                      /* Reserved.                 */
  hyper fsid_id;                       /* Internal identifier       */
#define FSID_VER_INITIAL 1              /* Initial version */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];  /* Name, null terminated    */
  char fsid_reserved[32];              /* Reserved for the future  */
  char fsid_reserved2[2];              /* Reserved for the future  */
} FS_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
 /* Real malloc'd structure will have an array of FS_IDs here */
 long size;
 } ;
```

```
int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;

struct parmstruct myparmstruct;
AGGR_ID *aggPtr;
FS_ID *fsPtr;
int fsSize = sizeof(FS_ID);
int buflen = sizeof(FS_ID);
struct parmstruct *myp = &myparmstruct;
int mypsize;
int count_fs, total_fs;
char aggrname[45]="OMVS.PRV.AGGR001.LDS0001";

memset(&myparmstruct.aggr_id,0,sizeof(AGGR_ID));     /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.aggr_id.aid_eye,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);

myparmstruct.myparms.opcode = AGOP_LISTFSNAMES_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

BPX1PCT("ZFS     ",
        ZFSCALL_AGGR,             /* Aggregate operation     */
        sizeof(myparmstruct),     /* Length of Argument      */
        (char *) &myparmstruct,   /* Pointer to Argument     */
        &bpxrv,                   /* Pointer to Return_value */
        &bpxrc,                   /* Pointer to Return_code  */
        &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
{
      if (bpxrc == E2BIG)
      {
          buflen = myp->size;          /* Get buffer size needed  */
          mypsize = buflen + sizeof(syscall_parmlist) + sizeof(AGGR_ID) + sizeof(long);
          myp = (struct parmstruct *) malloc ((long) mypsize);
          memset(myp, 0, mypsize);

          memcpy(myp->aggr_id.aid_eye,AID_EYE,4);
          myp->aggr_id.aid_len = sizeof(AGGR_ID);
          myp->aggr_id.aid_ver = AID_VER_INITIAL;
          strcpy(myp->aggr_id.aid_name,aggrname);

          myp->myparms.opcode = AGOP_LISTFSNAMES_PARMDATA;
          myp->myparms.parms[0] = sizeof(syscall_parmlist);
          myp->myparms.parms[1] = buflen;
          myp->myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
          myp->myparms.parms[3] = sizeof(syscall_parmlist) + sizeof(AGGR_ID) + buflen;
          myp->myparms.parms[4] = 0;
          myp->myparms.parms[5] = 0;
          myp->myparms.parms[6] = 0;

          BPX1PCT("ZFS     ",
                  ZFSCALL_AGGR,            /* Aggregate operation     */
                  mypsize,                 /* Length of Argument      */
```

```
                (char *) myp,            /* Pointer to Argument     */
                &bpxrv,                  /* Pointer to Return_value */
                &bpxrc,                  /* Pointer to Return_code  */
                &bpxrs);                 /* Pointer to Reason_code  */
          if (bpxrv == 0)
          {
              total_fs = buflen/fsSize;
              printf("total file systems = %d\n",total_fs);
              count_fs = 1;
              for(fsPtr = (FS_ID *) &(myp->size) ; count_fs <= total_fs ; fsPtr++, count_fs++)
              {
                  printf("%-64.64s\n",fsPtr->fsid_name);
              }
              free(myp);
          }
          else  /* lsaggr names failed with large enough buffer */
          {
              printf("Error on ls fs with large enough buffer\n");
              printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
              free(myp);
              return bpxrc;
          }
      }
      else  /* error was not E2BIG */
      {
          printf("Error on ls fs trying to get required size\n");
          printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
          free(myp);
          return bpxrc;

      }
}
else /* asking for buffer size gave rv = 0; maybe there are no file systems */
{
    if (myparmstruct.size == 0)
    {
        printf("No file systems\n");
    }
    else   /* No, there was some other problem with getting the size needed */
    {
        printf("Error getting size required\n");
    }
}
return 0;
}
```

List File System Names (Version 2)

Purpose

The List File System Names (Version 2) subcommand call is an aggregate operation that returns the names of the zFS file systems contained in a specified aggregate on this system and their corresponding z/OS UNIX file system names (if they are mounted).

Format

```
syscall_parmlist
   opcode                          144      AGOP_LISTFSNAMES_PARMDATA2
   parms[0]                        offset to AGGR_ID
   parms[1]                        buffer length or 0
   parms[2]                        offset to buffer or 0
   parms[3]                        offset to size
   parms[4]                        0
   parms[5]                        0
   parms[6]                        0
AGGR_ID
   aid_eye                         char[4]    "AGID"
   aid_len                         char       sizeof(AGGR_ID)
   aid_ver                         char       1
   aid_name                        char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                    char[33]   0
FS_ID2[n]                          Array of FS_ID2s (n can be zero)
   fsid_eye                        char[4]    "FSID"
   fsid_len                        char       sizeof(FS_ID2)
   fsid_ver                        char       2
   fsid_res1                       char       0
   fsid_res2                       char       0
   fsid_id
     high                          unsigned long
     low                           unsigned long
   fsid_aggrname                   char[45]
   fsid_name                       char[45]
   fsid_mtname                     char[45]
   fsid_reserved                   char[49]
size                               long

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  E2BIG         List is too big for buffer supplied

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The version 2 List File System Names returns an array of FS_ID2s.

The aggregate specified must be attached.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Attached Aggregate Names
List File System Status

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);
#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_LISTFSNAMES_PARMDATA2  144
#define E2BIG  145

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye Catcher               */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure  */
  char aid_ver;                       /* Version                   */
#define AID_VER_INITIAL 1             /* Initial version           */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* aggr name, null terminated */
  char aid_reserved[33];              /* Reserved for the future   */
} AGGR_ID;

typedef struct hyper {             /* This is a 64 bit integer to zFS */
  unsigned long high;
  unsigned long low;
} hyper;

typedef struct fs_id2_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                 */
  char fsid_res2;                      /* Reserved.                 */
  hyper fsid_id;                       /* Internal identifier       */
#define FSID_VER_2       2             /* Second version  */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];  /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated     */
  char fsid_reserved[49];              /* Reserved for the future  */
} FS_ID2;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
```

```
 /* Real malloc'd structure will have an array of FS_ID2s here */
 long size;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;

struct parmstruct myparmstruct;
AGGR_ID *aggPtr;
FS_ID2 *fsPtr;
int fsSize = sizeof(FS_ID2);
int buflen = sizeof(FS_ID2);
struct parmstruct *myp = &myparmstruct;
int mypsize;
int count_fs, total_fs;
char aggrname[45]="OMVS.PRV.AGGR001.LDS0001";

long *p;

memset(&myparmstruct.aggr_id,0,sizeof(AGGR_ID));     /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.aggr_id.aid_eye,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);

myparmstruct.myparms.opcode = AGOP_LISTFSNAMES_PARMDATA2;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

BPX1PCT("ZFS     ",
        ZFSCALL_AGGR,             /* Aggregate operation     */
        sizeof(myparmstruct),     /* Length of Argument      */
        (char *) &myparmstruct,   /* Pointer to Argument     */
        &bpxrv,                   /* Pointer to Return_value */
        &bpxrc,                   /* Pointer to Return_code  */
        &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
{
      if (bpxrc == E2BIG)
      {
          buflen = myp->size;          /* Get buffer size needed  */
          mypsize = buflen + sizeof(syscall_parmlist) + sizeof(AGGR_ID) +
              sizeof(myparmstruct.size);
          myp = (struct parmstruct *) malloc ((long) mypsize);
          memset(myp, 0, mypsize);

          memcpy(myp->aggr_id.aid_eye,AID_EYE,4);
          myp->aggr_id.aid_len = sizeof(AGGR_ID);
          myp->aggr_id.aid_ver = AID_VER_INITIAL;
          strcpy(myp->aggr_id.aid_name,aggrname);

          myp->myparms.opcode = AGOP_LISTFSNAMES_PARMDATA2;
          myp->myparms.parms[0] = sizeof(syscall_parmlist);
          myp->myparms.parms[1] = buflen;
          myp->myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
          myp->myparms.parms[3] = sizeof(syscall_parmlist) + sizeof(AGGR_ID) + buflen;
          myp->myparms.parms[4] = 0;
```

```
          myp->myparms.parms[5] = 0;
          myp->myparms.parms[6] = 0;

          BPX1PCT("ZFS     ",
                  ZFSCALL_AGGR,             /* Aggregate operation     */
                  mypsize,                  /* Length of Argument      */
                  (char *) myp,             /* Pointer to Argument     */
                  &bpxrv,                   /* Pointer to Return_value */
                  &bpxrc,                   /* Pointer to Return_code  */
                  &bpxrs);                  /* Pointer to Reason_code  */
          if (bpxrv == 0)
          {
              total_fs = buflen/fsSize;
              printf("total file systems = %d in aggregate %s\n",total_fs, aggrname);
              count_fs = 1;
              for(fsPtr = (FS_ID2 *) &(myp->size) ; count_fs <= total_fs ; fsPtr++, count_fs++)
              {
                  printf("\n");
                  printf("zFS file system name [%s]\n",fsPtr->fsid_name);
                  printf("UNIX file system name [%s]\n",fsPtr->fsid_mtname);
              }
              free(myp);
          }
          else  /* lsaggr names failed with large enough buffer */
          {
              printf("Error on ls fs with large enough buffer\n");
              printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
              free(myp);
              return bpxrc;
          }
      }
      else  /* error was not E2BIG */
      {
          printf("Error on ls fs trying to get required size\n");
          printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
          free(myp);
          return bpxrc;

      }
}
else /* asking for buffer size gave rv = 0; maybe there are no file systems */
{
    if (myparmstruct.size == 0)
    {
        printf("No file systems\n");
    }
    else   /* No, there was some other problem with getting the size needed */
    {
        printf("Error getting size required\n");
    }
}
return 0;
}
```

List File System Status

Purpose

The List File System Status subcommand call is a file system operation that lists the status information of a file system.

You can use an FS_ID as input or (if you want to specify the z/OS UNIX file system name (that is, the mount name)) you can use an FS_ID2 as input. Of course, if you use the z/OS UNIX file system name, the file system must be mounted using that file system name.

Format

```
syscall_parmlist
   opcode                        142      FSOP_GETSTAT_PARMDATA
   parms[0]                      offset to FS_ID
   parms[1]                      offset ro FS_STATUS
   parms[2]                      0
   parms[3]                      0
   parms[4]                      0
   parms[5]                      0
   parms[6]                      0
FS_ID or FS_ID2
   fsid_eye                      char[4]    "FSID"
   fsid_len                      short      sizeof(FS_ID)
   fsid_ver                      char       1
   fsid_res1                     char       0
   fsid_res2                     char       0
   fsid_id
     high                        unsigned long  0
     low                         unsigned long  0
   fsid_aggrname                 char[45]   0
   fsid_name                     char[45]   "OMVS.PRV.FS3"
   fsid_reserved                 char[32]   0
   fsid_reserved2                char[2]    0
FS_ID2 or FS_ID
   fsid_eye                      char[4]    "FSID"
   fsid_len                      short      sizeof(FS_ID2)
   fsid_ver                      char       2
   fsid_res1                     char       0
   fsid_res2                     char       0
   fsid_id
     high                        unsigned long  0
     low                         unsigned long  0
   fsid_aggrname                 char[45]   0
   fsid_name                     char[45]   0
   fsid_mtname                   char[45]   "OMVS.PRV.MNT.FS3"
   fsid_reserved                 char[49]   0
FS_STATUS
  fs_eye                         char[4]    "FSST"
  fs_len                         short      sizeof(FS_STATUS)
  fs_ver                         char       1
  fs_res1                        char       0
  fs_id
    high                         unsigned long   0
    low                          unsigned long   0
  fs_cloneTime                   timeval    0
  fs_createTime                  timeval    0
  fs_updateTime                  timeval    0
  fs_accessTime                  timeval    0
  fs_allocLimit                  unsigned long   0
  fs_allocUsage                  unsigned long   0
  fs_visQuotaLimit              unsigned long   0
  fs_visQuotaUsage              unsigned long   0
  fs_accError                   unsigned long   0
```

```
  fs_accStatus                    long       0
  fs_states                       long       0
  fs_nodeMax                      long       0
  fs_minQuota                     long       0
  fs_type                         long       0
  fs_threshold                    char       0
  fs_increment                    char       0
  fs_mountstate                   char       0
    FS_NOT_MOUNTED                0
    FS_MOUNTED_RW                 1
    FS_MOUNTED_RO                 2
  fs_msglen                       char       0
  fs_msg                          char[128]  0
  fs_aggrname                     char[45]   0
  fs_reserved1                 char[3]
fs_reserved2                unsigned long[3]
fs_InodeTbl                 unsigned long
fs_requests
  high                      unsigned long
  low                       unsigned long
fs_reserved3              unsigned long
fs_reserved4              unsigned long
fs_reserved5              unsigned long
fs_pad1                   int
fs_diskFormatMajorVersion unsigned long
fs_diskFormatMinorVersion unsigned long
fs_reserved               char[80]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate containing file system is quiesced
  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate containing the file system to be listed must be attached.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

List Attached Aggregate Names
List File System Aggregate Names

Restrictions

The aggregate containing the file system to be listed cannot be quiesced.

When FS_ID2 is used, if you specify the z/OS UNIX file system name (fsid_mtname), you cannot specify the zFS file system name (fsid_name) nor the aggregate name (fsid_aggrname).

The following fields are internal use only and are not intended for application usage.

- fs_accError
- fs_accStatus
- fs_type

The following field contains flags 0x00010000 and 0x00030000 indicating a read-write file system and a backup file system respectively. All other flags in this field are internal use only and are not intended for application usage.

- fs_states

Examples

Example 1 - Using FS_ID

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>
#include <time.h>       /* ctime  */

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_GETSTAT_PARMDATA  142

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform            */
  int parms[7];             /* Specific to type of operation,       */
                            /* provides access to the parms         */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper {             /* This is a 64 bit integer to zFS */
  unsigned long high;
  unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                 */
  char fsid_res2;                      /* Reserved.                 */
  hyper fsid_id;                       /* Internal identifier       */
#define FSID_VER_INITIAL 1              /* Initial version */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];               /* Reserved for the future  */
  char fsid_reserved2[2];               /* Reserved for the future  */
} FS_ID;

typedef unsigned long   u_long;

struct timeval {
        long            tv_sec;         /* seconds */
        long            tv_usec;        /* microseconds */
};

typedef struct fs_status_t {
  char  fs_eye[4];                    /* Eye catcher               */
#define FS_EYE "FSST"
  short fs_len;                       /* Length of structure       */
  char  fs_ver;
#define FS_VER_INITIAL 1              /* Initial version */
```

```
  char  fs_flags;                     /* Flags                     */
#define FS_PERFINFO 0x80              /* Performance information in output status */

  hyper fs_id;                        /* Internal identifier       */
  struct timeval fs_cloneTime;        /* Time when this filesys made via clone or when last recloned */
  struct timeval fs_createTime;       /* Time when this filesys was created */
  struct timeval fs_updateTime;       /* Time when this filesys was last updated */
  struct timeval fs_accessTime;       /* Time when this filesys was last accessed */
  u_long fs_allocLimit;               /* Allocation limit for filesys in kilobytes*/
  u_long fs_allocUsage;               /* Amount of allocation used in kilobytes*/
  u_long fs_visQuotaLimit;            /* Visible filesystem quota in kilobytes*/
  u_long fs_visQuotaUsage;            /* How much quota is used in kilobytes*/
  u_long fs_accError;                  /* error to return for incompatible vnode ops */
  long  fs_accStatus;                 /* Operations currently being performed on file system */
  long  fs_states;                    /* State bits */
#define    FS_TYPE_RW        0x10000    /* read-write (ordinary) */
#define    FS_TYPE_BK        0x30000    /* ``.backup'' */
  long  fs_nodeMax;                   /* Maximum inode number used */
  long  fs_minQuota;
  long  fs_type;
  char  fs_threshold;                 /* Threshold for fsfull monitoring   */
  char  fs_increment;                 /* Increment for fsfull monitoring   */
  char  fs_mountstate;                /* Aggregate flags */
#define FS_NOT_MOUNTED 0              /* Filesys not mounted */
#define FS_MOUNTED_RW  1              /* Filesys mounted RW */
#define FS_MOUNTED_RO  2              /* Filesys mounted RO */
  char  fs_msglen;                    /* Length of status message   */
  char  fs_msg[128];                  /* Status message for filesystem */
  char  fs_aggrname[ZFS_MAX_AGGRNAME+1]; /* Name of aggregate I reside on */
  char  fs_reserved1[3];              /* Reserved for future use/alignment */
  unsigned long fs_reserved2[3];      /* reserved */
  u_long fs_InodeTbl;                 /*Amount of k used for the Filesystem Inode table*/
                  /*fs_InodeTbl is zero for all releases prior to r7 and non zero in r7 and above*/
  hyper fs_requests;                  /* Number of filesystem requests by users/applications */
  u_long   fs_reserved3;
  u_long   fs_reserved4;
  u_long   fs_reserved5;
  int      fs_pad1;
  u_long fs_diskFormatMajorVersion;   /* disk format major version */
  u_long fs_diskFormatMinorVersion;   /* disk format minor version */
  char  fs_reserved[80];             /* Reserved for future use */

} FS_STATUS;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID fs_id;
 FS_STATUS fs_status;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";          /* file system name to getstatus */

struct parmstruct myparmstruct;

FS_ID *idp = &(myparmstruct.fs_id);
FS_STATUS *fsp = &(myparmstruct.fs_status);

myparmstruct.myparms.opcode = FSOP_GETSTAT_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(FS_ID);
myparmstruct.myparms.parms[2] = 0;
```

```
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */
memset(fsp,0,sizeof(FS_STATUS));              /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fs_status.fs_eye[0], FS_EYE, 4);
myparmstruct.fs_status.fs_len = sizeof(FS_STATUS);
myparmstruct.fs_status.fs_ver = FS_VER_INITIAL;

memcpy(&myparmstruct.fs_id.fsid_eye,FSID_EYE,4);
myparmstruct.fs_id.fsid_len = sizeof(FS_ID);
myparmstruct.fs_id.fsid_ver = FSID_VER_INITIAL;
strcpy(myparmstruct.fs_id.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* File system operation   */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error getstatus file system %s\n", filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from getstatus was successful  */
     {
     printf("File system %s getstatus successful\n",filesystemname);
     printf("getstatus: fs_id=%d,,%d, clone_time=%s, create_time=%s, update_time=%s, access_time=%s\n",
                        myparmstruct.fs_status.fs_id.high,
                        myparmstruct.fs_status.fs_id.low,
                                    ctime(&myparmstruct.fs_status.fs_cloneTime.tv_sec),
                                     ctime(&myparmstruct.fs_status.fs_createTime.tv_sec),
                                       ctime(&myparmstruct.fs_status.fs_updateTime.tv_sec),
                                        ctime(&myparmstruct.fs_status.fs_accessTime.tv_sec));
     printf("getstatus: alloc_limit=%u, alloc_usage=%u, quota_limit=%u\n",
                        myparmstruct.fs_status.fs_allocLimit,
                                   myparmstruct.fs_status.fs_allocUsage,
                                                myparmstruct.fs_status.fs_visQuotaLimit);
     printf("getstatus: quota_usage=%u, accError=%u, accStatus=%x, states=%x\n",
                        myparmstruct.fs_status.fs_visQuotaUsage,
                                      myparmstruct.fs_status.fs_accError,
                                                  myparmstruct.fs_status.fs_accStatus,
                                                               myparmstruct.fs_status.fs_states);
     printf("getstatus: max_inode=%d, min_quota=%d, type=%d, fsfull_threshold=%d\n",
         myparmstruct.fs_status.fs_nodeMax,
                myparmstruct.fs_status.fs_minQuota,
                   myparmstruct.fs_status.fs_type,
                      myparmstruct.fs_status.fs_threshold);
     printf("getstatus: fsfull_increment=%d, mount_state=%d, msg_len=%d, msg=%s\n",
                        myparmstruct.fs_status.fs_increment,
                                     myparmstruct.fs_status.fs_mountstate,
                                                  myparmstruct.fs_status.fs_msglen,
                                                               myparmstruct.fs_status.fs_msg);
     printf("getstatus: aggrname=%s\n", myparmstruct.fs_status.fs_aggrname);
     printf("getstatus: inode_table_k=%d, fs_requests=%d,,%d\n",
                        myparmstruct.fs_status.fs_InodeTbl,
                            myparmstruct.fs_status.fs_requests.high,
                              myparmstruct.fs_status.fs_requests.low);
     printf("getstatus: version=%d.%d\n",
                        myparmstruct.fs_status.fs_diskFormatMajorVersion,
```

```
                                myparmstruct.fs_status.fs_diskFormatMinorVersion);

     }

return 0;
}
```

Example 2 - Using FS_ID2

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>
#include <time.h>       /* ctime  */

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_GETSTAT_PARMDATA  142

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper {             /* This is a 64 bit integer to zFS */
  unsigned long high;
  unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id2_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                 */
  char fsid_res2;                      /* Reserved.                 */
  hyper fsid_id;                       /* Internal identifier       */
#define FSID_VER_2 2                   /* version for FS_ID2 */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated */
  char fsid_reserved[49];              /* Reserved for the future  */
} FS_ID2;

typedef unsigned long   u_long;

struct timeval {
        long            tv_sec;         /* seconds */
        long            tv_usec;        /* microseconds */
};

typedef struct fs_status_t {
  char  fs_eye[4];                     /* Eye catcher               */
#define FS_EYE "FSST"
  short fs_len;                        /* Length of structure       */
  char  fs_ver;
#define FS_VER_INITIAL 1               /* Initial version */
  char  fs_flags;                      /* Flags                     */
#define FS_PERFINFO 0x80               /* Performance information in output status */
  hyper fs_id;                         /* Internal identifier       */
  struct timeval fs_cloneTime;         /* Time when this filesys made via clone or when last recloned */
  struct timeval fs_createTime;        /* Time when this filesys was created */
  struct timeval fs_updateTime;        /* Time when this filesys was last updated */
```

```
  struct timeval fs_accessTime;        /* Time when this filesys was last accessed */
  u_long fs_allocLimit;                /* Allocation limit for filesys in kilobytes*/
  u_long fs_allocUsage;                /* Amount of allocation used in kilobytes*/
  u_long fs_visQuotaLimit;             /* Visible filesystem quota in kilobytes*/
  u_long fs_visQuotaUsage;             /* How much quota is used in kilobytes*/
  u_long fs_accError;                   /* error to return for incompatible vnode ops */
  long  fs_accStatus;                  /* Operations currently being performed on file system */
  long  fs_states;                     /* State bits */
#define    FS_TYPE_RW        0x10000    /* read-write (ordinary) */
#define    FS_TYPE_BK        0x30000    /* ``.backup'' */
  long  fs_nodeMax;                    /* Maximum inode number used */
  long  fs_minQuota;
  long  fs_type;
  char  fs_threshold;                  /* Threshold for fsfull monitoring   */
  char  fs_increment;                  /* Increment for fsfull monitoring   */
  char  fs_mountstate;                 /* Aggregate flags */
#define FS_NOT_MOUNTED 0               /* Filesys not mounted */
#define FS_MOUNTED_RW  1               /* Filesys mounted RW */
#define FS_MOUNTED_RO  2               /* Filesys mounted RO */
  char  fs_msglen;                     /* Length of status message   */
  char  fs_msg[128];                   /* Status message for filesystem */
  char  fs_aggrname[ZFS_MAX_AGGRNAME+1]; /* Name of aggregate I reside on */
  char  fs_reserved1[3];               /* Reserved for future use/alignment */
  unsigned long fs_reserved2[3];       /* reserved */
  u_long fs_InodeTbl;                  /*Amount of k used for the Filesystem Inode table*/
                  /*fs_InodeTbl is zero for all releases prior to r7 and non zero in r7 and above*/
  hyper fs_requests;                   /* Number of filesystem requests by users/applications */
  u_long   fs_reserved3;
  u_long   fs_reserved4;
  u_long   fs_reserved5;
  int      fs_pad1;
  u_long fs_diskFormatMajorVersion;    /* disk format major version */
  u_long fs_diskFormatMinorVersion;    /* disk format minor version */
  char  fs_reserved[80];              /* Reserved for future use */

} FS_STATUS;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID2 fs_id2;
 FS_STATUS fs_status;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.MNT.FS3";           /* file system name to getstatus */

struct parmstruct myparmstruct;

FS_ID2 *idp = &(myparmstruct.fs_id2);
FS_STATUS *fsp = &(myparmstruct.fs_status);

myparmstruct.myparms.opcode = FSOP_GETSTAT_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(FS_ID2);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID2));                  /* Ensure reserved fields are 0 */
memset(fsp,0,sizeof(FS_STATUS));              /* Ensure reserved fields are 0 */
```

```
memcpy(&myparmstruct.fs_status.fs_eye[0], FS_EYE, 4);
myparmstruct.fs_status.fs_len = sizeof(FS_STATUS);
myparmstruct.fs_status.fs_ver = FS_VER_INITIAL;

memcpy(&myparmstruct.fs_id2.fsid_eye,FSID_EYE,4);
myparmstruct.fs_id2.fsid_len = sizeof(FS_ID2);
myparmstruct.fs_id2.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fs_id2.fsid_mtname,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* File system operation   */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error getstatus file system %s\n", filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from getstatus was successful  */
     {
     printf("File system %s getstatus successful\n",filesystemname);
     printf("getstatus: fs_id=%d,,%d, clone_time=%s, create_time=%s, update_time=%s, access_time=%s\n",
        myparmstruct.fs_status.fs_id.high,
            myparmstruct.fs_status.fs_id.low,
                ctime(&myparmstruct.fs_status.fs_cloneTime.tv_sec),
                   ctime(&myparmstruct.fs_status.fs_createTime.tv_sec),
                      ctime(&myparmstruct.fs_status.fs_updateTime.tv_sec),
                          ctime(&myparmstruct.fs_status.fs_accessTime.tv_sec));
     printf("getstatus: alloc_limit=%u, alloc_usage=%u, quota_limit=%u\n",
                       myparmstruct.fs_status.fs_allocLimit,
                                 myparmstruct.fs_status.fs_allocUsage,
                                           myparmstruct.fs_status.fs_visQuotaLimit);
     printf("getstatus: quota_usage=%u, accError=%u, accStatus=%x, states=%x\n",
                       myparmstruct.fs_status.fs_visQuotaUsage,
                                    myparmstruct.fs_status.fs_accError,
                                                myparmstruct.fs_status.fs_accStatus,
                                                             myparmstruct.fs_status.fs_states);
     printf("getstatus: max_inode=%d, min_quota=%d, type=%d, fsfull_threshold=%d\n",
              myparmstruct.fs_status.fs_nodeMax,
                         myparmstruct.fs_status.fs_minQuota,
                                    myparmstruct.fs_status.fs_type,
                                         myparmstruct.fs_status.fs_threshold);
     printf("getstatus: fsfull_increment=%d, mount_state=%d, msg_len=%d, msg=%s\n",
                       myparmstruct.fs_status.fs_increment,
                                   myparmstruct.fs_status.fs_mountstate,
                                               myparmstruct.fs_status.fs_msglen,
                                                          myparmstruct.fs_status.fs_msg);
     printf("getstatus: aggrname=%s\n", myparmstruct.fs_status.fs_aggrname);
     printf("getstatus: inode_table_k=%d, fs_requests=%d,,%d\n",
                       myparmstruct.fs_status.fs_InodeTbl,
                                   myparmstruct.fs_status.fs_requests.high,
                                     myparmstruct.fs_status.fs_requests.low);
     printf("getstatus: version=%d.%d\n",
                       myparmstruct.fs_status.fs_diskFormatMajorVersion,
                                 myparmstruct.fs_status.fs_diskFormatMinorVersion);

     }

return 0;
}
```

List Systems

Purpose

The List Systems subcommand call is used to retrieve the system names that are part of the zFS XCF group.

Format

```
syscall_parmlist
   opcode                  174    CFGOP_LSSYS
   parms[0]                size of buffer
   parms[1]                offset to buffer
   parms[2]                offset to size
   parms[3]                0
   parms[4]                0
   parms[5]                0
   parms[6]                0
buffer                     char[ ]
size                       int

Return_value    0 if request successful, -1 if it is not successful

Return_code

  E2BIG         Data to return is too large for buffer supplied
  EINTR         ZFS is shutting down
  EMVSERR       Internal error
  ERANGE        No systems to return

Reason_code

  0xEFnnxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

List Systems is used to retrieve the system names that are part of the zFS XCF group.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

Query sysplex_state

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_CONFIG  0x40000006
#define CFGOP_LSSYS                     174    /* List names of systems in the sysplex */

#define E2BIG     145                 /* data to return is too big for buffer */
#define ERANGE      2                 /* there were no systems to return      */
```

```
typedef struct system_name_t {
                   char  sys_name[9];  /* 8 byte name, null terminated       */
                } SYSTEM_NAME;

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

struct parmstruct
{
    syscall_parmlist myparms;
 /*   SYSTEM_NAME  buffer[32];    */          /* output buffer for sysnames */
    int              size;
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;

    struct parmstruct *myp = &myparmstruct;
    int mypsize, buflen;

    myparmstruct.myparms.opcode = CFGOP_LSSYS;
    myparmstruct.myparms.parms[0] = 0;                          /* size of buffer   */
    myparmstruct.myparms.parms[1] = 0;                          /* offset to buffer */
    myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist);  /* offset to size (required size) */
    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    BPX1PCT("ZFS     ",
            ZFSCALL_CONFIG,           /* Config query operation  */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */

    if( bpxrv < 0 )
    {
        if( bpxrc == E2BIG )
        {
            buflen = myparmstruct.size;          /* Get buffer size needed  */
            mypsize = sizeof(syscall_parmlist) + buflen + sizeof(myparmstruct.size);
            myp = (struct parmstruct *) malloc ((long) mypsize);
            memset(myp, 0, mypsize);

            myp->myparms.opcode = CFGOP_LSSYS;
            myp->myparms.parms[0] = buflen;                     /* size of buffer   */
            myp->myparms.parms[1] = sizeof(syscall_parmlist);  /* offset to buffer */
            myp->myparms.parms[2] = sizeof(syscall_parmlist) + buflen;  /* offset to size */
            myp->myparms.parms[3] = 0;
            myp->myparms.parms[4] = 0;
            myp->myparms.parms[5] = 0;
            myp->myparms.parms[6] = 0;

            BPX1PCT("ZFS     ",
                    ZFSCALL_CONFIG,           /* Config query operation  */
```

```
                mypsize,                /* Length of Argument      */
                (char *) myp,           /* Pointer to Argument     */
                &bpxrv,                 /* Pointer to Return_value */
                &bpxrc,                 /* Pointer to Return_code  */
                &bpxrs);                /* Pointer to Reason_code  */
            if( bpxrv == 0 )
            {

                int   j,syscount;
                SYSTEM_NAME *syslist;
                int *sizep;

                sizep=(int *)((int)myp + sizeof(syscall_parmlist) + buflen);

                syslist=(SYSTEM_NAME *)((int)myp + sizeof(syscall_parmlist));
                syscount=(*sizep)/sizeof(SYSTEM_NAME);
                for (j=1; j <= syscount; j++)
                {
                    printf("%-8.8s\n", syslist->sys_name);
                    syslist++;
                }

                free(myp);
            }
            else  /* lssys failed with large enough buffer */
            {
                if( bpxrc == ERANGE )
                {
                    printf("No systems to display\n");
                }
                else
                {
                    printf("Error on lssys with large enough buffer\n");
                    printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
                }
                free(myp);
                return bpxrc;
            }
        }
        else  /* error was not E2BIG on the original BPX1PCT */
        {
            if( bpxrc == ERANGE )
            {
                printf("No systems to display from original BPX1PCT\n");
            }
            else
            {
                printf("Error on lssys trying to get required size\n");
                printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
            }
            return bpxrc;

        }
    }
    else /* asking for buffer size gave rv = 0; maybe there is no data */
    {
        if( myparmstruct.size == 0 )
        {
            printf("No data\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        }
        else   /* No, there was some other problem with getting the size needed */
        {
            printf("Error getting size required\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
```

```
        }
    }
    return 0;
}
```

Query Config Option

Purpose

The Query Config Option is a set of subcommand calls (that are configuration operations) that retrieve the current value for a particular configuration setting. Each one returns the particular configuration setting as a character string.

The following Format and Example use the CFGOP_QUERY_ADM_THREADS subcommand. The other query subcommands (refer to “Configuration commands” on page 137) would operate in a similar manner. That is, each of them would return the configuration setting as a character string in the co_string field.

Format

```
syscall_parmlist
   opcode                         180      CFGOP_QUERY_ADM_THREADS
   parms[0]                       offset to CFG_OPTION
   parms[1]                       offset to system name (optional)
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
CFG_OPTION
   co_eye                         char[4]    "CFOP"
   co_len                         short      sizeof(CFG_OPTION)
   co_ver                         char       1
   co_string                      char[81]   0
   co_value_reserved              int        0
   co_reserved                    char[24]   0
systemname                        char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate could not be quiesced
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

Query Config Option subcommands are used to retrieve the current value of a particular configuration option. Each subcommand retrieves one configuration as a character string.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

Set Config Option

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_CONFIG  0x40000006
#define CFGOP_QUERY_ADM_THREADS    180    /* query number of admin threads */

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct config_option_t {
  char co_eye[4];               /* Eye catcher */
#define CFGO_EYE "CFOP"
  short co_len;                 /* Length of structure */
  char  co_ver;                 /* Version of structure */
#define CO_VER_INITIAL 1        /* Initial version */
#define CO_SLEN 80              /* Sizeof string */
  char  co_string[CO_SLEN+1];   /* String value for option must be 0 terminated */
  int   co_value[4];            /* Place for integer values */
  char  co_reserved[24];        /* Reserved for future use */
} CFG_OPTION;

struct parmstruct {
  syscall_parmlist myparms;
  CFG_OPTION co;
  char system[9];
} myparmstruct;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;

CFG_OPTION *coptr = &(myparmstruct.co);


/* This next field should only be set if parms[1] is non-zero */
/* strcpy(myparmstruct.system,"DCEIMGVN");  */  /* set system to query */

myparmstruct.myparms.opcode = CFGOP_QUERY_ADM_THREADS;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;

/* Only specify a non-zero offset for the next field (parms[1]) if           */
/* you are running z/OS 1.7 and above, and                                    */
/* you want to configquery to a different system                             */

/* myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(CFG_OPTION);  */

myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;
```

```
memset(coptr,0,sizeof(CFG_OPTION));
memcpy(coptr->co_eye,CFGO_EYE,4);
coptr->co_ver=CO_VER_INITIAL;
coptr->co_len=(int) sizeof(CFG_OPTION);

     BPX1PCT("ZFS     ",
             ZFSCALL_CONFIG,           /* Config operation        */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */
  if (bpxrv < 0) {
     printf("Error querying config -adm_threads, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
  }
  else {
     printf("Config query -adm_threads = %s\n",myparmstruct.co.co_string);
  }
  return 0;
}
```

Quiesce Aggregate

Purpose

The Quiesce Aggregate subcommand call is an aggregate operation that quiesces a multi-file system aggregate on a system. This quiesces activity on the aggregate and all its file systems.

Format

```
syscall_parmlist
   opcode                          132      AGOP_QUIESCE_PARMDATA
   parms[0]                        offset to AGGR_ID
   parms[1]                        offset to handle returned by quiesce
   parms[2]                        0
   parms[3]                        0
   parms[4]                        0
   parms[5]                        0
   parms[6]                        0
AGGR_ID
   aid_eye                         char[4]    "AGID"
   aid_len                         char       sizeof(AGGR_ID)
   aid_ver                         char       1
   aid_name                        char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                    char[33]   0
quiesce_handle                     long

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate could not be quiesced
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

Quiesce Aggregate is used to suspend activity on an aggregate. All activity on file systems contained in the aggregate that are mounted is also suspended. This would normally be used prior to backing up an aggregate. The aggregate must be attached in order to be quiesced. The quiesce operation returns a quiesce handle that must be supplied on the unquiesce call.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Unquiesce Aggregate

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_QUIESCE_PARMDATA  132

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye catcher */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure */
  char aid_ver;                       /* Version */
#define AID_VER_INITIAL 1             /* Initial version */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* Name, null terminated    */
  char aid_reserved[33];              /* Reserved for the future  */
} AGGR_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
 long quiesce_handle;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";
long save_quiesce_handle;

struct parmstruct myparmstruct;

AGGR_ID *idp = &(myparmstruct.aggr_id);

myparmstruct.myparms.opcode = AGOP_QUIESCE_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(AGGR_ID);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(&myparmstruct.aggr_id,0,sizeof(AGGR_ID));   /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.aggr_id,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
```

```
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error quiescing aggregate %s\n", aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from quiesce was successful  */
     {
     printf("Aggregate %s quiesced successfully, quiescehandle=%d\n",
     aggrname,myparmstruct.quiesce_handle);
     save_quiesce_handle = myparmstruct.quiesce_handle;
     }
return 0;
}
```

Rename File System

Purpose

The Rename File System subcommand call is a file system operation that renames a file system.

You can use an FS_ID or an FS_ID2 as input for the old zFS file system name or the new zFS file system name (that is, the fsid_name).

Format

```
syscall_parmlist
   opcode                      140      FSOP_RENAME_PARMDATA
   parms[0]                    offset to FS_ID (Old Name)
   parms[1]                    offset to FS_ID (New Nakme)
   parms[2]                    0
   parms[3]                    0
   parms[4]                    0
   parms[5]                    0
   parms[6]                    0
FS_ID or FS_ID2                /* Old File System Name */
   fsid_eye                    char[4]    "FSID"
   fsid_len                    short      sizeof(FS_ID)
   fsid_ver                    char       1
   fsid_res1                   char       0
   fsid_res2                   char       0
   fsid_id
     high                      unsigned long  0
     low                       unsigned long  0
   fsid_aggrname               char[45]   0
   fsid_name                   char[45]   "OMVS.PRV.FS3"
   fsid_reserved               char[32]   0
   fsid_reserved2              char[2]    0
FS_ID2 or FS_ID                /* Old File System Name */
   fsid_eye                    char[4]    "FSID"
   fsid_len                    short      sizeof(FS_ID2)
   fsid_ver                    char       2
   fsid_res1                   char       0
   fsid_res2                   char       0
   fsid_id
     high                      unsigned long  0
     low                       unsigned long  0
   fsid_aggrname               char[45]   0
   fsid_name                   char[45]   0
   fsid_mtname                 char[45]   "OMVS.PRV.FS3"
   fsid_reserved               char[49]   0
FS_ID or FS_ID2                         /* New File System Name */
   fsid_eye                    char[4]    "FSID"
   fsid_len                    short      sizeof(FS_ID)
   fsid_ver                    char       1
   fsid_res1                   char       0
   fsid_res2                   char       0
   fsid_id
     high                      unsigned long  0
     low                       unsigned long  0
   fsid_aggrname               char[45]   0
   fsid_name                   char[45]   "OMVS.PRV.FS4"
   fsid_reserved               char[32]   0
   fsid_reserved2              char[2]    0
FS_ID2 or FS_ID                /* New File System Name */
   fsid_eye                    char[4]    "FSID"
   fsid_len                    short      sizeof(FS_ID2)
   fsid_ver                    char       2
   fsid_res1                   char       0
   fsid_res2                   char       0
```

```
   fsid_id
     high                          unsigned long  0
     low                           unsigned long  0
   fsid_aggrname                   char[45]   0
   fsid_name                       char[45]   0
   fsid_mtname                     char[45]   "OMVS.PRV.FS4"
   fsid_reserved                   char[49]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate containing file system is quiesced
  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request
  EROFS         Aggregate is attached as read only

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate that contains the file system to be renamed must be attached.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Clone File System

Restrictions

A backup file system cannot be renamed by itself. You must rename the read-write file system (which renames both the read-write and the backup file systems). You cannot rename a read-write file system to an name that ends in **.bak**. This is reserved for backup file systems. If a backup file system exists, you cannot rename a read-write file system to a name that is longer than 40 characters. The file system(s) to be renamed cannot be mounted. The aggregate containing the file system to be renamed cannot be quiesced or attached as read-only. If you specify an aggregate name in the old file system name FS_ID and in the new file system name FS_ID, they must be the same.

When using an FS_ID2 for the old file system name, you cannot specify the z/OS UNIX file system name (fsid_mtname) because the file system to be renamed cannot be mounted. When using the FS_ID2 for the new file system name, you cannot specify the z/OS UNIX file system name (fsid_mtname) because the API needs the new zFS file system name.

Examples

Example 1 - Using FS_ID

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_FILESYS   0x40000004
```

```
#define FSOP_RENAME_PARMDATA  140

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform            */
  int parms[7];             /* Specific to type of operation,       */
                            /* provides access to the parms         */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
#define FSID_VER_INITIAL 1             /* Initial version           */
  char fsid_res1;                      /* Reserved.                 */
  char fsid_res2;                      /* Reserved.                 */
  hyper fsid_id;                       /* Internal identifier       */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];              /* Reserved for the future  */
  char fsid_reserved2[2];              /* Reserved for the future  */
} FS_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID fsid_old;
 FS_ID fsid_new;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char old_filesystemname[45] = "OMVS.PRV.FS3";
char new_filesystemname[45] = "OMVS.PRV.FS4";

struct parmstruct myparmstruct;

FS_ID *idop = &(myparmstruct.fsid_old);
FS_ID *idnp = &(myparmstruct.fsid_new);

myparmstruct.myparms.opcode = FSOP_RENAME_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(FS_ID);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idop,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */
memset(idnp,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid_old.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid_old.fsid_len = sizeof(FS_ID);
myparmstruct.fsid_old.fsid_ver = FSID_VER_INITIAL;
```

Rename File System

```
strcpy(myparmstruct.fsid_old.fsid_name,old_filesystemname);

memcpy(&myparmstruct.fsid_new.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid_new.fsid_len = sizeof(FS_ID);
myparmstruct.fsid_new.fsid_ver = FSID_VER_INITIAL;
strcpy(myparmstruct.fsid_new.fsid_name,new_filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* File system operation   */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error renaming file system %s to %s\n",old_filesystemname, new_filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from rename file system was successful  */
     {
     printf("File system %s was renamed to %s successfully\n",old_filesystemname, new_filesystemname);
     }
return 0;
}
```

Example 2 - Using FS_ID2

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_RENAME_PARMDATA  140

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
#define FSID_VER_INITIAL 1             /* Initial version            */
  char fsid_res1;                      /* Reserved.                  */
  char fsid_res2;                      /* Reserved.                  */
  hyper fsid_id;                       /* Internal identifier        */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];               /* Reserved for the future  */
  char fsid_reserved2[2];               /* Reserved for the future  */
} FS_ID;
```

```
typedef struct fs_id2_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                */
  char fsid_res2;                      /* Reserved.                */
  hyper fsid_id;                       /* Internal identifier      */
#define FSID_VER_2       2           /* version for R14 */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated    */
  char fsid_reserved[49];              /* Reserved for the future  */
} FS_ID2;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID2 fsid_old;
 FS_ID2 fsid_new;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char old_filesystemname[45] = "OMVS.PRV.FS3";
char new_filesystemname[45] = "OMVS.PRV.FS4";

struct parmstruct myparmstruct;

FS_ID2 *idop = &(myparmstruct.fsid_old);
FS_ID2 *idnp = &(myparmstruct.fsid_new);

myparmstruct.myparms.opcode = FSOP_RENAME_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(FS_ID2);
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idop,0,sizeof(FS_ID2));                  /* Ensure reserved fields are 0 */
memset(idnp,0,sizeof(FS_ID2));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid_old.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid_old.fsid_len = sizeof(FS_ID2);
myparmstruct.fsid_old.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fsid_old.fsid_name,old_filesystemname);

memcpy(&myparmstruct.fsid_new.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid_new.fsid_len = sizeof(FS_ID2);
myparmstruct.fsid_new.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fsid_new.fsid_name,new_filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* File system operation   */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */
```

```
if (bpxrv < 0)
     {
     printf("Error renaming file system %s to %s\n",old_filesystemname, new_filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from rename file system was successful  */
     {
     printf("File system %s was renamed to %s successfully\n",old_filesystemname, new_filesystemname);
     }
return 0;

}
```

Set Config Option

Purpose

The Set Config Option is a set of subcommand calls (that are configuration operations) that set the current value for a particular configuration setting. Each one sets the particular configuration setting from input specified as a character string.

The following Format and Example use the CFGOP_ADM_THREADS subcommand. The other set subcommands (refer to “Configuration commands” on page 137) would operate in a similar manner. That is, each of them would set the configuration setting from the character string in the co_string field.

Format

```
syscall_parmlist
   opcode                          150      CFGOP_ADM_THREADS
   parms[0]                        offset to CFG_OPTION
   parms[1]                        offset to system name (optional)
   parms[2]                        0
   parms[3]                        0
   parms[4]                        0
   parms[5]                        0
   parms[6]                        0
CFG_OPTION
   co_eye                          char[4]    "CFOP"
   co_len                          short      sizeof(CFG_OPTION)
   co_ver                          char       1
   co_string                       char[81]   "15"   /* New value for adm_threads  */
   co_value_reserved               int        0
   co_reserved                     char[24]   0
systemname                         char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate could not be quiesced
  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

Set Config Option subcommands are used to set the current value of a particular configuration option. Each subcommand sets one configuration from a character string.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Query Config Option

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_CONFIG  0x40000006
#define    CFGOP_ADM_THREADS          150    /* Set number of admin threads */


typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct config_option_t {
  char co_eye[4];               /* Eye catcher */
#define CFGO_EYE "CFOP"
  short co_len;                 /* Length of structure */
  char  co_ver;                 /* Version of structure */
#define CO_VER_INITIAL 1        /* Initial version */
#define CO_SLEN 80              /* Sizeof string */
  char  co_string[CO_SLEN+1];   /* String value for option must be 0 terminated */
  int   co_value[4];            /* Place for integer values */
  char  co_reserved[24];        /* Reserved for future use */
} CFG_OPTION;

struct parmstruct {
  syscall_parmlist myparms;
  CFG_OPTION co;
  char system[9];
} myparmstruct;

char new_adm_threads[CO_SLEN+1]="20";           /* New adm_threads value   */

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;

CFG_OPTION *coptr = &(myparmstruct.co);


/* This next field should only be set if parms[1] is non-zero */
/* strcpy(myparmstruct.system,"DCEIMGVN");  */  /* set system to change */

myparmstruct.myparms.opcode = CFGOP_ADM_THREADS;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = 0;

/* Only specify a non-zero offset for the next field (parms[1]) if            */
/* you are running z/OS 1.7 and above, and                                     */
/* you want to configquery to a different system                              */

/* myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(CFG_OPTION);  */

myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
```

```
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(coptr,0,sizeof(CFG_OPTION));
memcpy(coptr->co_eye,CFGO_EYE,4);
coptr->co_ver=CO_VER_INITIAL;
coptr->co_len=(int) sizeof(CFG_OPTION);

strcpy(coptr->co_string,new_adm_threads);  /* set new adm_thread value */

     BPX1PCT("ZFS     ",
             ZFSCALL_CONFIG,           /* Config operation        */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */
  if (bpxrv < 0) {
     printf("Error setting config -adm_threads, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
  }
  else {
     printf("Config -adm_threads = %s\n",myparmstruct.co.co_string);
  }
  return 0;
}
```

Set File System Quota

Purpose

The Set File System Quota subcommand call is a file system operation that sets the quota for the file system.

You can use an FS_ID or an FS_ID2 as input.

Format

```
syscall_parmlist
   opcode                         141      FSOP_SETQUOTA_PARMDATA
   parms[0]                       offset to FS_ID or FS_ID2
   parms[1]                       7000     quota
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
FS_ID or FS_ID2
   fsid_eye                       char[4]    "FSID"
   fsid_len                       short      sizeof(FS_ID)
   fsid_ver                       char       1
   fsid_res1                      char       0
   fsid_res2                      char       0
   fsid_id
     high                         unsigned long  0
     low                          unsigned long  0
   fsid_aggrname                  char[45]   0
   fsid_name                      char[45]   "OMVS.PRV.FS3"
   fsid_reserved                  char[32]   0
   fsid_reserved2                 char[2]    0
FS_ID2 or FS_ID
   fsid_eye                       char[4]    "FSID"
   fsid_len                       short      sizeof(FS_ID2)
   fsid_ver                       char       2
   fsid_res1                      char       0
   fsid_res2                      char       0
   fsid_id
     high                         unsigned long  0
     low                          unsigned long  0
   fsid_aggrname                  char[45]   0
   fsid_name                      char[45]   "OMVS.PRV.FS3"
   fsid_mtname                    char[45]   0
   fsid_reserved                  char[49]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EBUSY         Aggregate containing file system is quiesced
  EINTR         ZFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request
  EROFS         Aggregate is attached as read only

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The aggregate containing the file system to have its quota set must be attached. A quota can be decreased as long as the quota usage has not exceeded the new quota.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

List File System Status

Restrictions

You cannot set the quota of a backup file system. The aggregate containing the file system to have its quota set cannot be quiesced or attached as read-only. The minimum value for quota is 128 (for 128 K bytes).

Examples

Example 1 - Using FS_ID

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_SETQUOTA_PARMDATA  141

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform             */
  int parms[7];             /* Specific to type of operation,        */
                            /* provides access to the parms          */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                   /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                      /* Length of this structure */
  char fsid_ver;                      /* Version */
#define FSID_VER_INITIAL 1            /* Initial version           */
  char fsid_res1;                     /* Reserved.                 */
  char fsid_res2;                     /* Reserved.                 */
  hyper fsid_id;                      /* Internal identifier       */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];             /* Reserved for the future  */
  char fsid_reserved2[2];             /* Reserved for the future  */
} FS_ID;

struct parmstruct
{
```

```
 syscall_parmlist myparms;
 FS_ID fsid;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";
int quota;

struct parmstruct myparmstruct;

FS_ID *idp = &(myparmstruct.fsid);
quota = 7000;

myparmstruct.myparms.opcode = FSOP_SETQUOTA_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = quota;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID);
myparmstruct.fsid.fsid_ver = FSID_VER_INITIAL;
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* File system operation   */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error setting quota of %d for file system %s\n",quota, filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from set quota of file system was successful  */
     {
     printf("File system %s had its quota set to %d successfully\n",filesystemname, quota);
     }
return 0;
}
```

Example 2 - Using FS_ID2

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_FILESYS   0x40000004
#define FSOP_SETQUOTA_PARMDATA  141

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform            */
  int parms[7];             /* Specific to type of operation,       */
```

```
                          /* provides access to the parms          */
                          /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper { /* unsigned 64 bit integers */
    unsigned long high;
    unsigned long low;
} hyper;

#define ZFS_MAX_AGGRNAME 44
#define ZFS_MAX_FSYSNAME 44

typedef struct fs_id_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
#define FSID_VER_INITIAL 1             /* Initial version            */
  char fsid_res1;                      /* Reserved.                  */
  char fsid_res2;                      /* Reserved.                  */
  hyper fsid_id;                       /* Internal identifier        */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_reserved[32];              /* Reserved for the future  */
  char fsid_reserved2[2];              /* Reserved for the future  */
} FS_ID;

typedef struct fs_id2_t {
  char fsid_eye[4];                    /* Eye catcher */
#define FSID_EYE "FSID"
  char fsid_len;                       /* Length of this structure */
  char fsid_ver;                       /* Version */
  char fsid_res1;                      /* Reserved.                  */
  char fsid_res2;                      /* Reserved.                  */
  hyper fsid_id;                       /* Internal identifier        */
#define FSID_VER_2       2              /* Second version  */
  char fsid_aggrname[ZFS_MAX_AGGRNAME+1]; /* Aggregate name, can be NULL string  */
  char fsid_name[ZFS_MAX_FSYSNAME+1];   /* Name, null terminated    */
  char fsid_mtname[ZFS_MAX_FSYSNAME+1]; /* Mount name, null terminated     */
  char fsid_reserved[49];              /* Reserved for the future  */
} FS_ID2;

struct parmstruct
{
 syscall_parmlist myparms;
 FS_ID2 fsid;
 } ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char filesystemname[45] = "OMVS.PRV.FS3";
int quota;

struct parmstruct myparmstruct;

FS_ID2 *idp = &(myparmstruct.fsid);
quota = 7000;

myparmstruct.myparms.opcode = FSOP_SETQUOTA_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = quota;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
```

```
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(idp,0,sizeof(FS_ID2));                  /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.fsid.fsid_eye, FSID_EYE, 4);
myparmstruct.fsid.fsid_len = sizeof(FS_ID2);
myparmstruct.fsid.fsid_ver = FSID_VER_2;
strcpy(myparmstruct.fsid.fsid_name,filesystemname);

     BPX1PCT("ZFS     ",
             ZFSCALL_FILESYS,          /* File system operation   */
             sizeof(myparmstruct),     /* Length of Argument      */
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error setting quota of %d for file system %s\n",quota, filesystemname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from set quota of file system was successful  */
     {
     printf("File system %s had its quota set to %d successfully\n",filesystemname, quota);
     }
return 0;
}
```

Statistics Directory Cache Information

Purpose

The statistics directory cache information subcommand call is a performance statistics operation that returns directory cache counters.

Format

```
syscall_parmlist
   opcode               249             STATOP_DIR_CACHE
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
API_DIR_STATS
   ad_eye               char[4]         "ADIR"
   ad_size              short           size of output
   ad_version           char            version
   ad_reserved1         char            reserved byte
|  ad_reserved          int             always zero
   ad_buffers           int             number of buffers in the cache
   ad_buffersize        int             size of each buffer in K bytes
   ad_res1              int             reserved
|  ad_reserved          int             reserved
|  ad_requests          int             requests to the cache
|  ad_reserved          int             reserved
|  ad_hits              int             hits in the cache
|  ad_reserved          int             reserved
|  ad_discards          int             discards of data from the cache
   ad_reserved2         int[10]         reserved
systemname              char[9]

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         zFS is shutting down
  EINVAL        Invalid parameter list
  EMVSERR       Internal error occurred
  E2BIG         Information too big for buffer supplied

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of requests, hits and discards from the directory cache.

Privilege Required

None.

Related Services

Statistics Vnode Cache Information

Statistics Metadata Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_DIR_CACHE                249   /* Directory cache stats */

#define u_long unsigned long

#define CONVERT_RATIO_TO_INTS(RATIO, INTEGER, DECIMAL)             \
{                                                                  \
  INTEGER = (int)RATIO;                                            \
  DECIMAL = (int)((RATIO - (double)INTEGER) * (double)1000.0);     \
}

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper {
  unsigned long high;         /* unsigned long reserved */
  unsigned long low;
} hyper;

typedef struct API_DIR_STATS_t  {
  char     ad_eye[4];          /* Eye catcher = ADIR */
#define DS_EYE "ADIR"
  short    ad_size;            /* Size of output structure */
  char     ad_version;         /* Version of stats */
#define DS_VER_INITIAL 1       /* First version of log stats */
  char     ad_reserved1;       /* Reserved byte, 0 in version 1 */
  hyper    ad_buffers;         /* Number of buffers in cache */
  int      ad_buffsize;        /* Size of each buffer in K bytes */
  int      ad_res1;            /* Reserved for future use, zero in version 1 */
  hyper    ad_requests;        /* Requests to the cache */
  hyper    ad_hits;            /* Hits in the cache */
  hyper    ad_discards;        /* Discards of data from cache */
  int      ad_reserved2[10];   /* Reserved for future use */
} API_DIR_STATS;

/* reset timestamp */
typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
```

```
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;


struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    API_DIR_STATS mystats;
    char  systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;
    double temp_ratio;
    int whole,decimal;

    STAT_API *stapptr = &(myparmstruct.myapi);
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_DIR_CACHE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the directory cache statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) + sizeof(API_DIR_STATS); */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(API_DIR_STATS);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */
```

```
    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,           /* Perf statistics operation        */
            sizeof(myparmstruct),    /* Length of Argument      */
            (char *) &myparmstruct,  /* Pointer to Argument     */
            &bpxrv,                  /* Pointer to Return_value */
            &bpxrc,                  /* Pointer to Return_code  */
            &bpxrs);                 /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying directory cache, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {

        printf("%55s\n","Directory Backing Caching Statistics");
        printf("      \n");
        printf("Buffers    (K bytes)  Requests     Hits    Ratio   Discards\n");
        printf("---------- --------- ---------- ---------- ------ ----------\n");

        temp_ratio = (myparmstruct.mystats.ad_requests.low == 0) ? 0.0 :
            ((double)myparmstruct.mystats.ad_hits.low)/myparmstruct.mystats.ad_requests.low;
        temp_ratio *= 100.0;
        CONVERT_RATIO_TO_INTS(temp_ratio,whole, decimal);
        decimal = decimal / 100;   /* Just want tenths */

        printf("%10d %9d %10d %10d %3d.%1.1d%% %10d\n",
               myparmstruct.mystats.ad_buffers.low,
               myparmstruct.mystats.ad_buffers.low * myparmstruct.mystats.ad_buffsize,
               myparmstruct.mystats.ad_requests.low, myparmstruct.mystats.ad_hits.low,
               whole, decimal, myparmstruct.mystats.ad_discards.low);
        printf("      \n");

        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics iobyaggr Information

Purpose

This is information about the number of reads and writes and the number of bytes transferred for each aggregate.

Format

```
syscall_parmlist
   opcode               244             STATOP_IOBYAGGR
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
IO_REPORT2_GRAND_TOTALS
   io_count             int             count of IO_REPORT2 lines
   grand_total_reads    unsigned long   total reads
   grand_total_writes   unsigned long   total writes
   grand_total_read_bytes unsigned long  total bytes read (in kilobytes)
   grand_total_write_bytes unsigned long total bytes written (in kilobytes)
   grand_total_devices   unsigned long  total number of aggregates
   total_number_waits_for_io unsigned long total number of waits for I/O
   average_wait_time_for_io_whole unsigned long average wait time (whole number)
   average_wait_time_for_io_decimal unsigned long average wait time (decimal part)
IO_REPORT2[io_count]
   volser                char[8]         DASD volser where aggregate resides
   pavios                unsigned long   max number of concurrent I/Os that zFS will issue
   read_ind              char[4]         R/O or R/W (how aggregate is attached)
   temp_reads            unsigned long   count of reads for this aggregate
   temp_read_bytes       unsigned long   bytes read for this aggregate (in kilobytes)
   temp_writes           unsigned long   count of writes for this aggregate
   temp_write_bytes      unsigned long   bytes written for this aggregate (in kilobytes)
   allocation_dsname     char[84]        data set name of aggregate
systemname               char[9]

Return_value     0 if request is successful, -1 if it is not successful
Return_code

  EINTR          zFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of I/Os and the amount of data transferred on an aggregate basis.

Privilege Required

None.

Related Services

Statistics iobydasd Information

Statistics iocounts Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_IOBYAGGR                  244  /* Performance API queries */

#define E2BIG     145

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;
```

```
typedef struct io_report2_t
{
    char volser[8];
    unsigned long pavios;
    char read_ind[4];
    unsigned long temp_reads;
    unsigned long temp_read_bytes;
    unsigned long temp_writes;
    unsigned long temp_write_bytes;
    char  allocation_dsname[84];
} IO_REPORT2;

typedef struct io_report2_grand_totals_t
{
    int  io_count; /* number IO_REPORT2 structs in buffer */
    unsigned long grand_total_reads;           /* Total # reads      */
    unsigned long grand_total_writes;          /* Total # writes     */
    unsigned long grand_total_read_bytes;      /* Total bytes read   */
    unsigned long grand_total_write_bytes;     /* Total bytes written*/
    unsigned long grand_total_devices;         /* total # aggregates */
    unsigned long total_number_waits_for_io;
    unsigned long average_wait_time_for_io_whole;
    unsigned long average_wait_time_for_io_decimal;
} IO_REPORT2_GRAND_TOTALS;

struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    /* output buffer IO_REPORT2_GRAND_TOTALS + multiple IO_REPORT2s */
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;
    IO_REPORT2_GRAND_TOTALS *stgt;
    IO_REPORT2 *str2;
    char *stsy;

    char buf[33];
    struct parmstruct *myp = &myparmstruct;
    int mypsize, buflen;

    STAT_API *stapptr = &(myparmstruct.myapi);

    myparmstruct.myparms.opcode = STATOP_IOBYAGGR;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the iobyaggr statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API); */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
```

```
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=0;

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation        */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */

    if( bpxrv < 0 )
    {
        if( bpxrc == E2BIG )
        {
            buflen = stapptr->sa_len;          /* Get buffer size needed  */
            mypsize = sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen +
                      sizeof(myparmstruct.systemname);
            myp = (struct parmstruct *) malloc ((long) mypsize);
            memset(myp, 0, mypsize);

            printf("Need buffer size of %d, for a total of %d\n",buflen,mypsize);

            myp->myparms.opcode = STATOP_IOBYAGGR;
            myp->myparms.parms[0] = sizeof(syscall_parmlist);
            myp->myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
            myp->myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the iobyaggr statistics of a different system than this one */

/* myp->myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen; */

            myp->myparms.parms[3] = 0;
            myp->myparms.parms[4] = 0;
            myp->myparms.parms[5] = 0;
            myp->myparms.parms[6] = 0;

            stapptr = (STAT_API *)((char *)myp + sizeof(syscall_parmlist));
            memcpy(stapptr->sa_eye,SA_EYE,4);
            stapptr->sa_ver=SA_VER_INITIAL;
            stapptr->sa_len=buflen;
            stgt = (IO_REPORT2_GRAND_TOTALS *)((char *)myp + sizeof(syscall_parmlist) +
                   sizeof(STAT_API));
            str2 = (IO_REPORT2 *)((char *)stgt + sizeof(IO_REPORT2_GRAND_TOTALS));
            stsy = (char *)((char *)myp + sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(stsy,"DCEIMGVQ"); */

            BPX1PCT("ZFS     ",
                    ZFSCALL_STATS,            /* Aggregate operation     */
                    mypsize,                  /* Length of Argument      */
                    (char *) myp,             /* Pointer to Argument     */
                    &bpxrv,                   /* Pointer to Return_value */
                    &bpxrc,                   /* Pointer to Return_code  */
                    &bpxrs);                  /* Pointer to Reason_code  */
            if( bpxrv == 0 )
            {
                printf("                     zFS I/O by Currently Attached Aggregate\n");
                printf("\n");
                printf("DASD   PAV\n");
      printf("VOLSER IOs Mode  Reads       K bytes     Writes      K bytes     Dataset Name\n");
```

```
  printf("------ --- ----  ----------  ----------  ----------  ----------  ------------\n");
            for( i = 0 ; i < stgt->io_count ; i++, str2++ )
            {
                printf( "%6.6s %3d  %s  %10d  %10d  %10d  %10d  %-44.44s\n",
                        str2->volser,
                        str2->pavios,
                        str2->read_ind,
                        str2->temp_reads,
                        str2->temp_read_bytes,
                        str2->temp_writes,
                        str2->temp_write_bytes,
                        str2->allocation_dsname);
            }
            printf(  "%6d           %10d  %10d  %10d  %10d  %-44.44s\n",
                     stgt->grand_total_devices,
                     stgt->grand_total_reads,
                     stgt->grand_total_read_bytes,
                     stgt->grand_total_writes,
                     stgt->grand_total_write_bytes, "*TOTALS*");

            printf("\n");
            printf("Total number of waits for I/O: %10d\n", stgt->total_number_waits_for_io);
            printf("Average I/O wait time:         %9d.%3.3d (msecs)\n",
                   stgt->average_wait_time_for_io_whole,
                   stgt->average_wait_time_for_io_decimal);
            printf("\n");
            if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
            {
                printf("Could not get timestamp.\n");
            }
            else
            {   /* Insert the microseconds into the displayable time value */
                strncpy(&(buf[27]),&(buf[20]),6);
                sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
                buf[26]=' ';
                buf[19]='.';
                printf("Last Reset Time: %s",buf);
            }

            free(myp);
        }
        else  /* iobyaggr failed with large enough buffer */
        {
            printf("Error on iobyaggr with large enough buffer\n");
            printf("Error querying iobyaggr, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
            free(myp);
            return bpxrc;
        }
    }
    else  /* error was not E2BIG */
    {
        printf("Error on iobyaggr trying to get required size\n");
        printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        free(myp);
        return bpxrc;

    }
}
else /* asking for buffer size gave rv = 0; maybe there is no data */
{
    if( myparmstruct.myapi.sa_len == 0 )
    {
        printf("No data\n");
        printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
    }
    else   /* No, there was some other problem with getting the size needed */
    {
```

```
            printf("Error getting size required\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        }
    }
    return 0;
}
```

Statistics iobydasd Information

Purpose

This is information about the number of reads and writes and the number of bytes transferred for each DASD volume.

Format

```
syscall_parmlist
   opcode               245             STATOP_IOBYDASD
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
API_IOBYDASD_HDR
   number_of_lines      int             count of API_IOBYDASD_DATA lines
   pad                  int             0
|  grand_total_reserved  int             always zero
   grand_total_waits    hyper           total waits
   average_wait_time_whole int          average wait time (whole number)
   average_wait_time_decimal int        average wait time (decimal part)
API_IOBYDASD_DATA[number_of_lines]
   spare                int             0
   volser               char[6]         DASD volser
   filler               char[2]         reserved
   pavios               unsigned long   max number of concurrent I/Os that zFS will issue for this DASD
   reads                unsigned long   count of reads for this DASD
   read_bytes           unsigned long   bytes read for this DASD (in kilobytes)
   writes               unsigned long   count of writes for this DASD
   write_bytes          unsigned long   bytes written for this DASD (in kilobytes)
   waits                unsigned long   waits
   avg_wait_whole       int             average wait time (whole number)
   avg_wait_decimal     int             average wait time (decimal part)
systemname              char[9]

Return_value     0 if request is successful, -1 if it is not successful
Return_code
  EINTR          zFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied
Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of I/Os and the amount of data transferred on a DASD basis.

Privilege Required

None.

Related Services

Statistics iobyaggr Information

Statistics iocounts Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_IOBYDASD                  245  /* Performance API queries */

#define E2BIG     145
#define ENOMEM    132

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

| typedef struct hyper_t {
|     unsigned long high;  /* unsigned long reserved */
|     unsigned long low;
| } hyper;

/*****************************************************************/
/* The following structure is the api query control block        */
/* It is used for all api query commands                         */
/*****************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
```

```
} STAT_API;

typedef struct api_iobydasd_hdr
{
    int number_of_lines;
    int pad;
    hyper grand_total_waits;
    int   avg_wait_time_whole;
    int   avg_wait_time_decimal;
} API_IOBYDASD_HDR;

typedef struct api_iobydasd_data
{
    int   spare;
    char  volser[6];
    char  filler[2];
    unsigned long pavios;
    unsigned long reads;
    unsigned long read_bytes;
    unsigned long writes;
    unsigned long write_bytes;
    unsigned long waits;
    int avg_wait_whole;
    int avg_wait_decimal;
} API_IOBYDASD_DATA;

struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    /* output buffer API_IOBYDASD_HDR + multiple API_IOBYDASD_DATAs */
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;
    API_IOBYDASD_HDR *stdh;
    API_IOBYDASD_DATA *stdd;
    char *stsy;
    char buf[33];

    struct parmstruct *myp = &myparmstruct;
    int mypsize, buflen;

    STAT_API *stapptr = &(myparmstruct.myapi);

    myparmstruct.myparms.opcode = STATOP_IOBYDASD;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the iobydasd statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API); */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
```

```
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=0;

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */

    if( bpxrv < 0 )
    {
        if( bpxrc == E2BIG )
        {
            buflen = stapptr->sa_len;          /* Get buffer size needed  */
            mypsize = sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen +
                      sizeof(myparmstruct.systemname);
            myp = (struct parmstruct *) malloc ((long) mypsize);
            memset(myp, 0, mypsize);

            printf("Need buffer size of %d, for a total of %d\n\n",buflen,mypsize);

            myp->myparms.opcode = STATOP_IOBYDASD;
            myp->myparms.parms[0] = sizeof(syscall_parmlist);
            myp->myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
            myp->myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the iobydasd statistics of a different system than this one */

/* myp->myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen; */

            myp->myparms.parms[3] = 0;
            myp->myparms.parms[4] = 0;
            myp->myparms.parms[5] = 0;
            myp->myparms.parms[6] = 0;

            stapptr = (STAT_API *)((char *)myp + sizeof(syscall_parmlist));
            memcpy(stapptr->sa_eye,SA_EYE,4);
            stapptr->sa_ver=SA_VER_INITIAL;
            stapptr->sa_len=buflen;
            stdh = (API_IOBYDASD_HDR *)((char *)myp + sizeof(syscall_parmlist) + sizeof(STAT_API));
            stdd = (API_IOBYDASD_DATA *)((char *)stdh + sizeof(API_IOBYDASD_HDR));

            stsy = (char *)((char *)myp + sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(stsy,"DCEIMGVQ"); */

            BPX1PCT("ZFS     ",
                    ZFSCALL_STATS,           /* Perf stats operation    */
                    mypsize,                 /* Length of Argument      */
                    (char *) myp,            /* Pointer to Argument     */
                    &bpxrv,                  /* Pointer to Return_value */
                    &bpxrc,                  /* Pointer to Return_code  */
                    &bpxrs);                 /* Pointer to Reason_code  */
            if( bpxrv == 0 )
            {
                printf("                     zFS I/O by Currently Attached DASD/VOLs\n");
                printf("\n");
                printf("DASD   PAV\n");
```

```
printf("VOLSER IOs   Reads       K bytes     Writes           K bytes      Waits         Average Wait\n");
printf("------ ---   ----------  ----------  ----------       ----------   ----------    ------------\n");
                for( i = 0 ; i < stdh->number_of_lines ; i++, stdd++ )
                {
                    printf( "%6.6s %3d   %10d  %10d  %10d       %10d   %10d    %6d.%3.3d\n",
                            stdd->volser,
                            stdd->pavios,
                            stdd->reads,
                            stdd->read_bytes,
                            stdd->writes,
                            stdd->write_bytes,
                            stdd->waits,
                            stdd->avg_wait_whole,
                            stdd->avg_wait_decimal);
                }

                printf("\n");
                printf("Total number of waits for I/O: %d,,%d\n",
                        stdh->grand_total_waits.high,stdh->grand_total_waits.low);
                printf("Average I/O wait time:         %9d.%3.3d (msecs)\n",
                       stdh->avg_wait_time_whole,
                       stdh->avg_wait_time_decimal);
                printf("\n");
                if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
                {
                    printf("Could not get timestamp.\n");
                }
                else
                {   /* Insert the microseconds into the displayable time value */
                    strncpy(&(buf[27]),&(buf[20]),6);
                    sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
                    buf[26]=' ';
                    buf[19]='.';
                    printf("Last Reset Time: %s",buf);
                }

                free(myp);
            }
            else  /* iobydasd failed with large enough buffer */
            {
             printf("Error on iobydasd with large enough buffer\n");
             printf("Error querying iobydasd, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
             free(myp);
             return bpxrc;
            }
        }
        else  /* error was not E2BIG */
        {
            printf("Error on iobydasd trying to get required size\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
            free(myp);
            return bpxrc;

        }
    }
    else /* asking for buffer size gave rv = 0; maybe there is no data */
    {
        if( myparmstruct.myapi.sa_len == 0 )
        {
            printf("No data\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        }
        else   /* No, there was some other problem with getting the size needed */
        {
            printf("Error getting size required\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
```

```
        }
    }
    return 0;
}
```

Statistics iocounts Information

Purpose

This is information about how often zFS performs I/O for various circumstances and how often it waits on that I/O.

Format

```
syscall_parmlist
   opcode               243             STATOP_IOCOUNTS
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
API_IO_BY_TYPE[3]
   number_of_lines      unsigned long   count of API_IO_BY_TYPE lines (3)
   count                unsigned long   count of I/Os for type
   waits                unsigned long   number of waits for type
   cancels              unsigned long   number of cancels for type
   merges               unsigned long   number of merges for type
   type                 reserved1       reserved
   description          char[51]        type description
   pad1                 char[3]         pad bytes
API_IO_BY_CIRC[18]
   number_of_lines      unsigned long   count of API_IO_BY_CIRC lines (18)
   count                unsigned long   count of I/Os for circumstance
   waits                unsigned long   number of waits for circumstance
   cancels              unsigned long   number of cancels for circumstance
   merges               unsigned long   number of merges for circumstance
   type                 reserved1       reserved
   description          char[51]        circumstance description
   pad1                 char[3]         pad bytes
systemname              char[9]

Return_value     0 if request is successful, -1 if it is not successful
Return_code
  EINTR      zFS is shutting down
  EINVAL             Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code
  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of I/Os zFS has issued for various circumstances.

Privilege Required

None.

Related Services

Statistics iobyaggr Information

Statistics iobydasd Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_IOCOUNTS                  243  /* Performance API queries */

#define TOTAL_TYPES       3
#define TOTAL_CIRC       18

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;

typedef struct API_IO_BY_TYPE_t
{
    unsigned long number_of_lines;
```

```
    unsigned long count;
    unsigned long waits;
    unsigned long cancels;  /* Successful cancels of IO */
    unsigned long merges;   /* Successful merges of IO */
    char     reserved1[6];
    char     description[51];
    char     pad1[3];
} API_IO_BY_TYPE;

typedef struct API_IO_BY_CIRC_t
{
    unsigned long number_of_lines;
    unsigned long count;
    unsigned long waits;
    unsigned long cancels;
    unsigned long merges;
    char     reserved1[6];
    char     description[51];
    char     pad1[3];
} API_IO_BY_CIRC;

/*********************************************************************/
/* The following structures are used to represent cfgop queries      */
/* for iocounts                                                      */
/*********************************************************************/

struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    API_IO_BY_TYPE mystatsbytype[TOTAL_TYPES];
    API_IO_BY_CIRC mystatsbycirc[TOTAL_CIRC];
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;

    STAT_API *stapptr = &(myparmstruct.myapi);
    API_IO_BY_TYPE *stiotptr = &(myparmstruct.mystatsbytype[0]);
    API_IO_BY_CIRC *stiocptr = &(myparmstruct.mystatsbycirc[0]);

    char buf[33];

    myparmstruct.myparms.opcode = STATOP_IOCOUNTS;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the iocounts of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) */
/*                                + (TOTAL_TYPES * sizeof(API_IO_BY_TYPE))    */
/*                                + (TOTAL_CIRC * sizeof(API_IO_BY_CIRC));    */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
```

```
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) (TOTAL_TYPES * sizeof(API_IO_BY_TYPE))
                        + (TOTAL_CIRC * sizeof(API_IO_BY_CIRC));

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation        */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying iocounts, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {
     if( stiotptr->number_of_lines != TOTAL_TYPES )
     {
      printf("Unexpected number of IO Types, %d instead of TOTAL_TYPES\n",stiotptr->number_of_lines);
      return 1;
     }
     if( stiocptr->number_of_lines != TOTAL_CIRC )
     {
      printf("Unexpected number of IO Circumstances, %d instead of TOTAL_CIRC\n",
             stiocptr->number_of_lines);
      return 2;
     }
     printf("                  I/O Summary By Type\n");
     printf("                  -------------------\n");
     printf("\n");
     printf("Count       Waits       Cancels     Merges      Type\n");
     printf("----------  ----------  ----------  ----------  ----------\n");
     for( i=0; i<TOTAL_TYPES; i++ )
     {
         printf("%10d  %10d  %10d  %10d  %s\n",
                stiotptr->count, stiotptr->waits,
                stiotptr->cancels, stiotptr->merges,
                stiotptr->description);
         stiotptr = stiotptr + 1;
     }
     printf("\n");
     printf("                  I/O Summary By Circumstance\n");
     printf("                  ---------------------------\n");
     printf("\n");
     printf("Count       Waits       Cancels     Merges      Circumstance\n");
     printf("----------  ----------  ----------  ----------  ------------\n");
     for( i=0; i<TOTAL_CIRC; i++ )
     {
         printf("%10d  %10d  %10d  %10d  %s\n",
                stiocptr->count, stiocptr->waits,
                stiocptr->cancels, stiocptr->merges,
                stiocptr->description);
         stiocptr = stiocptr +1;
         printf("\n");
     }
     if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
     {
         printf("Could not get timestamp.\n");
     }
     else
     {   /* Insert the microseconds into the displayable time value */
```

```
          strncpy(&(buf[27]),&(buf[20]),6);
          sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
          buf[26]=' ';
          buf[19]='.';
          printf("Last Reset Time: %s",buf);
      }
     }
     return 0;
}
```

Statistics Kernel Information

Purpose

The statistics kernel information subcommand call is a performance statistics operation that returns kernel counters.

Format

```
syscall_parmlist
   opcode               246             STATOP_KNPFS
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
KERNEL_CALL_STATS
   kc_eye               char[8]         "xxxxADIR"
   kc_version           short           version
   kc_size              short           size of output
   pad1                 int             reserved
  KERNEL_LINE[40]
     kl_operation_name    char[27]        operation name string
     kl_valid             char            operation entry is valid (0x01)
     kl_count             unsigned long   count of operations
|    kl_time_reserved     int             always zero
|    kl_time              int             average time for operation
     kl_reserved          int[6]          reserved
   kc_totalops          unsigned long   grand total operations
   pad2                 int             reserved
|  kc_totaltime_reserved int             reserved
|  kc_totaltime          int             grand total wait time
   kc_valid_slots       int             number of slots in above array that actually contains data
   kc_reserved          int[10]         reserved
   pad3                 int             reserved
systemname              char[9]

Return_value     0 if request is successful, -1 if it is not successful

Return_code

  EINTR          zFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of kernel operations and average time for the operation.

Privilege Required

None.

Related Services

Statistics Vnode Cache Information

Statistics Metadata Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_KNPFS                  246  /* Performance API queries */

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef union {
    struct double_word_t
  {
    unsigned int first_word;
    unsigned int second_word;
    } double_word;
double alignment_dummy;
} two_words;

#define MAX_KERNEL_LINES 40
/*                                */
typedef struct KERNEL_line_t{
  char   kl_operation_name[27];
  char   kl_valid;
  u_long kl_count;
  two_words  kl_time;
  int    kl_reserved[6];
} KERNEL_LINE;
/*                                */
typedef struct kernel_call_stats_t {
  char   kc_eye[8];  /*eye catcher */
  short  kc_version;
  short  kc_len;
  int    pad1;
  KERNEL_LINE  OUTPUT[MAX_KERNEL_LINES];
  u_long kc_totalops;  /*Grand Total operations */
  int    pad2;
  two_words  kc_totaltime;  /*Grand Total wait time*/
```

```
  int    kc_valid_slots;  /* Number of slots in the above array*/
                    /* that actually contain data*/
  int    kc_reserved[10];
  int    pad3;
} KERNEL_CALL_STATS;

/* reset timestamp */
typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;


struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    KERNEL_CALL_STATS mystats;
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;

    STAT_API *stapptr = &(myparmstruct.myapi);
    KERNEL_CALL_STATS *stkcptr = &(myparmstruct.mystats);
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_KNPFS;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the kernel statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) +   */
/*                                 sizeof(KERNEL_CALL_STATS);                      */

    myparmstruct.myparms.parms[3] = 0;
```

```
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(KERNEL_CALL_STATS);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation       */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying kernel calls, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {

        printf("%34s\n","zFS Kernel PFS Calls");
        printf("%34s\n","--------------------");
        printf("\n");
        printf("Operation               Count          Avg Time\n");
        printf("---------          ----------        ----------\n");

        i=0;
        while (myparmstruct.mystats.OUTPUT[i].kl_valid == 1)
        {
            printf("%13s     %10u     %9d.%3.3d\n",myparmstruct.mystats.OUTPUT[i].kl_operation_name,
                           myparmstruct.mystats.OUTPUT[i].kl_count,
                           myparmstruct.mystats.OUTPUT[i].kl_time.double_word.first_word,
                           myparmstruct.mystats.OUTPUT[i].kl_time.double_word.second_word);
         i+=1;
        }

        printf("---------          ----------        ----------\n");
        printf("*TOTALS*           %10u     %9d.%3.3d\n",
               myparmstruct.mystats.kc_totalops,
               myparmstruct.mystats.kc_totaltime.double_word.first_word,
               myparmstruct.mystats.kc_totaltime.double_word.second_word);

        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics Locking Information

Purpose

The statistics locking information subcommand call is a performance statistics operation that returns locking information.

Format

```
syscall_parmlist
   opcode                          240
   parm[0]                         offset to STAT_API
   parm[1]                         offset to STAT_LOCKING
   parm[2]                         offset to system name (optional)
   parm[3]                         0
   parm[4]                         0
   parm[5]                         0
   parm[6]                         0
STAT_API
   sa_eye                          char[4]         "STAP"
   sa_len                          int             sizeof(STAT_LOCKING)
   sa_ver                          int             1
   sa_flags                        char            0x80 for reset; 0x00 otherwise
   sa_fill                         char[3]         0
   sa_reserve                      int[4]          0
STAT_LOCKING
   reserved1                       int
   stlk_untimed_sleeps             unsigned long   number of untimed sleeps
   stlk_timed_sleeps               unsigned long   number of timed sleeps
   stlk_wakeups                    unsigned long   number of wake ups
   stlk_total_wait_for_locks       unsigned long   total waits for locks
   stlk_average_lock_wait_time     double          average lock wait time
   stlk_avg_lock_wait_time_whole   int             average lock wait time in msecs left of the decimal
                                                   part
   stlk_avg_lock_wait_time_decimal int             average lock wait time in msecs decimal portion
   stlk_total_monitored_sleeps     unsigned long   total monitored sleeps
   stlk_average_monitored_sleep_time  double       average monitored sleep time
   stlk_avg_mon_sleep_time_whole   int             average monitored sleep time in msecs left of the
                                                   decimal part
   stlk_avg_mon_sleep_time_decimal int             average monitored sleep time in msecs
                                                   decimal portion
   stlk_total_contentions          unsigned long   total lock contention of all kinds
   stlk_reserved_space             char[48]        reserved for future use
   stlk_locks                      struct Lock_line[15]   storage for the lock data
     count                         int             Number of thread waits for this lock
     async                         int             Asynchronous disposition
     spins                         int             Number of attempts to get lock that did not
                                                   resolve immediately
     percentage                    double
     percentage_whole              int             percentage >= 1
     percentage_decimal            int             percentage < 1
     description                   char[84]        Description of the lock
   stlk_sleeps                     struct Sleep_line[5]   storage for sleep data
     sleepcount                    unsigned long   Time spent sleeping
     percentage                    double          Percentage of time spent sleeping
     percentage_whole              int             Percentage >=1
     percentage_decimal            int             Percentage < 1
     description                   char[84]        Description of the thread
systemname                         char[9]

Return value     0 if request is successful, -1 if it is not successful
Return code
  EINTR          ZFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
```

```
Reason code
  0xEFxxnnnn     See z/OS Distributed File Service Messages and Codes
```

Usage

This function is used to retrieve locking information.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

Statistics Storage Information

Statistics User Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_LOCKING                  240  /* Performance API queries */

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct Lock_line_t
{
    int         count; /* Number of thread waits for this lock  */
    int         async; /* Asynchronous disposition*/
    int         spins; /* Number of attempts to get lock that did not resolve immediately*/
    int         pad1;
    double      percentage; /**/
    int         percentage_whole; /* percentage >= 1*/
    int         percentage_decimal;/* percentage < 1*/
    char        description[84]; /* Description of the lock */
    int         pad2;
} LOCK_LINE;

typedef struct Sleep_line_t
{
    unsigned long  sleepcount; /* Time spent sleeping             */
    int            pad1;
    double         percentage; /* Percentage of time spent sleeping*/
    int            percentage_whole; /* Percentage >=1 */
    int            percentage_decimal; /* Percentage < 1 */
    char           description[84]; /*Description of the thread*/
```

```
    int            pad2;
} SLEEP_LINE;

/* reset timestamp */
typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;

typedef struct stat_locking_t
{
 int               reserved1;
 unsigned long     stlk_untimed_sleeps;             /* Number of untimed sleeps */
 unsigned long     stlk_timed_sleeps;               /* Number of timed sleeps */
 unsigned long     stlk_wakeups;                    /* Number of wake ups    */
 unsigned long     stlk_total_wait_for_locks;       /* Total waits for locks */
 int               pad1;
 double            stlk_average_lock_wait_time;     /*Average lock wait time */
 int               stlk_avg_lock_wait_time_whole;   /*Average lock wait time in msecs */
                                                    /*left of the decimal part */
 int               stlk_avg_lock_wait_time_decimal; /*Average lock wait time in msecs */
                                                    /*decimal portion */
 unsigned long     stlk_total_monitored_sleeps;      /*Total monitored sleeps   */
 int               pad2;
 double            stlk_average_monitored_sleep_time;/* Average monitored sleep time */
 int               stlk_avg_mon_sleep_time_whole; /*Average monitored sleep time in msecs */
                                                  /* left of the decimal part*/
 int               stlk_avg_mon_sleep_time_decimal; /*Average monitored sleep time in msecs */
                                                    /* decimal portion */
 unsigned long     stlk_total_contentions;      /*Total lock contention of all kinds*/
 char              stlk_reserved_space[48];  /* reserved for future use */
 int               pad3;
#define MAX_LOCKS 15                  /* Maximum number of locks in this release*/
#define MAX_SLEEPS 5                  /* Maximum number of sleeps in this release*/
 LOCK_LINE  stlk_locks[MAX_LOCKS]; /* Storage for the lock data */
 SLEEP_LINE stlk_sleeps[MAX_SLEEPS]; /* Storage for the top 5 most common sleep threads*/

} STAT_LOCKING;
/*********************************************************************/
/* The following structures are used to represent cfgop queries      */
/* for locking stats                                                 */
/*********************************************************************/

struct parmstruct
{
```

```
    syscall_parmlist myparms;
    STAT_API myapi;
    STAT_LOCKING mystats;
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;

    STAT_API *stapptr = &(myparmstruct.myapi);
    STAT_LOCKING *stlkptr = &(myparmstruct.mystats);
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_LOCKING;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the locking statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) + sizeof(STAT_LOCKING); */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(STAT_LOCKING);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation        */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying locking stats, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {

        printf("%55s\n","Locking Statistics");
        printf("\n");
        printf("\n");
        printf("Untimed sleeps: %10d   Timed Sleeps: %10d   Wakeups: %10d\n",
               myparmstruct.mystats.stlk_untimed_sleeps,
               myparmstruct.mystats.stlk_timed_sleeps,
               myparmstruct.mystats.stlk_wakeups);

        printf("\n");

        printf("Total waits for locks:                    %10d\n",
```

```
               myparmstruct.mystats.stlk_total_wait_for_locks);

        printf("Average lock wait time:     %9d.%3.3d (msecs)\n",
               myparmstruct.mystats.stlk_avg_lock_wait_time_whole,
               myparmstruct.mystats.stlk_avg_lock_wait_time_decimal);

        printf("\n");

        printf("Total monitored sleeps:                    %10d\n",
               myparmstruct.mystats.stlk_total_monitored_sleeps);

        printf("Average monitored sleep time:     %9d.%3.3d (msecs)\n",
               myparmstruct.mystats.stlk_avg_mon_sleep_time_whole,
               myparmstruct.mystats.stlk_avg_mon_sleep_time_decimal);
        printf("\n");

        printf("               Top %d Most Highly Contended Locks\n",
               MAX_LOCKS);
        printf("  Thread      Async       Spin                          \n");
        printf("   Wait       Disp.       Resol.     Pct.    Description\n");
        printf("----------  ----------  ----------   -----   --------------\n");
        for( i = 0; i < MAX_LOCKS;i++ )
        {
            printf("%10d  %10d  %10d   %3d.%1.1d%%   %.80s\n",
                   myparmstruct.mystats.stlk_locks[i].count,
                   myparmstruct.mystats.stlk_locks[i].async,
                   myparmstruct.mystats.stlk_locks[i].spins,
                   myparmstruct.mystats.stlk_locks[i].percentage_whole,
                   myparmstruct.mystats.stlk_locks[i].percentage_decimal,
                   myparmstruct.mystats.stlk_locks[i].description);
        }

        printf("\n");
        printf("Total lock contention of all kinds: %10d\n",
               myparmstruct.mystats.stlk_total_contentions);
        printf("\n");

        printf("               Top %d Most Common Thread Sleeps\n",
               MAX_SLEEPS);
        printf("Thread Wait     Pct.      Description\n");
        printf("-----------     -----     -----------\n");

        for( i = 0; i < MAX_SLEEPS;i++ )
        {
            printf(" %10d    %3d.%1.1d%%     %.80s\n",
                   myparmstruct.mystats.stlk_sleeps[i].sleepcount,
                   myparmstruct.mystats.stlk_sleeps[i].percentage_whole,
                   myparmstruct.mystats.stlk_sleeps[i].percentage_decimal,
                   myparmstruct.mystats.stlk_sleeps[i].description);
            printf("\n");
        }
        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics Log Cache Information

Purpose

The statistics log cache information subcommand call is a performance statistics operation that returns log cache counters.

Format

```
syscall_parmlist
   opcode               247             STATOP_LOG_CACHE
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
API_LOG_STATS
   al_eye                 char[4]         "ALOG"
   al_size                short           size of output
   al_version             char            version
   al_reserved1           char            reserved byte
   al_reserved2           int             reserved
   al_buffersize          int             size of each buffer in K bytes
|  al_lookups_reserved    int             reserved
|  al_lookups             int             lookups/creates of item in log buffer cache
|  al_hits_reserved       int             reserved
|  al_hits                int             hits - number of items time item found in cache
|  al_writtenPages_reserved  int            reserved
|  al_writtenPages        int             number of log buffer pages written to disk
|  al_fullWaits_reserved    int             reserved
|  al_fullWaits           int             number of times new log buffer requires wait on prior
|                                           log pages
|  al nbsWaits_reserved     int             reserved
|  al nbsWaits            int             number of times new log buffer requires wait on new block
|                                           user I/O
   al_reserved3           int[10]         reserved
   systemname               char[9]

Return_value     0 if request is successful, -1 if it is not successful

Return_code

  EINTR          zFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Statistics Log Cache Information

Usage

It is used to determine the numbers of requests, hits and waits on the log buffer cache.

Privilege Required

None.

Related Services

Statistics Vnode Cache Information

Statistics Metadata Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_LOG_CACHE                247  /* Performance API queries */

#define u_long unsigned long

#define CONVERT_RATIO_TO_INTS(RATIO, INTEGER, DECIMAL)             \
{                                                                  \
  INTEGER = (int)RATIO;                                            \
  DECIMAL = (int)((RATIO - (double)INTEGER) * (double)1000.0);     \
}

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct hyper {
  unsigned long high;              /* unsigned long reserved */
  unsigned long low;
} hyper;
typedef struct API_LOG_STATS_t  {
  char     al_eye[4];          /* Eye catcher = ALOG */
#define LS_EYE "ALOG"
  short    al_size;            /* Size of output structure */
  char     al_version;         /* Version of stats */
#define LS_VER_INITIAL 1       /* First version of log stats */
  char     al_reserved1;       /* Reserved byte, 0 in version 1 */
  hyper    al_buffers;         /* Number of buffers used */
  int      al_reserved2;       /* Reserved for future use, 0 in version 1 */
  int      al_buffsize;        /* Size in kilobytes of one buffer */
  hyper    al_lookups;         /* Lookups/creates of item in log buffer cache */
  hyper    al_hits;            /* Hits, number of times item found in cache */
  hyper    al_writtenPages;    /* Number of log buffer pages written to disk */
  hyper    al_fullWaits;       /* Number of time new log buffer requires wait on prior log pages */
  hyper    al_nbsWaits;        /* Number of time new log buffer requires wait on new block user IO */
  int      al_reserved3[10];   /* Reserved for future use */
} API_LOG_STATS;
```

```
/* reset timestamp */
typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;


struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    API_LOG_STATS mystats;
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;
    double temp_ratio;
    int whole,decimal;

    STAT_API *stapptr = &(myparmstruct.myapi);
 /*   STAT_TRAN_CACHE *sttcptr = &(myparmstruct.mystats);   */
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_LOG_CACHE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the log cache statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) + sizeof(API_LOG_STATS); */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;
```

```
    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(API_LOG_STATS);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation        */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying log cache, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {
        printf("%52s\n","Log File Caching Statistics");
        printf("      \n");
        printf("Buffers    (K bytes)  Requests     Hits    Ratio   Written \n");
        printf("---------- --------- ---------- ---------- ------ ----------\n");

        temp_ratio = (myparmstruct.mystats.al_lookups.low == 0) ? 0.0 :
            ((double)myparmstruct.mystats.al_hits.low)/myparmstruct.mystats.al_lookups.low;
        temp_ratio *= 100.0;
        CONVERT_RATIO_TO_INTS(temp_ratio,whole, decimal);
        decimal = decimal / 100;   /* Just want tenths */

        printf("%10d %9d %10d %10d %3d.%1.1d%% %10d\n",
               myparmstruct.mystats.al_buffers.low,
               myparmstruct.mystats.al_buffers.low * myparmstruct.mystats.al_buffsize,
               myparmstruct.mystats.al_lookups.low, myparmstruct.mystats.al_hits.low,
               whole, decimal, myparmstruct.mystats.al_writtenPages.low);
        printf("  \n");
        printf("New buffer: log full waits %10d  NBS IO waits %10d\n",
               myparmstruct.mystats.al_fullWaits.low, myparmstruct.mystats.al_nbsWaits.low);
        printf("  \n");

        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics Metadata Cache Information

Purpose

The statistics metadata cache information subcommand call is a performance statistics operation that returns metadata cache counters.

Format

```
syscall_parmlist
   opcode               248             STATOP_META_CACHE
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]         "STAP"
   sa_len               int             length of buffer that follows STAT_API
   sa_ver               int             1
   sa_flags             char[1]         0x00
     SA_RESET             0x80          Reset statistics
   sa_fill              char[3]         0
   sa_reserve           int[4]          0
   posix_time_high      unsigned long   high order 32 bits since epoch
   posix_time_low       unsigned long   low order 32 bits since epoch
   posix_useconds       unsigned long   microseconds
   pad1                 int
API_META_STATS
   am_eye               char[4]         "AMET"
   am_size              short           size of output
   am_version           char            version
   am_reserved1         char            reserved byte
  PRIMARY_STATS
     buffers_reserved     int             reserved
     buffers              int             number of buffers in the cache
     buffsize             int             size of each buffer in K bytes
     amc_res1             int             reserved
|    requests_reserved    int             reserved
|    requests             int             requests to the cache
|    hits_reserved        int             reserved
|    hits                 int             hits in the cache
|    updates_reserved     int             reserved
|    updates              int             updates to buffers in the cache

  BACK_STATS
     buffers              hyper           number of buffers in the cache
     buffsize             int             size of each buffer in K bytes
     amc_res1             int             reserved
|    requests_reserved    int             reserved
|    requests             int             requests to the cache
|    hits_reserved        int             reserved
|    hits                 int             hits in the cache
|    discards_reserved    int             reserved
|    discards             int             discards of data from the cache

   am_reserved3         int[10]         reserved
systemname              char[9]

Return_value     0 if request is successful, -1 if it is not successful

Return_code

  EINTR          zFS is shutting down
```

```
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of requests, hits and discards from the directory cache.

Privilege Required

None.

Related Services

Statistics Vnode Cache Information

Statistics Metadata Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_META_CACHE                248   /* Metadata cache (and back cache) stats */

#define u_long unsigned long

#define CONVERT_RATIO_TO_INTS(RATIO, INTEGER, DECIMAL)             \
{                                                                  \
  INTEGER = (int)RATIO;                                            \
  DECIMAL = (int)((RATIO - (double)INTEGER) * (double)1000.0);     \
}

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

| typedef struct hyper {
|   unsigned long high;              /* unsigned long reserved */
|   unsigned long low;
| } hyper;

/*****************************************************************/
/* META cache stats, including backing cache.                    */
/*****************************************************************/
typedef struct PRIMARY_STATS_t {
  hyper    buffers;            /* Number of buffers in cache */
  int      buffsize;           /* Size of each buffer in K bytes */
  int      amc_res1;           /* Reserved for future use, zero in version 1 */
|   int      requests_reserved;  /* Reserved */
|   int      requests;           /* Requests to the cache */
```

```
|    int      hits_reserved;      /* Reserved */
|    int      hits;               /* Hits in the cache */
|    int      updates_reserved;   /* Reserved */
|    int      updates;            /* Updates to buffers in the cache */
     int      reserved[10];       /* For future use */
   } PRIMARY_STATS;

   typedef struct BACK_STATS_t {
     hyper    buffers;            /* Number of buffers in cache */
     int      buffsize;           /* Size of each buffer in K bytes */
     int      amc_res1;           /* Reserved for future use, zero in version 1 */
|    int      requests_reserved;  /* Reserved */
|    int      requests;           /* Requests to the cache */
|    int      hits_reserved;      /* Reserved */
|    int      hits;               /* Hits in the cache */
|    int      discards_reserved;  /* Reserved */
|    int      discards;           /* Discards of data from backing cache */
     int      reserved[10];       /* For future use */
   } BACK_STATS;

   typedef struct API_META_STATS_t  {
     char     am_eye[4];          /* Eye catcher = AMET */
   #define MS_EYE "AMET"
     short    am_size;            /* Size of output structure */
     char     am_version;         /* Version of stats */
   #define MS_VER_INITIAL 1       /* First version of log stats */
     char     am_reserved1;       /* Reserved byte, 0 in version 1 */
     PRIMARY_STATS am_primary;        /* Primary space cache statistics */
     BACK_STATS    am_back;           /* Backing cache statistics */
     int      am_reserved3[10];   /* Reserved for future use */
   } API_META_STATS;

   /* reset timestamp */
   typedef  struct  reset_time {
     u_long   posix_time_high;   /* high order 32 bits since epoc */
     u_long   posix_time_low;    /* low order 32 bits since epoch */
     u_long   posix_usecs;        /* microseconds */
     int      pad1;
    } RESET_TIME;

   /*********************************************************************/
   /* The following structure is the api query control block            */
   /* It is used for all api query commands                             */
   /*********************************************************************/

   typedef struct stat_api_t
   {
   #define SA_EYE    "STAP"
       char  sa_eye[4];     /* 4 byte identifier must be */
       int   sa_len;        /* length of the buffer to put data into*/
                            /* this buffer area follows this struct*/
       int   sa_ver;        /* the version number currently always 1*/
   #define SA_VER_INITIAL 0x01
       char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
   #define SA_RESET 0x80
       char  sa_fill[3];    /* spare bytes */
       int   sa_reserve[4];       /* Reserved */
       struct reset_time reset_time_info;
   } STAT_API;


   struct parmstruct
   {
       syscall_parmlist myparms;
       STAT_API myapi;
       API_META_STATS mystats;
       char systemname[9];
```

```
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;
    double temp_ratio;
    int whole,decimal;

    STAT_API *stapptr = &(myparmstruct.myapi);
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_META_CACHE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the metadata cache statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) +  */
/* sizeof(API_META_STATS);                                                        */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(API_META_STATS);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,           /* Perf statistics operation       */
            sizeof(myparmstruct),    /* Length of Argument      */
            (char *) &myparmstruct,  /* Pointer to Argument     */
            &bpxrv,                  /* Pointer to Return_value */
            &bpxrc,                  /* Pointer to Return_code  */
            &bpxrs);                 /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying meta cache, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {

          /* Primary cache */
        printf("%52s\n","Metadata Caching Statistics");
        printf("      \n");
        printf("Buffers    (K bytes)  Requests     Hits    Ratio   Updates\n");
        printf("---------- --------- ---------- ---------- ------ ----------\n");

        temp_ratio = (myparmstruct.mystats.am_primary.requests.low == 0) ? 0.0 :
         ((double)myparmstruct.mystats.am_primary.hits.low)/myparmstruct.mystats.am_primary.requests.low;
        temp_ratio *= 100.0;
        CONVERT_RATIO_TO_INTS(temp_ratio,whole, decimal);
        decimal = decimal / 100;   /* Just want tenths */

        printf("%10d %9d %10d %10d %3d.%1.1d%% %10d\n",
```

```
               myparmstruct.mystats.am_primary.buffers.low,
               myparmstruct.mystats.am_primary.buffers.low * myparmstruct.mystats.am_primary.buffsize,
               myparmstruct.mystats.am_primary.requests.low, myparmstruct.mystats.am_primary.hits.low,
               whole, decimal, myparmstruct.mystats.am_primary.updates.low);
        printf("      \n");

        /* Backing cache */
        printf("%56s\n","Metadata Backing Caching Statistics");
        printf("      \n");
        printf("Buffers    (K bytes)  Requests     Hits    Ratio   Discards\n");
        printf("---------- --------- ---------- ---------- ------ ----------\n");

        temp_ratio = (myparmstruct.mystats.am_back.requests.low == 0) ? 0.0 :
             ((double)myparmstruct.mystats.am_back.hits.low)/myparmstruct.mystats.am_back.requests.low;
        temp_ratio *= 100.0;
        CONVERT_RATIO_TO_INTS(temp_ratio,whole, decimal);
        decimal = decimal / 100;   /* Just want tenths */

        printf("%10d %9d %10d %10d %3d.%1.1d%% %10d\n",
               myparmstruct.mystats.am_back.buffers.low,
               myparmstruct.mystats.am_back.buffers.low * myparmstruct.mystats.am_back.buffsize,
               myparmstruct.mystats.am_back.requests.low, myparmstruct.mystats.am_back.hits.low,
               whole, decimal, myparmstruct.mystats.am_back.discards.low);
        printf("      \n");



        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics Storage Information

Purpose

The statistics storage information subcommand call is a performance statistics operation that returns storage information.

Format

```
syscall_parmlist
   opcode                          241
   parm[0]                         offset to STAT_API
   parm[1]                         offset to STAT_STORAGE
   parm[2]                         offset to system name (optional)
   parm[3]                         0
   parm[4]                         0
   parm[5]                         0
   parm[6]                         0
STAT_API
   sa_eye                          char[4]         "STAP"
   sa_len                          int             0
   sa_ver                          int             1
   sa_flags                        char            0x80 for reset; 0x00 otherwise
   sa_fill                         char[3]         0
   sa_reserve                      int[4]          0
API_STOR_STATS
  reserved1                        int
  ss_total_bytes_allocated         unsigned long      /* Total bytes allocated*/
  ss_total_pieces_allocated        unsigned long      /* Total pieces allocated*/
  ss_total_allocation_requests     unsigned long      /* Total allocation requests*/
  ss_total_free_requests           unsigned long      /* Total free requests*/
  ss_number_of_comp_lines          unsigned long      /* Total number of components lines in buffer*/
  ss_reserved_space                char[48]           /* reserved for future use */
COMP_LINE[n]
  ss_comp_bytes_allocated          int                /* The number of bytes allocated by this*/
                                                     /* component */
  ss_comp_pieces                   int                /* The number of pieces allocated*/
  ss_comp_allocations              int                /* the number of storage allocations requests*/
                                                      /*done by this component */
  ss_comp_frees                     int               /* the number of storage frees done by this*/
                                                      /*component */
  ss_comp_description              char[84]           /* the component description */
  ss_number_of_detail_lines        int                /* the number of detail lines following this*/
                                                      /* component line */
  DETAIL_LINE[m]
    ss_detail_bytes_allocated      int                /*number of bytes allocated*/
    ss_detail_pieces               int                /*number of pieces allocated*/
    ss_detail_allocations          int                /*number of allocation requests*/
    ss_detail_frees                int                /*number of free requests*/
    ss_detail_description          char[84]           /*description */
systemname                         char[9]

Return value     0 if request is successful, -1 if it is not successful

Return code
  EINTR          ZFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason code
  0xEFxxnnnn     See z/OS Distributed File Service Messages and Codes
```

Usage

This function is used to retrieve storage information. You can specify a buffer that you think might be large enough or you can specify a buffer length of zero. If you get a return code E2BIG, the required size for the buffer is contained in the sa_len field.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

Statistics Locking Information

Statistics User Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_STORAGE                  241  /* Performance API queries */

#define E2BIG     145

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/
typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
```

```
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;

} STAT_API;

typedef struct comp_line
{
    int      ss_comp_bytes_allocated; /* The number of bytes allocated by this component */
    int      ss_comp_pieces; /* The number of pieces allocated*/
    int      ss_comp_allocations; /* the number of storage allocations requests done by this component */
    int      ss_comp_frees; /* the number of storage frees done by this component */
    char     ss_comp_description[84]; /* the component description */
    int      ss_number_of_detail_lines; /* the number of detail lines following this component line */
                                        /* before the next component line or end of buffer */
} COMP_LINE;
typedef struct detail_line
{
    int      ss_detail_bytes_allocated;    /*number of bytes allocated*/
    int      ss_detail_pieces;             /*number of pieces allocated*/
    int      ss_detail_allocations;        /*number of allocation requests*/
    int      ss_detail_frees;              /*number of free requests*/
    char     ss_detail_description[84];    /*description */
} DETAIL_LINE;
typedef struct api_stor_stats
{
    int               reserved1;
    unsigned long     ss_total_bytes_allocated;          /* Total bytes allocated*/
    unsigned long     ss_total_pieces_allocated;         /* Total pieces allocated*/
    unsigned long     ss_total_allocation_requests;      /* Total allocation requests*/
    unsigned long     ss_total_free_requests;            /* Total free requests*/
    unsigned long     ss_number_of_comp_lines;           /* Total number of components lines in buffer*/
    char   ss_reserved_space[48];                        /* reserved for future use */

    /*********************************************************************/
    /**The returned data can contain comp_lines and detail_lines    ******/
    /**The first line is a component line                           ******/
    /**The number of component lines returned is in this structure  ******/
    /* Each component line is followed by zero or more detail lines      */
    /* The comp_line struct indicates how many detail lines follow       */
    /*********************************************************************/
} API_STOR_STATS;

struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    /* output buffer API_STOR_STATS + COMP_LINEs and DETAIL_LINEs */
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i,j;
    COMP_LINE *stcl;
    DETAIL_LINE *stdl;
    char *stsy;
    char buf[33];

    struct parmstruct *myp = &myparmstruct;
    int mypsize, buflen;

    API_STOR_STATS *stst;

    STAT_API *stapptr = &(myparmstruct.myapi);
```

```
    myparmstruct.myparms.opcode = STATOP_STORAGE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the storage statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API); */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=0;

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */

    if( bpxrv < 0 )
    {
        if( bpxrc == E2BIG )
        {
            buflen = stapptr->sa_len;          /* Get buffer size needed  */
            mypsize = sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen +
                      sizeof(myparmstruct.systemname);
            myp = (struct parmstruct *) malloc ((long) mypsize);
            memset(myp, 0, mypsize);

            printf("Need buffer size of %d, for a total of %d\n",buflen,mypsize);

            myp->myparms.opcode = STATOP_STORAGE;
            myp->myparms.parms[0] = sizeof(syscall_parmlist);
            myp->myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
            myp->myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the storage statistics of a different system than this one */

/* myp->myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen; */

            myp->myparms.parms[3] = 0;
            myp->myparms.parms[4] = 0;
            myp->myparms.parms[5] = 0;
            myp->myparms.parms[6] = 0;

            stapptr = (STAT_API *)((char *)myp + sizeof(syscall_parmlist));
            memcpy(stapptr->sa_eye,SA_EYE,4);
            stapptr->sa_ver=SA_VER_INITIAL;
            stapptr->sa_len=buflen;
            stst = (API_STOR_STATS *)((char *)myp + sizeof(syscall_parmlist) + sizeof(STAT_API));
            stsy = (char *)((char *)myp + sizeof(syscall_parmlist) + sizeof(STAT_API) + buflen);
```

```
/* This next field should only be set if parms[2] is non-zero */
/* strcpy(stsy,"DCEIMGVQ"); */

            BPX1PCT("ZFS     ",
                    ZFSCALL_STATS,           /* Aggregate operation     */
                    mypsize,                 /* Length of Argument      */
                    (char *) myp,            /* Pointer to Argument     */
                    &bpxrv,                  /* Pointer to Return_value */
                    &bpxrc,                  /* Pointer to Return_code  */
                    &bpxrs);                 /* Pointer to Reason_code  */
            if( bpxrv == 0 )
            {
                printf("                zFS Primary Address Space Storage Usage\n");
                printf("                ---------------------------------------\n");
                printf("\n");
                printf(
                      "Total Bytes Allocated: %d (%dK) (%dM)\n",
                      stst->ss_total_bytes_allocated,
                      stst->ss_total_bytes_allocated/1024,
                      stst->ss_total_bytes_allocated/(1024*1024));
                printf(
                      "Total Pieces Allocated: %d\n",
                      stst->ss_total_pieces_allocated);
                printf(
                      "Total Allocation Requests: %d\n",
                      stst->ss_total_allocation_requests);
                printf(
                      "Total Free Requests: %d, %d\n",
                      stst->ss_total_free_requests, stst->ss_number_of_comp_lines);

                stcl = (COMP_LINE *)((char *)stst + sizeof(API_STOR_STATS));

                for( i = 0 ; i < stst->ss_number_of_comp_lines ; i++ )
                {

                    printf("\n");
                    printf("            Storage Usage By Component\n");
                    printf("            --------------------------\n");
                    printf("Bytes               No. of  No. of           \n");
                    printf("Allocated   Pieces  Allocs  Frees   Component\n");
                    printf("----------  ------  ------  ------  ---------\n");
                    printf("\n");
                    printf("%10d  %6d  %6d  %6d  %s\n",
                           stcl->ss_comp_bytes_allocated,
                           stcl->ss_comp_pieces,
                           stcl->ss_comp_allocations,
                           stcl->ss_comp_frees,
                           stcl->ss_comp_description);

                    stdl = (DETAIL_LINE *)((char *)stcl + sizeof(COMP_LINE));
                    for( j = 0 ; j < stcl->ss_number_of_detail_lines ; j++, stdl++ )
                    {
                        if( j == 0 )
                        {
                            printf("\n");
                            printf("           Storage Details by Component\n");
                            printf("           ----------------------------\n");
                            printf("\n");
                        }
                        printf("  %10d  %6d  %6d  %6d  %s\n",
                               stdl->ss_detail_bytes_allocated,
                               stdl->ss_detail_pieces,
                               stdl->ss_detail_allocations,
                               stdl->ss_detail_frees,
                               stdl->ss_detail_description);
```

```
                    }
                    stcl = (COMP_LINE *)stdl;
                }
                printf("\n");
                if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
                {
                    printf("Could not get timestamp.\n");
                }
                else
                {   /* Insert the microseconds into the displayable time value */
                    strncpy(&(buf[27]),&(buf[20]),6);
                    sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
                    buf[26]=' ';
                    buf[19]='.';
                    printf("Last Reset Time: %s",buf);
                }

                free(myp);
            }
            else  /* storage stats failed with large enough buffer */
            {
                printf("Error on storage stats with large enough buffer\n");
                printf("Error querying storage stats, BPXRV = %d BPXRC = %d BPXRS = %x\n",
                        bpxrv,bpxrc,bpxrs);
                free(myp);
                return bpxrc;
            }
        }
        else  /* error was not E2BIG */
        {
            printf("Error on storage stats trying to get required size\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
            free(myp);
            return bpxrc;

        }
    }
    else /* asking for buffer size gave rv = 0; maybe there is no data */
    {
        if( myparmstruct.myapi.sa_len == 0 )
        {
            printf("No data\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        }
        else   /* No, there was some other problem with getting the size needed */
        {
            printf("Error getting size required\n");
            printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        }
    }
    return 0;
}
```

Statistics Transaction Cache Information

Purpose

The statistics transaction cache information subcommand call is a performance statistics operation that returns transaction cache counters.

Format

```
syscall_parmlist
   opcode               250              STATOP_TRAN_CACHE
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]          "STAP"
   sa_len               int              length of buffer that follows STAT_API
   sa_ver               int              1
   sa_flags             char[1]          0x00
     SA_RESET             0x80           Reset statistics
   sa_fill              char[3]          0
   sa_reserve           int[4]           0
   posix_time_high      unsigned long    high order 32 bits since epoch
   posix_time_low       unsigned long    low order 32 bits since epoch
   posix_useconds       unsigned long    microseconds
   pad1                 int
STAT_TRAN_CACHE
   sttr_started_high    unsigned long    transactions started high 32 bits
   sttr_started         unsigned long    transactions started
   sttr_lookups_high    unsigned long    lookups on transaction high 32 bits
   sttr_lookups         unsigned long    lookups on transaction
   sttr_ec_merges_high  unsigned long    equivalence class merges high 32 bits
   sttr_ec_merges       unsigned long    equivalence class merges
   sttr_alloc_trans_high unsigned long   allocated transactions high 32 bits
   sttr_alloc_trans     unsigned long    allocated transactions
   sttr_trans_act_high  unsigned long    transactions active high 32 bits
   sttr_trans_act       unsigned long    transactions active
   sttr_trans_pend_high unsigned long    transactions pending high 32 bits
   sttr_trans_pend      unsigned long    transactions pending
   sttr_trans_comp_high unsigned long    transactions completed high 32 bits
   sttr_trans_comp      unsigned long    transactions completed
   sttr_trans_free_high unsigned long    free transactions high 32 bits
   sttr_trans_free      unsigned long    free transactions
systemname              char[9]

Return_value     0 if request is successful, -1 if it is not successful

Return_code

  EINTR          zFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

It is used to determine the numbers of transactions in the transaction cache.

Privilege Required

None.

Related Services

Statistics Vnode Cache Information

Statistics Metadata Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_TRAN_CACHE                  250  /* Performance API queries */

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct stat_tran_cache_t
{
   unsigned long sttr_started_high;
   unsigned long sttr_started;
   unsigned long sttr_lookups_high;
   unsigned long sttr_lookups;
   unsigned long sttr_ec_merges_high;
   unsigned long sttr_ec_merges;
   unsigned long sttr_alloc_trans_high;
   unsigned long sttr_alloc_trans;
   unsigned long sttr_trans_act_high;
   unsigned long sttr_trans_act;
   unsigned long sttr_trans_pend_high;
   unsigned long sttr_trans_pend;
   unsigned long sttr_trans_comp_high;
   unsigned long sttr_trans_comp;
   unsigned long sttr_trans_free_high;
   unsigned long sttr_trans_free;
   char reserved[60];
} STAT_TRAN_CACHE;

/* reset timestamp */
typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
```

Statistics Transaction Cache Information

```
/*****************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;


struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    STAT_TRAN_CACHE mystats;
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;

    STAT_API *stapptr = &(myparmstruct.myapi);
    STAT_TRAN_CACHE *sttcptr = &(myparmstruct.mystats);
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_TRAN_CACHE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the tran cache statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) +  */
                               /*  sizeof(STAT_TRAN_CACHE);                      */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(STAT_TRAN_CACHE);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,           /* Perf statistics operation       */
            sizeof(myparmstruct),    /* Length of Argument      */
            (char *) &myparmstruct,  /* Pointer to Argument     */
            &bpxrv,                  /* Pointer to Return_value */
```

```
            &bpxrc,                  /* Pointer to Return_code  */
            &bpxrs);                 /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying tran cache, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {

        printf("%52s\n","Transaction Cache Statistics");
        printf("%52s\n","---------------------------");
        printf("\n");
        printf("Trans started: %8d Lookups on Tran: %8d EC Merges: %8d\n",
               myparmstruct.mystats.sttr_started,
               myparmstruct.mystats.sttr_lookups,
               myparmstruct.mystats.sttr_ec_merges);

        printf("Allocated Trans: %8d (Act=  %7d, Pend= %7d,\n",
               myparmstruct.mystats.sttr_alloc_trans,
               myparmstruct.mystats.sttr_trans_act,
               myparmstruct.mystats.sttr_trans_pend);

        printf("                           Comp= %7d, Free= %7d)\n",
               myparmstruct.mystats.sttr_trans_comp,
               myparmstruct.mystats.sttr_trans_free);

        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics User Cache Information

Purpose

The statistics user cache information subcommand call is a performance statistics operation that returns user cache information.

Format

```
syscall_parmlist
   opcode                         242
   parm[0]                        offset to STAT_API
   parm[1]                        offset to STAT_USER_CACHE
   parm[2]                        offset to system name (optional)
   parm[3]                        0
   parm[4]                        0
   parm[5]                        0
   parm[6]                        0
STAT_API
   sa_eye                         char[4]         "STAP"
   sa_len                         int             sizeof(STAT_USER_CACHE)
   sa_ver                         int             1
   sa_flags                       char            0x80 for reset; 0x00 otherwise
   sa_fill                        char[3]         0
   sa_reserve                     int[4]          0
STAT_USER_CACHE[2]
  vm_schedules                    u_long
  vm_setattrs                     u_long
  vm_fsyncs                       u_long
  vm_unmaps                       u_long
  vm_reads                        u_long
  vm_readasyncs                   u_long
  vm_writes                       u_long
  vm_getattrs                     u_long
  vm_flushes                      u_long
  vm_scheduled_deletes            u_long
  vm_reads_faulted                u_long
  vm_writes_faulted               u_long
  vm_read_ios                     u_long
  vm_scheduled_writes             u_long
  vm_error_writes                 u_long
  vm_reclaim_writes               u_long
  vm_read_waits                   u_long
  vm_write_waits                  u_long
  vm_fsync_waits                  u_long
  vm_error_waits                  u_long
  vm_reclaim_waits                u_long
  vm_reclaim_steal                u_long
  vm_waits_for_reclaim            u_long
DS_ENTRY[32]
  ds_name                         char[9]
  pad1                            char[3]
  ds_alloc_segs                   int
  ds_free_pages                   int
systemname                        char[9]


Return value     0 if request is successful, -1 if it is not successful
Return code
  EINTR          ZFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
Reason code
  0xEFxxnnnn     See z/OS Distributed File Service Messages and Codes
```

Usage

This function is used to retrieve cache information.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

None.

Related Services

Statistics Locking Information

Statistics Storage Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_USER_CACHE                  242  /* Performance API queries */
#define LOCAL 0
#define REMOTE 1

#define u_long unsigned long

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef struct ds_entry
{
    char ds_name[9];
    char pad1[3];
    int  ds_alloc_segs;
    int  ds_free_pages;
    int  ds_reserved[5];             /*reserved for future use*/
} DS_ENTRY;

typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
```

Statistics User Cache Information

```
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;

/*********************************************************************/
/* The following structure is the user data cache statistics         */
/*********************************************************************/
typedef struct vm_stats_t
{
    /*****************************************************************/
    /* First set of counters are for external requests to the VM system.  */
    /*****************************************************************/
    u_long vm_schedules;
    u_long vm_setattrs;
    u_long vm_fsyncs;
    u_long vm_unmaps;
    u_long vm_reads;
    u_long vm_readasyncs;
    u_long vm_writes;
    u_long vm_getattrs;
    u_long vm_flushes;
    u_long vm_scheduled_deletes;

    /*****************************************************************/
    /* Next two are fault counters, they measure number of read or write  */
    /* requests requiring a fault to read in data, this synchronizes      */
    /* an operation to a DASD read, we want these counters as small as    */
    /* possible.  (These are read I/O counters).                          */
    /*****************************************************************/
    u_long vm_reads_faulted;
    u_long vm_writes_faulted;
    u_long vm_read_ios;

    /*****************************************************************/
    /* Next counters are write counters.  They measure number of times    */
    /* we scheduled and waited for write I/Os.                            */
    /*****************************************************************/
    u_long vm_scheduled_writes;
    u_long vm_error_writes;
    u_long vm_reclaim_writes;  /* Wrote dirty data for reclaim */

    /*****************************************************************/
    /* Next counters are I/O wait counters.  They count the number of     */
    /* times we had to wait for a write I/O and under what conditions.    */
    /*****************************************************************/
    u_long vm_read_waits;
    u_long vm_write_waits;
    u_long vm_fsync_waits;
    u_long vm_error_waits;
    u_long vm_reclaim_waits;      /* Waited for pending I/O for reclaim */

    /*****************************************************************/
    /* Final set are memory management counters.                          */
    /*****************************************************************/
    u_long vm_reclaim_steal;        /* Number of times steal from others function invoked */
    u_long vm_waits_for_reclaim;    /* Waits for reclaim thread */
    u_long vm_reserved[10];         /*reserved for future use*/
} VM_STATS;
```

```
typedef struct stat_user_cache_t
{
    VM_STATS stuc[2];                /*Various statistics for both LOCAL and REMOTE systems*/
    int    stuc_dataspaces;          /* Number of dataspaces in user data cache */
    int    stuc_pages_per_ds;        /* Pages per dataspace */
    int    stuc_seg_size_loc;        /* Local Segment Size (in K) */ /*#B@D12838MG*/
    int    stuc_seg_size_rmt;        /* Remote Segment Size (in K) */
    int    stuc_page_size;           /* Page Size (in K) */
    int    stuc_cache_pages;         /* Total number of pages */
    int    stuc_total_free;          /* Total number of free pages */
    int    stuc_vmSegTable_cachesize; /* Number of segments */
    int    stuc_reserved[5];            /* reserved */
    DS_ENTRY stuc_ds_entry[32];      /* Array of dataspace entries */
} STAT_USER_CACHE;

struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    STAT_USER_CACHE mystats;
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i,j;
    double ratio1,ratio2,ratio3,ratio4;
    char buf[33];

    STAT_API *stapptr = &(myparmstruct.myapi);

    myparmstruct.myparms.opcode = STATOP_USER_CACHE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;


/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the user cache statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) +  */
                                 /* sizeof(STAT_USER_CACHE);                      */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(STAT_USER_CACHE);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,           /* Perf statistics operation       */
            sizeof(myparmstruct),    /* Length of Argument      */
            (char *) &myparmstruct,  /* Pointer to Argument     */
            &bpxrv,                  /* Pointer to Return_value */
            &bpxrc,                  /* Pointer to Return_code  */
            &bpxrs);                 /* Pointer to Reason_code  */
```

```
if( bpxrv < 0 )
{
    printf("Error querying user cache stats, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
    return bpxrc;
}
else
{
    printf("                  User File (VM) Caching System Statistics\n");
    printf("                  ----------------------------------------\n");
    printf("\n");
    for( i = 0 ; i <= REMOTE ; i++ )
    {
        if( i == 0 )
        {
            printf("                  Direct Statistics\n");
            printf("                  -----------------\n");
            printf("\n");
        }
        else
        {
            printf("                  Client Statistics\n");
            printf("                  -----------------\n");
            printf("\n");
        }
        printf("External Requests:\n");
        printf("------------------\n");
        printf("%-9s %10u     %-9s %10u     %-9s %10u\n",
               "Reads",myparmstruct.mystats.stuc[i].vm_reads,
               "Fsyncs",myparmstruct.mystats.stuc[i].vm_fsyncs,
               "Schedules",myparmstruct.mystats.stuc[i].vm_schedules);
        printf("%-9s %10u     %-9s %10u     %-9s %10u\n",
               "Writes",myparmstruct.mystats.stuc[i].vm_writes,
               "Setattrs",myparmstruct.mystats.stuc[i].vm_setattrs,
               "Unmaps",myparmstruct.mystats.stuc[i].vm_unmaps);
        printf("%-9s %10u     %-9s %10u     %-9s %10u\n",
               "Asy Reads",myparmstruct.mystats.stuc[i].vm_readasyncs,
               "Getattrs",myparmstruct.mystats.stuc[i].vm_getattrs,
               "Flushes",myparmstruct.mystats.stuc[i].vm_flushes);
        printf("\n");
        printf("File System Reads:\n");
        printf("------------------\n");
        ratio1 = ratio2 = ratio3 = ratio4 = 0.0;
        if( myparmstruct.mystats.stuc[i].vm_reads > 0 )
        {
            ratio1 = 100 * (((double)myparmstruct.mystats.stuc[i].vm_reads_faulted)
                            / ((double)myparmstruct.mystats.stuc[i].vm_reads));
        }
        if( myparmstruct.mystats.stuc[i].vm_writes > 0 )
        {
            ratio2 = 100 * (((double)myparmstruct.mystats.stuc[i].vm_writes_faulted)
                            / ((double)myparmstruct.mystats.stuc[i].vm_writes));
        }
        if( myparmstruct.mystats.stuc[i].vm_reads > 0 )
        {
            ratio3 = 100 * (((double)myparmstruct.mystats.stuc[i].vm_read_waits)
                            / ((double)myparmstruct.mystats.stuc[i].vm_reads));
        }
        printf("%-14s %10u     (%s Ratio    %.2f%%)\n",
               "Reads Faulted",myparmstruct.mystats.stuc[i].vm_reads_faulted,
               "Fault",ratio1);
        printf("%-14s %10u     (%s Ratio    %.2f%%)\n",
               "Writes Faulted",myparmstruct.mystats.stuc[i].vm_writes_faulted,
               "Fault",ratio2);
        printf("%-14s %10u     (%s Ratio    %.2f%%)\n",
               "Read Waits",myparmstruct.mystats.stuc[i].vm_read_ios,
               "Wait",ratio3);
        printf("\n");
```

```
            printf("File System Writes:\n");
            printf("-------------------\n");
            printf("%-19s %10u     %-13s %10u\n",
                   "Scheduled Writes", myparmstruct.mystats.stuc[i].vm_scheduled_writes,
                   "Sync  Waits", myparmstruct.mystats.stuc[i].vm_fsync_waits);
            printf("%-19s %10u     %-13s %10u\n",
                   "Error Writes", myparmstruct.mystats.stuc[i].vm_error_writes,
                   "Error Waits", myparmstruct.mystats.stuc[i].vm_error_waits);
            printf("%-19s %10u     %-13s %10u\n",
                   "Page Reclaim Writes", myparmstruct.mystats.stuc[i].vm_reclaim_writes,
                   "Reclaim Waits", myparmstruct.mystats.stuc[i].vm_reclaim_waits);
            if( myparmstruct.mystats.stuc[i].vm_writes > 0 )
            {
                ratio4 = 100 * (((double)myparmstruct.mystats.stuc[i].vm_write_waits)
                                / ((double)myparmstruct.mystats.stuc[i].vm_writes));
            }
            printf("%-19s %10u     (Wait Ratio    %.2f%%)\n",
                   "Write Waits", myparmstruct.mystats.stuc[i].vm_write_waits,
                   ratio4);
        }
        printf("\n");
        printf("Page Management (Segment Size = (%dK Local %dK Remote) ) (Page Size = %dK)\n",
               myparmstruct.mystats.stuc_seg_size_loc,
               myparmstruct.mystats.stuc_seg_size_rmt,
               myparmstruct.mystats.stuc_page_size);
        printf("-------------------------------------------------------------------------\n");
        printf("Total Pages       %10u     Free               %10u\n",
               myparmstruct.mystats.stuc_cache_pages,myparmstruct.mystats.stuc_total_free);
        printf("Segments          %10u\n",
               myparmstruct.mystats.stuc_vmSegTable_cachesize);
        printf("Steal Invocations %10u     Waits for Reclaim %11u\n",
               myparmstruct.mystats.stuc[0].vm_reclaim_steal,
               myparmstruct.mystats.stuc[0].vm_waits_for_reclaim);
        printf("\n");
        printf("Number of dataspaces used: %5d  ",myparmstruct.mystats.stuc_dataspaces);
        printf("Pages per dataspace: %11d\n",myparmstruct.mystats.stuc_pages_per_ds);
        printf("\n");
        printf("Dataspace   Allocated     Free\n");
        printf("Name        Segments      Pages\n");
        printf("--------    ----------    ----------\n");
        for( i = 0 ; i < myparmstruct.mystats.stuc_dataspaces ; i++ )
        {
            printf("%8s    %10u    %10u\n",
                   myparmstruct.mystats.stuc_ds_entry[i].ds_name,
                   myparmstruct.mystats.stuc_ds_entry[i].ds_alloc_segs,
                   myparmstruct.mystats.stuc_ds_entry[i].ds_free_pages);
        }
        printf("\n");
        if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }

    }
    return 0;
}
```

Statistics Vnode Cache Information

Purpose

The statistics vnode cache information subcommand call is a performance statistics operation that returns vnode cache counters.

Format

```
syscall_parmlist
   opcode               251              STATOP_VNODE_CACHE
   parms[0]             offset to STAT_API
   parms[1]             offset to output buffer
   parms[2]             offset to system name (optional)
   parms[3]             0
   parms[4]             0
   parms[5]             0
   parms[6]             0
STAT_API
   sa_eye               char[4]          "STAP"
   sa_len               int              length of buffer that follows STAT_API
   sa_ver               int              1
   sa_flags             char[1]          0x00
     SA_RESET             0x80           Reset statistics
   sa_fill              char[3]          0
   sa_reserve           int[4]           0
   posix_time_high      unsigned long    high order 32 bits since epoch
   posix_time_low       unsigned long    low order 32 bits since epoch
   posix_useconds       unsigned long    microseconds
   pad1                 int
STAT_VNODE_CACHE
  VNM_STATS_API_STRUCT
     reserved             hyper            reserved
     Vnodes               hyper            number of vnodes
     Requests             hyper            number of requests
     Hits                 hyper            number of hits
     RatioWhole           hyper            ratio of hits to requests (whole number part)
     RatioDecimal         hyper            ratio of hits to requests (decimal part)
     Allocates            hyper            allocates
     Deletes              hyper            deletes
     VnodeStructSize      hyper            base vnode structure size
     ExtendedVnodes       hyper            number of extended vnodes
     extensionSize        hyper            size of vnode extension
     USSHeldVnodes        hyper            number of held vnodes
     USSHeldVnodesHi      hyper            hi water mark of held vnodes
     OpenVnodes           hyper            number of open vnodes
     OpenVnodesHi         hyper            hi water mark of open vnodes
     OpenVnodesReuse      hyper            number of vnodes that can be reused
     reserved1            long[3]          reserved
     pad1                 int              padding
     reserved2            hyper[10]        reserved
  EFS_STATS_API_STRUCT
     reserved             hyper            reserved
     grand_total_vnodes   hyper            total count of vnode ops
     total_ops            hyper            number of vnode op counts
     reserved1            long[3]          reserved
     pad1                 int              reserved
     reserved2            hyper[10]        reserved
   ZFSVNODEOPCOUNTS
     opname               char[26]         vnode operation name
     pad1                 char[2]          reserved
     opcount              hyper            count of vnode op requests
     reserved             hyper[2]         reserved
  reserved                hyper[10]        reserved
systemname                char[9]
```

```
Return_value     0 if request is successful, -1 if it is not successful

Return_code

  EINTR          zFS is shutting down
  EINVAL         Invalid parameter list
  EMVSERR        Internal error occurred
  E2BIG          Information too big for buffer supplied

Reason_code

  0xEFnnxxxx     See z/OS Distributed File Service Messages and Codes
```

Usage

This function is used to determine the numbers of requests, hits and discards from the vnode cache.

Privilege Required

None.

Related Services

Statistics Vnode Cache Information

Statistics Metadata Cache Information

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);

/* #include <stdlib.h>  */
#include <stdio.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_VNODE_CACHE              251   /* vnode cache stats */

#define u_long unsigned long

#define CONVERT_RATIO_TO_INTS(RATIO, INTEGER, DECIMAL)             \
{                                                                  \
  INTEGER = (int)RATIO;                                            \
  DECIMAL = (int)((RATIO - (double)INTEGER) * (double)1000.0);     \
}

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform            */
    int parms[7];             /* Specific to type of operation,       */
                              /* provides access to the parms         */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

|  typedef struct hyper {
|    unsigned long high;                        /* unsigned long reserved */
|    unsigned long low;
|  } hyper;

/* reset timestamp */
typedef  struct  reset_time {
  u_long   posix_time_high;   /* high order 32 bits since epoc */
  u_long   posix_time_low;    /* low order 32 bits since epoch */
```

```
  u_long   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/* API STATOP_VNODE_CACHE storage structures */
typedef struct VNM_STATS_API_STRUCT_T
{
  hyper   reserved;
  hyper   Vnodes;
  hyper   Requests;
  hyper   Hits;
  hyper   RatioWhole;
  hyper   RatioDecimal;
  hyper   Allocates;
  hyper   Deletes;
  hyper   VnodeStructSize;
  hyper   ExtendedVnodes;
  hyper   extensionSize; /* (minimum) in bytes */
  hyper   USSHeldVnodes;
  hyper   USSHeldVnodesHi;
  hyper   OpenVnodes;
  hyper   OpenVnodesHi;
  hyper   OpenVnodesReuse;
  long    reserved1[3];
  int     pad1;
  hyper   reserved2[10];
}  VNM_STATS_API_STRUCT;

typedef struct ZFSVNODEOPCOUNTS_T {
  char  opname[26];         /* Operation being counted              */
  char  pad1[2];
  hyper opcount;            /* Number of operations performed       */
  hyper reserved[2];        /* reserved for future use              */
} ZFSVNODEOPCOUNTS;

typedef struct EFS_STATS_API_STRUCT_T
{
  hyper   reserved;
  hyper   grand_total_vnodes;
  hyper   total_ops;
  long    reserved1[3];
  int     pad1;
  hyper   reserved2[10];
  ZFSVNODEOPCOUNTS zFSOpCounts[50];
} EFS_STATS_API_STRUCT;

typedef struct stat_vnode_cache_t
 {
   VNM_STATS_API_STRUCT vnm_stats_info;
   EFS_STATS_API_STRUCT efs_stats_info;
   hyper   reserved[10];
 } STAT_VNODE_CACHE;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
```

```
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;


struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    STAT_VNODE_CACHE mystats;
    char systemname[9];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;
    double temp_ratio;
    int whole,decimal;

    STAT_API *stapptr = &(myparmstruct.myapi);
    char buf[33];

    myparmstruct.myparms.opcode = STATOP_VNODE_CACHE;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;

/* Only specify a non-zero offset for the next field (parms[2]) if */
/* you are running z/OS 1.7 and above, and */
/* you want to query the vnode cache statistics of a different system than this one */

/* myparmstruct.myparms.parms[2] = sizeof(syscall_parmlist) + sizeof(STAT_API) +  */
/* sizeof(STAT_VNODE_CACHE);                                                      */

    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) sizeof(STAT_VNODE_CACHE);

/* This next field should only be set if parms[2] is non-zero */
/* strcpy(myparmstruct.systemname,"DCEIMGVQ"); */

    BPX1PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation       */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
        printf("Error querying vnode cache, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
        return bpxrc;
    }
    else
    {
```

```
i=0;

printf("%50s\n","zFS Vnode Op Counts");
printf("     \n");

printf("Vnode Op                      Count   Vnode Op                      Count   \n");
printf("----------------------  ----------   ----------------------  ----------   \n");

while (i<=myparmstruct.mystats.efs_stats_info.total_ops.low)
{
  printf("%-25s %10d   ",
       myparmstruct.mystats.efs_stats_info.zFSOpCounts[i].opname,
       myparmstruct.mystats.efs_stats_info.zFSOpCounts[i++].opcount.low);

  if (i<=myparmstruct.mystats.efs_stats_info.total_ops.low)
  {
    printf("%-25s %10d\n",
       myparmstruct.mystats.efs_stats_info.zFSOpCounts[i].opname,
       myparmstruct.mystats.efs_stats_info.zFSOpCounts[i++].opcount.low);
  }
}
printf("\nTotal zFS Vnode Ops       %10d\n\n",
       myparmstruct.mystats.efs_stats_info.grand_total_vnodes.low);
printf("%52s\n","zFS Vnode Cache Statistics");

printf("      \n");


printf(" Vnodes      Requests     Hits     Ratio  Allocates   Deletes\n");
printf(" ---------- ---------- ---------- ------- ---------- ----------\n");
printf("%10d %10d %10d %3d.%1.1d%% %10d %10d\n",
        myparmstruct.mystats.vnm_stats_info.Vnodes.low,
        myparmstruct.mystats.vnm_stats_info.Requests.low,
        myparmstruct.mystats.vnm_stats_info.Hits.low,
        myparmstruct.mystats.vnm_stats_info.RatioWhole.low,
        myparmstruct.mystats.vnm_stats_info.RatioDecimal.low,
        myparmstruct.mystats.vnm_stats_info.Allocates.low,
        myparmstruct.mystats.vnm_stats_info.Deletes.low);
printf("    \n");
printf("zFS Vnode structure size: %d bytes\n",
       myparmstruct.mystats.vnm_stats_info.VnodeStructSize.low);
printf("zFS extended vnodes: %d, extension size %d bytes (minimum)\n",
       myparmstruct.mystats.vnm_stats_info.ExtendedVnodes.low,
       myparmstruct.mystats.vnm_stats_info.extensionSize.low);
printf("Held zFS vnodes: %10d (high %10d) \nOpen zFS vnodes:     %10d (high %10d) Reusable: %u\n",
       myparmstruct.mystats.vnm_stats_info.USSHeldVnodes.low,
       myparmstruct.mystats.vnm_stats_info.USSHeldVnodesHi.low,
       myparmstruct.mystats.vnm_stats_info.OpenVnodes.low,
       myparmstruct.mystats.vnm_stats_info.OpenVnodesHi.low,
       myparmstruct.mystats.vnm_stats_info.OpenVnodesReuse.low);
printf("    \n");

if (0==ctime_r((time_t *) &stapptr->reset_time_info.posix_time_low, buf))
{
    printf("Could not get timestamp.\n");
}
else
{   /* Insert the microseconds into the displayable time value */
    strncpy(&(buf[27]),&(buf[20]),6);
    sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
    buf[26]=' ';
    buf[19]='.';
    printf("Last Reset Time: %s",buf);
}
```

```
    }
    return 0;
}
```

Unquiesce Aggregate

Purpose

The Unquiesce Aggregate subcommand call is an aggregate operation that unquiesces a multi-file system aggregate on a system. This allows activity on the aggregate and all its file systems to resume.

Format

```
syscall_parmlist
   opcode                         133      AGOP_UNQUIESCE_PARMDATA
   parms[0]                       offset to AGGR_ID
   parms[1]                       quiesce handle
   parms[2]                       0
   parms[3]                       0
   parms[4]                       0
   parms[5]                       0
   parms[6]                       0
AGGR_ID
   aid_eye                        char[4]    "AGID"
   aid_len                        char       sizeof(AGGR_ID)
   aid_ver                        char       1
   aid_name                       char[45]   "OMVS.PRV.AGGR001.LDS0001"
   aid_reserved                   char[33]   0

Return_value    0 if request is successful, -1 if it is not successful

Return_code

  EINTR         ZFS is shutting down
  EMVSERR       Internal error using an osi service
  ENOENT        Aggregate is not attached
  EPERM         Permission denied to perform request

Reason_code

  0xEFnnxxxx    See z/OS Distributed File Service Messages and Codes
```

Usage

The unquiesce call must supply the quiesce handle that was returned by the quiesce call. The aggregate would normally be quiesced prior to backing up the aggregate. After the backup is complete, the aggregate can be unquiesced.

Reserved fields and undefined flags must be set to binary zeros.

Privilege Required

The issuer must be logged in as root or must have READ authority to the SUPERUSER.FILESYS.PFSCTL resource in the z/OS UNIXPRIV class.

Related Services

Quiesce Aggregate

Restrictions

None.

Examples

```
#pragma linkage(BPX1PCT, OS)
extern void BPX1PCT(char *, int, int, char *, int *, int *, int *);
```

```
#include <stdio.h>
#include <stdlib.h>

#define ZFSCALL_AGGR   0x40000005
#define AGOP_UNQUIESCE_PARMDATA  133

typedef struct syscall_parmlist_t {
  int opcode;               /* Operation code to perform            */
  int parms[7];             /* Specific to type of operation,       */
                            /* provides access to the parms         */
                            /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

#define ZFS_MAX_AGGRNAME 44

typedef struct aggr_id_t {
  char aid_eye[4];                    /* Eye catcher */
#define AID_EYE "AGID"
  char aid_len;                       /* Length of this structure */
  char aid_ver;                       /* Version */
#define AID_VER_INITIAL 1             /* Initial version */
  char aid_name[ZFS_MAX_AGGRNAME+1];  /* Name, null terminated    */
  char aid_reserved[33];              /* Reserved for the future  */
} AGGR_ID;

struct parmstruct
{
 syscall_parmlist myparms;
 AGGR_ID aggr_id;
} ;

int main(int argc, char **argv)
{
int bpxrv;
int bpxrc;
int bpxrs;
char aggrname[45] = "OMVS.PRV.AGGR001.LDS0001";
long save_quiesce_handle;

struct parmstruct myparmstruct;

if (argc != 2)
   {
    printf("This unquiesce program requires a quiesce handle from the quiesce program as a parameter\n");
    return 1;
    }
save_quiesce_handle = atoi(argv[1]);

myparmstruct.myparms.opcode = AGOP_UNQUIESCE_PARMDATA;
myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
myparmstruct.myparms.parms[1] = save_quiesce_handle;
myparmstruct.myparms.parms[2] = 0;
myparmstruct.myparms.parms[3] = 0;
myparmstruct.myparms.parms[4] = 0;
myparmstruct.myparms.parms[5] = 0;
myparmstruct.myparms.parms[6] = 0;

memset(&myparmstruct.aggr_id,0,sizeof(AGGR_ID));    /* Ensure reserved fields are 0 */

memcpy(&myparmstruct.aggr_id.aid_eye,AID_EYE,4);
myparmstruct.aggr_id.aid_len = sizeof(AGGR_ID);
myparmstruct.aggr_id.aid_ver = AID_VER_INITIAL;
strcpy(myparmstruct.aggr_id.aid_name,aggrname);

     BPX1PCT("ZFS     ",
             ZFSCALL_AGGR,             /* Aggregate operation     */
             sizeof(myparmstruct),     /* Length of Argument      */
```

```
             (char *) &myparmstruct,   /* Pointer to Argument     */
             &bpxrv,                   /* Pointer to Return_value */
             &bpxrc,                   /* Pointer to Return_code  */
             &bpxrs);                  /* Pointer to Reason_code  */

if (bpxrv < 0)
     {
     printf("Error unquiescing aggregate %s\n", aggrname);
     printf("BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
     return bpxrc;
     }
   else /* Return from unquiesce was successful  */
     {
     printf("Aggregate %s unquiesced successfully\n",aggrname);
     }
return 0;
}
```

Appendix A. Running the zFS pfsctl APIs in 64-bit mode

The pfsctl (BPX1PCT) application programming interface can be invoked in a 64-bit environment. In order to do this, you must:

- replace the BPX1PCT with BPX4PCT
- replace the `#pragma linkage(BPX1PCT, OS)` statement with `#pragma linkage(BPX4PCT, OS64_NOSTACK)`
- change all the ″long″ declares to ″int″
- Ensure there are appropriate includes for function calls
- Ensure all functions requiring 64-bit parameters are passing 64-bit numbers (for example, ctime_r).

The remaining code is, or can remain unchanged. The following is an example with these changes.

Statistics iocounts information

Examples

```
#pragma linkage(BPX4PCT, OS64_NOSTACK)
extern void BPX4PCT(char *, int, int, char *, int *, int *, int *);

#include <stdio.h>
#include <time.h>

#define ZFSCALL_STATS    0x40000007
#define STATOP_IOCOUNTS                  243  /* Performance API queries */

#define TOTAL_TYPES       3
#define TOTAL_CIRC       18

#define u_int unsigned int

typedef struct syscall_parmlist_t
{
    int opcode;               /* Operation code to perform             */
    int parms[7];             /* Specific to type of operation,        */
                              /* provides access to the parms          */
                              /* parms[4]-parms[6] are currently unused*/
} syscall_parmlist;

typedef  struct  reset_time {
  u_int   posix_time_high;   /* high order 32 bits since epoc */
  u_int   posix_time_low;    /* low order 32 bits since epoch */
  u_int   posix_usecs;        /* microseconds */
  int      pad1;
 } RESET_TIME;

/*********************************************************************/
/* The following structure is the api query control block            */
/* It is used for all api query commands                             */
/*********************************************************************/

typedef struct stat_api_t
{
#define SA_EYE    "STAP"
    char  sa_eye[4];     /* 4 byte identifier must be */
    int   sa_len;        /* length of the buffer to put data into*/
                         /* this buffer area follows this struct*/
    int   sa_ver;        /* the version number currently always 1*/
#define SA_VER_INITIAL 0x01
    char  sa_flags;      /* flags field  must be x00 or x80, x80 means reset statistics*/
#define SA_RESET 0x80
    char  sa_fill[3];    /* spare bytes */
    int   sa_reserve[4];       /* Reserved */
    struct reset_time reset_time_info;
} STAT_API;

typedef struct API_IO_BY_TYPE_t
{
    unsigned int number_of_lines;
    unsigned int count;
    unsigned int waits;
    unsigned int cancels;  /* Successful cancels of IO */
    unsigned int merges;   /* Successful merges of IO */
    char     reserved1[6];
    char     description[51];
    char     pad1[3];
} API_IO_BY_TYPE;

typedef struct API_IO_BY_CIRC_t
```

```
{
    unsigned int number_of_lines;
    unsigned int count;
    unsigned int waits;
    unsigned int cancels;
    unsigned int merges;
    char     reserved1[6];
    char     description[51];
    char     pad1[3];
} API_IO_BY_CIRC;

/*********************************************************************/
/* The following structures are used to represent cfgop queries      */
/* for iocounts                                                      */
/*********************************************************************/

struct parmstruct
{
    syscall_parmlist myparms;
    STAT_API myapi;
    API_IO_BY_TYPE mystatsbytype[TOTAL_TYPES];
    API_IO_BY_CIRC mystatsbycirc[TOTAL_CIRC];
} myparmstruct;

int main(int argc, char **argv)
{
    int bpxrv;
    int bpxrc;
    int bpxrs;
    int i;

    STAT_API *stapptr = &(myparmstruct.myapi);
    API_IO_BY_TYPE *stiotptr = &(myparmstruct.mystatsbytype[0]);
    API_IO_BY_CIRC *stiocptr = &(myparmstruct.mystatsbycirc[0]);

    char buf[33];

    myparmstruct.myparms.opcode = STATOP_IOCOUNTS;
    myparmstruct.myparms.parms[0] = sizeof(syscall_parmlist);
    myparmstruct.myparms.parms[1] = sizeof(syscall_parmlist) + sizeof(STAT_API);
    myparmstruct.myparms.parms[2] = 0;
    myparmstruct.myparms.parms[3] = 0;
    myparmstruct.myparms.parms[4] = 0;
    myparmstruct.myparms.parms[5] = 0;
    myparmstruct.myparms.parms[6] = 0;

    memset(stapptr,0,sizeof(STAT_API));
    memcpy(stapptr->sa_eye,SA_EYE,4);
    stapptr->sa_ver=SA_VER_INITIAL;
    stapptr->sa_len=(int) (TOTAL_TYPES * sizeof(API_IO_BY_TYPE))
                       + (TOTAL_CIRC * sizeof(API_IO_BY_CIRC));

    BPX4PCT("ZFS     ",
            ZFSCALL_STATS,            /* Perf statistics operation       */
            sizeof(myparmstruct),     /* Length of Argument      */
            (char *) &myparmstruct,   /* Pointer to Argument     */
            &bpxrv,                   /* Pointer to Return_value */
            &bpxrc,                   /* Pointer to Return_code  */
            &bpxrs);                  /* Pointer to Reason_code  */
    if( bpxrv < 0 )
    {
       printf("Error querying iocounts, BPXRV = %d BPXRC = %d BPXRS = %x\n",bpxrv,bpxrc,bpxrs);
       return bpxrc;
    }
    else
    {
        if( stiotptr->number_of_lines != TOTAL_TYPES )
```

```
        {
            printf("Unexpected number of IO Types, %d instead of TOTAL_TYPES\n",
            stiotptr->number_of_lines);
            return 1;
        }
        if( stiocptr->number_of_lines != TOTAL_CIRC )
        {
            printf("Unexpected number of IO Circumstances, %d instead of TOTAL_CIRC\n",
            stiocptr->number_of_lines);
            return 2;
        }
        printf("                  I/O Summary By Type\n");
        printf("                  -------------------\n");
        printf("\n");
        printf("Count       Waits       Cancels     Merges      Type\n");
        printf("----------  ----------  ----------  ----------  ----------\n");
        for( i=0; i<TOTAL_TYPES; i++ )
        {
            printf("%10d  %10d  %10d  %10d  %s\n",
                   stiotptr->count, stiotptr->waits,
                   stiotptr->cancels, stiotptr->merges,
                   stiotptr->description);
            stiotptr = stiotptr + 1;
        }
        printf("\n");
        printf("                  I/O Summary By Circumstance\n");
        printf("                  ---------------------------\n");
        printf("\n");
        printf("Count       Waits       Cancels     Merges      Circumstance\n");
        printf("----------  ----------  ----------  ----------  ------------\n");
        for( i=0; i<TOTAL_CIRC; i++ )
        {
            printf("%10d  %10d  %10d  %10d  %s\n",
                   stiocptr->count, stiocptr->waits,
                   stiocptr->cancels, stiocptr->merges,
                   stiocptr->description);
            stiocptr = stiocptr +1;
            printf("\n");
        }
        if (0==ctime_r((time_t *) &stapptr->reset_time_info, buf))
        {
            printf("Could not get timestamp.\n");
        }
        else
        {   /* Insert the microseconds into the displayable time value */
            strncpy(&(buf[27]),&(buf[20]),6);
            sprintf(&(buf[20]),"%06d",stapptr->reset_time_info.posix_usecs);
            buf[26]=' ';
            buf[19]='.';
            printf("Last Reset Time: %s",buf);
        }
    }
    return 0;
}
```

Appendix B. Accessibility

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use software products successfully. The major accessibility features in z/OS enable users to:

- Use assistive technologies such as screen readers and screen magnifier software
- Operate specific or equivalent features using only the keyboard
- Customize display attributes such as color, contrast, and font size

Using assistive technologies

Assistive technology products, such as screen readers, function with the user interfaces found in z/OS. Consult the assistive technology documentation for specific information when using such products to access z/OS interfaces.

Keyboard navigation of the user interface

Users can access z/OS user interfaces using TSO/E or ISPF. Refer to *z/OS TSO/E Primer*, *z/OS TSO/E User's Guide*, and *z/OS ISPF User's Guide Vol I* for information about accessing TSO/E and ISPF interfaces. These guides describe how to use TSO/E and ISPF, including the use of keyboard shortcuts or function keys (PF keys). Each guide includes the default settings for the PF keys and explains how to modify their functions.

z/OS information

z/OS information is accessible using screen readers with the BookServer/Library Server versions of z/OS books in the Internet library at:

`http://www.ibm.com/servers/eserver/zseries/zos/bkserv/`

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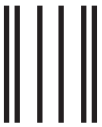

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