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zFS Enhancements
z/OS V1R7

Redbooks
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Trademarks

eNetwork	DFSMS/MVS	IMS	RACF
geoManager	DFSMSdfp	IMS/ESA	RMF
AD/Cycle	DFSMSdss	IP PrintWay	RS/6000
ADSTAR	DFSMShsm	IPDS	S/390
AFP	DFSMSrmm	Language Environment	S/390 Parallel Enterprise Server
APL2	DFSORT	Multiprise	SecureWay
APPN	Enterprise System 3090	MQSeries	StorWatch
BookManger	Enterprise System 4381	MVS/ESA	Sysplex Timer
BookMaster	Enterprise System 9000	Network Station	System/390
C/370	ES/3090	NetSpool	SystemView
CallPath	ES/4381	OfficeVision/MVS	SOM
CICS	ES/9000	Open Class	SOMobjects
CICS/ESA	ESA/390	OpenEdition	SP
CICS/MVS	ESCON	OS/2	VisualAge
CICSPlex	First Failure Support Technology	OS/390	VisualGen
COBOL/370	FLowMark	Parallel Sysplex	VisualLift
DataPropagator	FFST	Print Services Facility	VTAM
DisplayWrite	GDDM	PrintWay	WebSphere
DB2	ImagePlus	ProductPac	3090
DB2 Universal Database	Intelligent Miner	PR/SM	3890/XP
DFSMS/MVS	IBM	QMFr	z/OS
			z/OS.e

Domino (Lotus Development Corporation)   Tivoli (Tivoli Systems Inc.)   UNIX (X/Open Company Limited)
DFS (Transarc Corporation)   Tivoli Management Framework   Windows (Microsoft Corporation)
Java (Sun Microsystems, Inc.)   (Tivoli Systems Inc.)   Windows NT (Microsoft Corporation)
Lotus (Lotus Development Corporation)   Tivoli Manger (Tivoli Systems Inc.)

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zFS - 1-2

Installation and Documentation

❏ Installed first in z/OS V1R2

   ➤ Enabling APAR/PTF - OW50850 / UW82925

   ➤ Coding APAR/PTF   -   OW51563 / UW83377

❏ The support for OS/390 V2R10 and z/OS V1R1 is provided by APAR OW51780

❏ z/OS Distributed File Service zSeries Administration, SC24-5989 - (Standard documentation)

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zFS Redbooks

z/OS Distributed File Service zSeries File System Implementation, SG24-6580-00 - (z/OS V1R3) Publication   -   September 2002

z/OS Distributed File Service zSeries File System Implementation, SG24-6580-01 - (z/OS V1R6) Publication   -   April 2005

z/OS Distributed File Service zSeries File System Implementation, SG24-6580-02 - (z/OS V1R7) Publication   - 4Q 2005
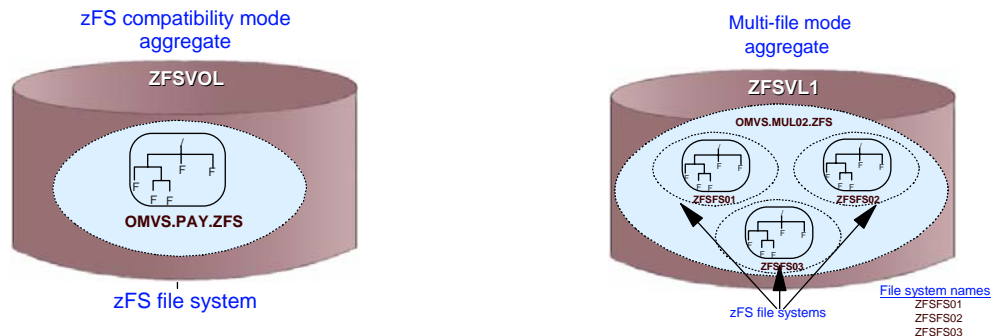
zFS File Systems

- ❑ An **aggregate** is a VSAM linear data set (LDS)
- ❑ An aggregate contains one or more zFS file systems
- ❑ Two types of aggregates:
  - ➢ HFS compatibility mode - contains 1 zFS file system
  - ➢ Multiple file system mode - contains 1 or more zFS file systems
    - – Space sharing between file systems in same aggregate

zFS compatibility mode aggregate

ZFSVOL

OMVS.PAY.ZFS

zFS file system

Multi-file mode aggregate

ZFSVL1

OMVS.MUL02.ZFS

ZFSFS01   ZFSFS02

ZFSFS03

zFS file systems

File system names
ZFSFS01
ZFSFS02
ZFSFS03

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zFS and Multi-file Mode Aggregates

- ❑ In February 2005, IBM announced:
  - ➢ z/OS V1R7 is planned to be the last release to allow mounting zSeries File System (zFS) file systems contained in multi-file system aggregates that are to be shared across systems in a sysplex
  - ➢ IBM has previously recommended that these multi-file system aggregates not be shared in a sysplex environment. Once this support has been removed, attempts to mount zFS file systems contained in multi-file system aggregates will fail in a z/OS UNIX System Services shared file system environment
  - ➢ Mounting zFS compatibility mode aggregates, which have a single file system per data set, will continue to be supported in all environments

zFS and a Future Release

❏ In a future release, IBM plans to withdraw support for zFS multi-file system aggregates

❏ When this support is withdrawn, only zFS compatibility mode aggregates will be supported

➢ A zFS compatibility mode aggregate has a single file system per data set

zFS with z/OS V1R7

❏ With completion of zFS EOM support zFS being now the preferred z/OS UNIX file system

❏ Sysplex awareness of APIs and the zfsadm command interface

❏ Various new zfsadm commands and options

❏ Removal of zFS aggregate and file system name restrictions

❏ Further enhancements to LFS support for zFS

❏ New directory cache parameter

❏ New performance monitoring APIs

zFS with z/OS V1R7

❏ zFS is the preferred file system

❏ Continued use of HFS will be discouraged

❏ Significant effort is needed to migrate data from HFS file systems to zFS file systems

❏ Tools to help with migration are needed

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zFS Enhancements for z/OS V1R7

❏ New LFS support enhancements for zFS
❏ HFS compatibility
  ➤ zfsadm command forwarding/pfsctl to another system
  ➤ Addition of valid aggregate/file system name characters (@ # $)
  ➤ UNQUIESCE MODIFY command
  ➤ Performance Monitoring APIs – Phase 2
  ➤ zFS End of Memory (EOM) support
❏ Additions to the pax command
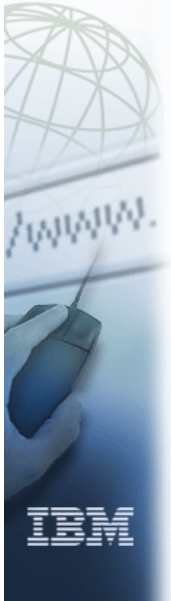❏ zFS migration support
  ➤ BPXWH2Z tool - ISPF based

zFS Sysplex Enhancements

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zFS Sysplex Support

❑ **BPXPRMxx SYSPLEX option**

➤ SYSPLEX(YES) must be specified for this to take effect
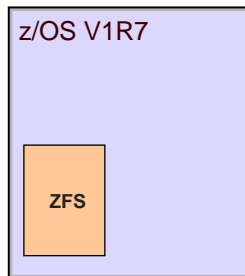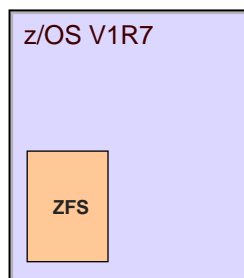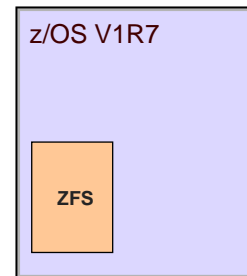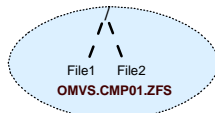
z/OS V1R7

ZFS

SC63

z/OS V1R7

ZFS

SC64

z/OS V1R7

ZFS

SC65

File1 File2
OMVS.CMP01.ZFS

BPXPRMxx

SYSPLEX=YES

zfsadm Command Changes for Sysplex

❑ Previously, zfsadm commands (and the pfsctl APIs) could only display or change information that is located or owned on the current member of the sysplex

  ➤ Only issued from the owning system

❑ When DFSMS is used to backup a zFS aggregate, the aggregate is quiesced by DFSMS before the backup

  ➤ In order for this quiesce to be successful, it must be issued on the system that owns the aggregate

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zfsadm Command Changes for Sysplex

❑ In z/OS V1R7, if you are in a shared file system environment, zfsadm commands and zFS pfsctl APIs generally work across the sysplex

❑ There are two main changes:

  ➤ The zfsadm commands act globally and report or modify all zFS objects across the sysplex

  ➤ They support a new –system option that limits output to zFS objects on a single system or sends a request to a single system

New zfsadm Commands Changes

❏ zfsadm configquery command options
  ➢ -group, -sysplex_state
  ➢ -system system_name
❏ Option, -long shows more details

```
$> zfsadm lsfs OMVS.HERING.TEST.ZFS -long
IOEZ00129I Total of 1 file systems found for aggregate
OMVS.HERING.TEST.ZFS
OMVS.HERING.TEST.ZFS 100005,,5 RW (Mounted R/W)     states 0x10010005
On-line
    4294967232 K alloc limit;       10847 K alloc usage
         11375 K quota limit;       10847 K quota usage
           112 K Filesystem Inode Table          21 file requests
```

Configuration Options New - z/OS V1R7

❏ -system system_name
  ➢ Specifies the name of the system the report request will be
    sent to, to retrieve the data requested
❏ -group
  ➢ Displays the XCF group used by ZFS for communication
    between sysplex members
    – Default Value: IOEZFS
    – Expected Value: 1 to 8 characters
    – Example group: IOEZFS1

```
$> zfsadm configquery -group
IOEZ00317I The value for configuration option -group is IOEZFS.
```

zFS Starts and Joins the XCF group

```
 IEF403I ZFS - STARTED - TIME=18.59.13 - ASID=008F - SC70
...
 IOEZ00052I zFS kernel: Initializing z/OS    zSeries File System
 Version 01.07.00 Service Level 0000000 - HZFS370.
 Created on Mon Apr  4 16:06:17 EDT 2005.
...
 IOEZ00350I Successfully joined group IOEZFS
*IOEZ00525I Starting initialization with SC65
 IOEZ00529I Preparing for initialization with SC70. <===== SC65
 IOEZ00530I Ready to initialize with SC70. <============== SC65
*IOEZ00526I Requesting aggregate information from SC65
 IOEZ00532I Sending aggregate information to SC70. <====== SC65
...
 IOEZ00528I Initialization with SC65 complete.
 IOEZ00533I Done initializing with SC70. <============== SC65
...
 IOEZ00055I zFS kernel: initialization complete.
```

Configuration Options New - z/OS V1R7

❑ -sysplex_state

➢ Displays the sysplex state of ZFS. Zero (0) indicates that
ZFS is not in a shared file system environment. One (1)
indicates that ZFS is in a shared file system environment

```
$> zfsadm configquery -sysplex_state
IOEZ00317I The value for configuration option -sysplex_state is 1.
```

zFS - 17-18

zFS Sysplex Command Support

- ❏ z/OS V1R7 - Ability to issue zFS filesystem commands from anywhere within a sysplex
    - ➤ Allow quiesce of zFS from any LPAR in a sysplex
- ❏ zfsadm commands are global to sysplex
    - ➤ aggrinfo - clonesys - lsaggr - lsfs
- ❏ zfsadm commands "go" to the correct system
    - ➤ aggrinfo, clone, create, delete, grow,l sfs, lsquota, quiesce, rename, setquota, unquiesce
- ❏ zfsadm commands can be limited/directed to a system
    - ➤ aggrinfo, attach, clonesys, config, configquery, define, detach, format, lsaggr, lsfs, query

---

Command Forwarding Support

- ❏ zfsadm commands will now display and work with zFS aggregates and file systems across the sysplex
- ❏ This enhancement is exploited by:
    - ➤ DFSMS backup (ADRDSSU)
        - – Backups can now be issued from any member of the sysplex when all members are at z/OS V1R7 regardless of which member owns the file system
    - ➤ ISHELL
    - ➤ zFS administrators

New zfsadm Command Examples

❑ zfsadm lssys - Shows the members in a sysplex

```
ROGERS @ SC65:/u/rogers>zfsadm lssys
IOEZ00361I A total of 2 systems are in the XCF group for zFS
SC65
SC70
ROGERS @ SC65:/u/rogers>
```

❑ zfsadm sysplex command example using

➤ -system *system_name*

```
ROGERS @ SC65:/u/rogers>zfsadm aggrinfo -system SC70
IOEZ00368I A total of 2 aggregates are attached to system SC70.
OMVS.TEST.MULTIFS.ZFS (R/O MULT): 20597 K free out of total 20880
OMVS.HERING.TEST.ZFS (R/O COMP): 454 K free out of total 11520
ROGERS @ SC65:/u/rogers>
```

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zFS Fast Mount

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zFS Fast Mount - Performance Improvement

❏ Implemented with APAR OA12519

  ➤ Toleration APAR OA11573 for prior releases

    – Apply to Z/OS Versions V1R4, V1R5, V1R6, V1R7

    – **Note: Apply to V1R7 before OA12519**

❏ Resolves the following problem:

  ➤ Dead system recovery caused zFS file systems to move to another system

  ➤ zFS file system had tens of millions of files

  ➤ Mount during move took 30 minutes to complete

  ➤ System (USS) unavailable during this time

---

zFS Fast Mount - Performance Improvement

❏ To support this improvement, the first time that a zFS aggregate is mounted on z/OS V1R7 after APAR OA12519 is applied

  ➤ It is converted to a new on-disk format (called version 1.4)

  ➤ Additional information for mount processing can be recorded in the aggregate

  ➤ All existing aggregates are version 1.3 aggregates

❏ After conversion, subsequent mount processing will occur more quickly

  ➤ APAR OA11573 supplies the code to process the new format (version 1.4)

❏ Only works for compatibility mode aggregates
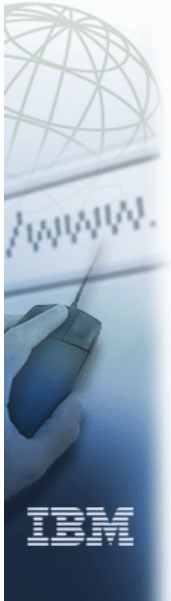
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Addition of valid aggregate/file system name characters (@ # $)

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Special Characters in zFS Aggregates

❑ Previously, you could not have a zFS aggregate or file system name that contained special characters

➢ (@ # $)

```
# zfsadm define -aggr OMVS.HERING.@TEST.ZFS -volumes CFC000 -cyl 10
IOEZ00248E VSAM linear datase PLEX.JMS.AGGR#06.LDS0006 successfully
created.
# zfsadm format -aggr OMVS.HERING.@TEST.ZFS -compat
IOEZ00077I HFS-compatibility aggregate OMVS.HERING.@TEST.ZFS has been
successfully created
```
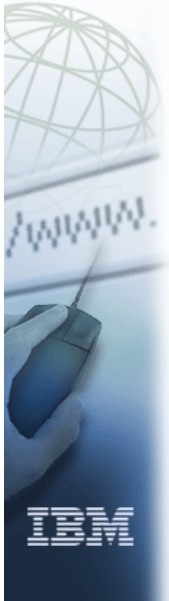
UNQUIESCE Modify Command

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New UNQUIESCE Command

❑ Previously, if a zFS aggregate was quiesced and the job failed to unquiesce it, you would need to use OMVS - zfsadm unquiesce command

➤ Not possible to unquiesce from operator console

➤ z/OS V1R7 new command to issue unquiesce

– F ZFS,UNQUIESCE,OMVS.HERING.@TEST.ZFS

– Must be issued from owning system

❑ This command only works on z/OS V1R7

➤ It must be issued from the owning system

➤ This command does not forward requests to other members of the sysplex
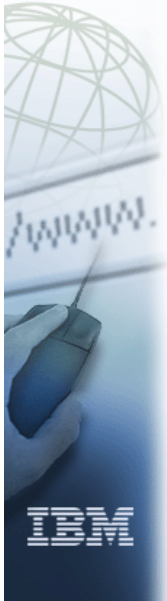
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Performance Monitoring APIs

Performance APIs

❏ Previously, certain zFS performance counters could only be retrieved via operator console command
  ➢ Data could not easily be retrieved by an application
  ➢ Provide an API to obtain statistics on zFS activity
❏ Now, all zFS performance counters can be retrieved by an application
  ➢ pfsctl API (BPX1PCT)
❏ Now, zfsadm command can be used to display/reset performance counters
  ➢ zfsadm query -metadata
❏ Administrative application programs can use this function
❏ RMF exploits this function in z/OS V1R7

Performance Monitoring APIs - z/OS V1R6

❑ zFS provides six new pfsctl APIs to retrieve performance counters

➢ Locks

➢ Storage

➢ User data cache

➢ iocounts

➢ iobyaggr

➢ iobydasd

`f zfs,query,all`

❑ zFS provides a new zfsadm command (query) to query/reset the performance counters

zfsadm query [-locking] [-storage] [-usercache] [-iocounts] [-iobyaggregate] [-iobydasd] [-reset]

---

zfsadm query Command

❑ zfsadm query command now supports additional options

➢ knpfs, -metadata, -dircache, -vnodecache, -logcache, -trancache

```
zfsadm query -dircache
              Directory Backing Caching Statistics

Buffers   (K bytes)  Requests      Hits    Ratio   Discards
--------- --------- ---------- ---------- ------ ----------
      256      2048    1216679    1216628  99.9%         50
```

Directory Cache (dircache)

❑ In z/OS V1R7 a new zFS IOEPRMxx parameter file statement is available to set the directory cache size

- ➤ dir_cache_size - Size of the directory buffer cache
  - ‒ Example: dir_cache_size=4M
- ➤ The minimum and default size is 2M, the maximum value that can be set is 512M
- ➤ Changing this cache size may be useful if you expect situations with many file creates or deletes
- ➤ This is available via APAR OA10136 and PTFs:
  - ‒ UA16125 for z/OS V1R4
  - ‒ UA16123 for z/OS V1R5
  - ‒ UA16124 for z/OS V1R6

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zFS EOM Enhancements

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zFS EOM Support

❏ Previously, an End of Memory condition while executing in zFS could cause zFS to go down
  ➤ When zFS goes down, all zFS file systems are unmounted
❏ Now, End of Memory conditions are recovered by zFS
  ➤ zFS does not go down
  ➤ No zFS file systems are unmounted
❏ z/OS V1R7 zFS will recover for EOM, earlier releases will not

zFS EOM Support

❏ zFS End of Memory (EOM) support is invoked by:
  ➤ A calling application going to End of Memory while executing in zFS
❏ Called by:
  ➤ Operator action when a job is forced (did not respond to cancel)
❏ Changed external output
  ➤ zFS does not go down/zFS file systems do not need to be remounted

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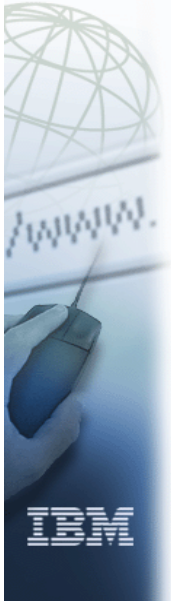
RMF Monitor Support for zFS

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RMF Monitor III Support for zFS

❏ New Monitor III zFS reports provides data on:
  ➤ zFS response time / wait times
  ➤ zFS cache activity
  ➤ zFS activity / capacity by aggregate
  ➤ zFS activity / capacity by filesystem
❏ Data helps to control the zFS environment for:
  ➤ Cache sizes
  ➤ I/O balancing
  ➤ Capacity control for zFS aggregates

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RMF Support for zFS

Continuous Async I/O

zFS filesystem

Application

Synchronous Application I/O

Vnode cache

Metadata cache

Transaction Cache

Log file cache

User cache

zFS Address space and Dataspaces

zFS VSAM data set (Aggregate)
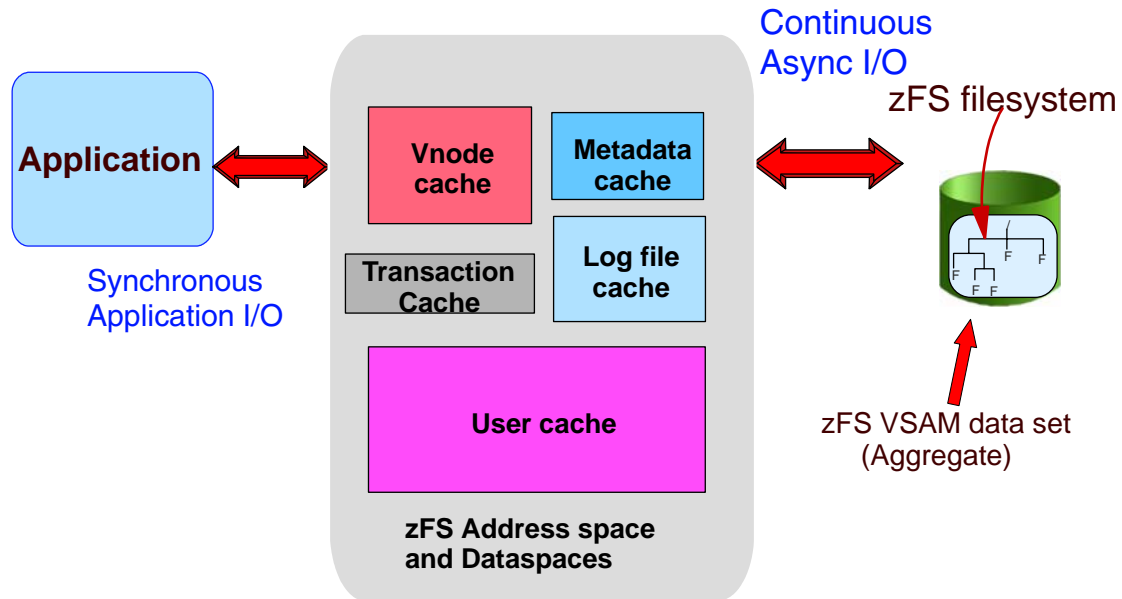
RMF Overview Report Selection Menu

```
                    RMF Overview Report Selection Menu
 Selection ===>

 Enter selection number or command for desired report.


  Basic Reports
        1 WFEX      Workflow/Exceptions                      (WE)
        2 SYSINFO   System information                       (SI)
        3 CPC       CPC capacity

  Detail Reports
        4 DELAY     Delays                                   (DLY)
        5 GROUP     Group response time breakdown            (RT)
        6 ENCLAVE   Enclave resource consumption and delays  (ENCL)
        7 OPD       OMVS process data
        8 ZFSSUM    zFS Summary                              (ZFSS)
        9 ZFSACT    zFS File system activity                 (ZFSA)
```

❑ RMF Overview Report Selection Menu (Detail reports)
❑ Command interface
 ➢ **ZFSSUM** or **ZFSS**:
  – zFS summary report
 ➢ **ZFSACT** or **ZFSA**:
  – zFS activity report
❑ Gatherer options:
 ➢ Option **NOZFS | ZFS**

zFS Summary Report

```
                        RMF V1R7    zFS Summary Report           Line 1 of 3
Command ===>                                                Scroll ===> CSR

Samples: 120     System: TRX2  Date: 09/07/04  Time: 16.30.00  Range: 120   Sec

---- Response Time ---- -------------- Cache Activity ----------------------
      ----- Wait% ----- --------- User ------  -- Vnode -- - Metadata - -Trx -
   Avg  I/O  Lock Sleep Rate Hit% Read% Dly%   Rate Hit%   Rate Hit%   Rate
   0.27 0.4  80.7  0.0 405.5 100   0.0  0.0     0.0  0.0   10.9 99.9    0.2

-----------Aggregate Name---------------- Size Use% --Mode- FS  Read Write
                                                                  (B/Sec)

OMVS.TRX2.LOCAL.COMPAT.A.ZFS              528K 29.2  R/W CP   1    0   137
OMVS.TRX2.LOCAL.MULTI.A.ZFS               2160K 8.0  R/W MS   3    0   137
RMF.TEST.ZFS.HFSMF1                       7200K 16.1 R/W MS   3   137 1058
```

zFS Actvity report for Aggregate name

Response time section:
- Average response time for zFS request
- Wait percentages

Cache activity:
- Request rates
- Hit ratios
- % read requests
- % requests delayed

Aggregate section:
- Capacity data
- Mount mode
- # filesystems in the aggregate
- Read / Write rates (Bytes per second)
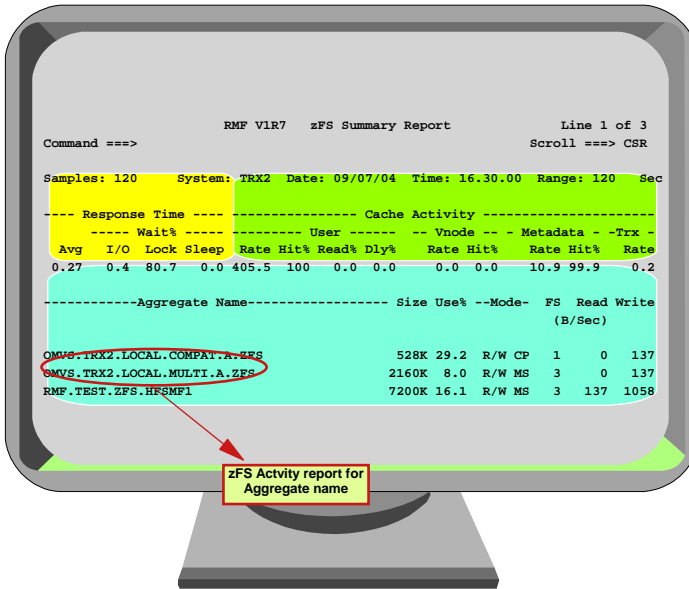
zFS Summary - I/O Details by Type

```
                        RMF V1R7    zFS Summary Report           Line 1 of 3
Command ===>                                                Scroll ===> CSR

Samples: 120     System: TRX2  Date: 09/07/04  Time: 16.30.00  Range: 120   Sec

---- Response Time ---- -------------- Cache Activity ----------------------
      ----- Wait% ----- --------- User ------  -- Vnode -- - Metadata - -Trx -
   Avg  I/O  Lock Sleep Rate Hit% Read% Dly%   Rate Hit%   Rate Hit%   Rate
   0.27 0.4  80.7  0.0 405.5 100   0.0  0.0     0.0  0.0   10.9 99.9    0.2

-----------Aggregate Name---------------

OMVS.TRX2.LOCAL.COMPAT.A.ZFS
OMVS.TRX2.LOCAL.MULTI.A.ZFS
RMF.TEST.ZFS.HFSMF1
```

```
           zFS Summary - I/O Details by Type

  Count Waits Cancl Merge  Type
   815   326    0     0    FILE SYSTEM METADATA
   346    23    0    29    LOG FILE
  1447   175    0     2    USER FILE DATA

  Press Enter to return to the Report panel.
```

User and Vnode Cache Detail

```
                     RMF V1R7    zFS Summary Report
Command ===>

Samples: 120     System: TRX2  Date: 09/07/04  Time: 16.30

---- Response Time ----  --------------- Cache Activity --
    ----- Wait% -----  --------- User ------  -- Vnode --
  Avg   I/O  Lock Sleep  Rate Hit% Read% Dly%   Rate Hit%
  0.27  0.4  80.7  0.0  405.5  100   0.0  0.0    0.0  0.0
```

```
           zFS Summary - Vnode Cache Details

Request Rate :   14.2     vnodes         :     65536
Hit%         :   99.9     vnode size     :       168
                          ext. vnodes    :     65536
                          ext. vnode size :      668
                          open vnodes    :        12
                          held vnodes    :        44

Press Enter to return to the Report panel.
```

```
           zFS Summary - User Cache Details

Read  Rate          :  27.4  Size         :  256M
Write Rate          :  16.9  Total Pages :  65536
Read  Hit (%)       :  59.4  Free Pages  :  12703
Write Hit (%)       : 100.0  Segments    :   8192
Read  Delay (%)     :   1.3
Write Delay (%)     :   0.0  User Cache readahead:  ON
Async Read Rate     :  10.1  Storage fixed     :   NO
Scheduled Write Rate:  83.8
Page Reclaim Writes :    0
Fsyncs              :    0

Press Enter to return to the Report panel.
```

```
                R/W CP   1    0   137
                R/W MS   3    0   137
                R/W MS   3  137  1058
```

Vnode cache details:
- **Request rate, hit ratio**
- **Vnode statistics**

User cache details:
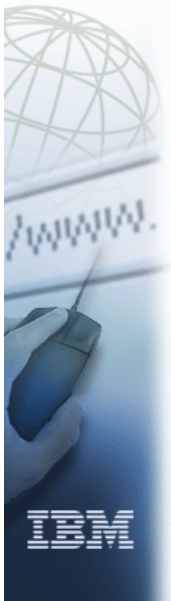- **Request rates, hit ratios, delays**
- **Storage statistics**

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zFS Redbook - SG24-6580 Download Material

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Download of REXX execs and JCL

Attention: The sample REXX procedures are available in softcopy on the Internet from the Redbooks Web server

Point your browser to:
ftp://www.redbooks.ibm.com/redbooks/SG246580/

Note: SG246580 must be uppercase (the SG part)

Alternatively, you can go to:
http://www.redbooks.ibm.com
and select Redbooks Online, and then Additional Materials

HFS to zFS Migration

❏ Input: List of source data sets (HFS data sets)

➢ Tool (REXX) creates a list of HFS data sets with

➢ Suggested settings for the target zFS aggregates

– You may change settings (storage group, size, etc.)

❏ Tool provides a final input data set for a job that performs the migration process

❏ Tool has option to determine whether you want to replace the old HFS with the new zFS if HFS is currently mounted

Using pax in copy mode - (COPYPAX)

❏ Without an intermediate archive is a more efficient way of copying an HFS file system to a zFS file system
  ➤ REXX procedure COPYPAX allows the user to use the pax command in copy mode - can be used from the TSO foreground but use in a TSO batch job

❏ Benefits of COPYPAX
  ➤ A test is done to verify that the source and the target structure are located in different file systems
  ➤ A test is done to verify that the target directory is empty
  ➤ Uses option -X to avoid skipping over mount point boundaries
  ➤ Invalid file descriptor files are corrected when pax has finished its copy processing

---

Batch Job for COPYPAX

```
//ZFSJOB   JOB ,'COPYPAX',NOTIFY=&SYSUID.,REGION=0M
//* ------------------------------------------------------------------
//* Use pax to copy source directory structure to target directory
//* Property of IBM  (C) Copyright IBM Corp. 2002
//* ------------------------------------------------------------------
//  SET SOURCED='/u/hering'                       <=== Source directoy
//  SET TARGETD='/u/zfs/m01'                       <=== Target directoy
//* ------------------------------------------------------------------
//  SET TIMEOUT=0          <=== Timeout value in seconds, 0=no timeout
//  SET REXXLIB=HERING.ZFS.REXX.EXEC               <=== SYSEXEC library
//* ------------------------------------------------------------------
//ZFSADM   EXEC PGM=IKJEFT01,PARM='COPYPAX &TIMEOUT &SOURCED &TARGETD'
//SYSEXEC  DD DSNAME=&REXXLIB.,DISP=SHR
//SYSTSIN  DD DUMMY
//SYSTSPRT DD SYSOUT=*,LRECL=136,RECFM=V
//*
```

Use COPYPAX for Copy of Root

```
//ZFSJOB   JOB ,'COPYPAX',NOTIFY=&SYSUID.,REGION=0M
//* -------------------------------------------------------------------
//* Use pax to copy source directory structure to target directory
//* Property of IBM  (C) Copyright IBM Corp. 2002
//* -------------------------------------------------------------------
//  SET SOURCED='/'                       <=== Source directory
//  SET TARGETD='/u/zfs/zfsroot'          <=== Target directory
//* -------------------------------------------------------------------
//  SET TIMEOUT=0          <=== Timeout value in seconds, 0=no timeout
//  SET REXXLIB=HERING.ZFS.REXX.EXEC           <=== SYSEXEC library
//* -------------------------------------------------------------------
//ZFSADM   EXEC PGM=IKJEFT01,PARM='COPYPAX &TIMEOUT &SOURCED &TARGETD'
//SYSEXEC  DD DSNAME=&REXXLIB.,DISP=SHR
//SYSTSIN  DD DUMMY
//SYSTSPRT DD SYSOUT=*,LRECL=136,RECFM=V
//*
```

REXX Procedure ADDMNTPS

❑ To recreate missing directories

  ➢ REXX exec ADDMNTPS

```
//ZFSJOB   JOB ,'ADDMNTPS',NOTIFY=&SYSUID.,REGION=0M
//* ----------------------------------------------------------------
//* Add missing mount point directories after clone process
//* Property of IBM  (C) Copyright IBM Corp. 2002
//* ----------------------------------------------------------------
//  SET SOURCED='/'                             <=== Source directory
//  SET TARGETD='/u/zfs/zfsroot'                <=== Target directory
//* ----------------------------------------------------------------
//  SET TIMEOUT=0          <=== Timeout value in seconds, 0=no timeout
//  SET REXXLIB=HERING.ZFS.REXX.EXEC               <=== SYSEXEC library
//* ----------------------------------------------------------------
//ZFSADM   EXEC PGM=IKJEFT01,PARM='ADDMNTPS &TIMEOUT &SOURCED &TARGETD'
//SYSEXEC  DD DSNAME=&REXXLIB.,DISP=SHR
//SYSTSIN  DD DUMMY
//SYSTSPRT DD SYSOUT=*,LRECL=136,RECFM=V
//*
```

ADDMNTPS ....

❑ It looks for all mount points of all the file systems mounted in the system

❑ If the file system is the source file system or the mount point is the root (/), no action is taken

❑ If the parent directory of the mount point belongs to the source file system, then this mount point is one of the mount point directories that needs to exist in the target structure

❑ A test is done to determine whether the corresponding directory in the target file system is already there (it could have been defined in the meantime). If it does not exist, it is created with owner UID 0 and permission bits set to 700

HFS or zFS Data Sets

❑ You can choose whether each filesystem is to be an HFS or a zFS:
  ➤ On the data set attributes panels
  ➤ With the new CHange DSNTYPE command

❑ Exception: The root file system must be an HFS

❑ New data set types in the installation dialog:
  ➤ HFS, zFS, PDS, PDSE, SEQ, and VSAM

```
>---+--- CHANGE ---+---+--- DSNTYPE ---+---+--- PDS PDSE ---+---<
    |       | |           | |               |
    +--- CH ------+   +--- TYPE ------+   +--- PDSE PDS ---+
         |       | |           | |               |
         +--- T --------+   +--- HFS ZFS ----+
                 |       |
                 +--- ZFS HFS ----+
```

Set Data Set Type

```
CPPP605D ----------- Modify System Layout ( RO150026 ) -----------------
COMMAND ==> _

Data Set Modification - Attributes


        Data set Name ==> OMVSZ15.RL000006.OMVS.ETC
         Shipped     :  OMVS.ETC

        Placement     :  C        (DLIB, Target, Catalog, or User-Defined)

        Data Set Type ==> HFS      (HFS, PDS, PDSE, SEQ, VSAM, or ZFS)
         Shipped     :  HFS

        SMS-Managed   ==> NO       (Yes or No)
        SMS-Eligible  :  YES
        SMS-Required  :  NO

        Logical Volume ==> HLB002  Shipped    :  CAT001
        Physical Volume  :  T6Z5H1
         Storage Class   :
```

HFS versus zFS

❏ HFS data set vs. VSAM LDS (aggregate) for zFS

❏ zFS aggregate must be preformatted

❏ Different FILESYSTYPEs used in BPXPRMxx

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

❏ Different operands on MOUNT command

❏ Different security system setup

❏ NONVSAM versus VSAM catalog entry

❏ CICS, DB2, and IMS ServerPacs assume that any necessary zFS setup has been done

ServerPac Changes if using zFS

- ❏ ALLOCDS job formats zFS data sets you define
- ❏ RACFDRV and RACFTGT Jobs in z/OS orders:
  - ➢ Add group for DFS setup
  - ➢ Add user ID for ZFS address space
- ❏ RESTFS Job:
  - ➢ Uses appropriate TYPE on MOUNT commands depending on filesystem type
  - ➢ Puts appropriate TYPE on MOUNT parameters in BPXPRMFS
  - ➢ Add FILESYSTYPE for zFS to BPXPRMFS if needed