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zFS and z/OS UNIX



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eNetwork	DFSMS/MVS	IMS	RACF
geoManager	DFSMSdfp	IMS/ESA	RMF
AD/Cycle	DFSMSdss	IP PrintWay	RS/6000
ADSTAR	DFSMSshsm	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
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DataPropagator	FFST	Print Services Facility	VTAM
DisplayWrite	GDDM	PrintWay	WebSphere
DB2	ImagePlus	ProductPac	3090
DB2 Universal Database	Intelligent Miner	PR/SM	3890/XP
DFSMS	IBM	QMFr	z/OS
	IBM System z		z/OS.e

Domino (Lotus Development Corporation)
 DFS (Transarc Corporation)
 Java (Sun Microsystems, Inc.)
 Lotus (Lotus Development Corporation)

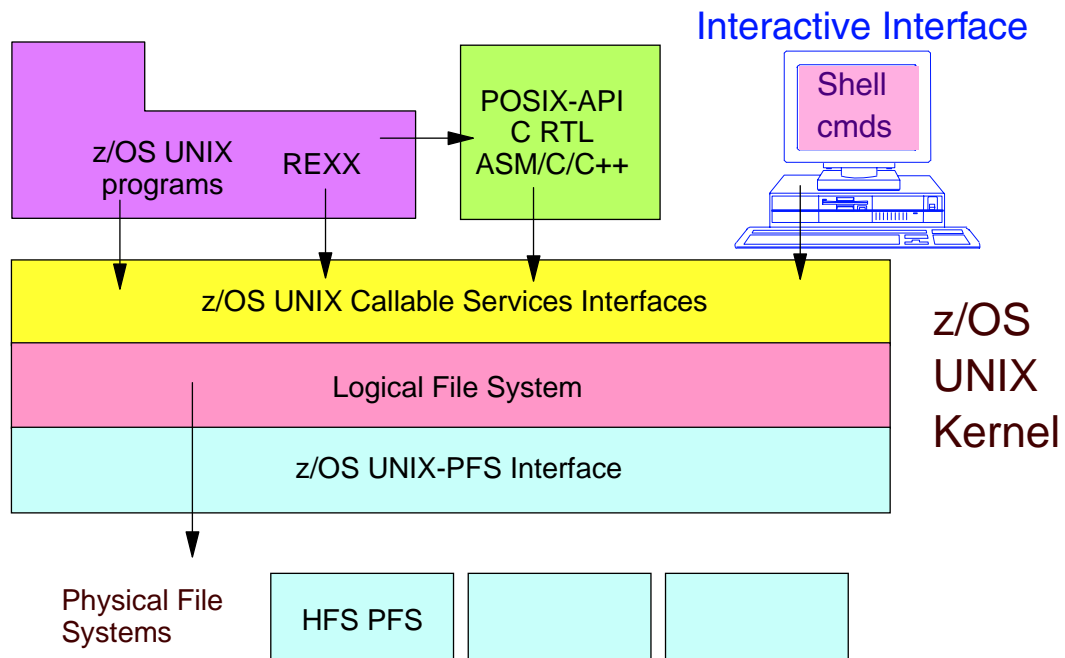
Tivoli (Tivoli Systems Inc.)
 Tivoli Management Framework
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UNIX (X/Open Company Limited)
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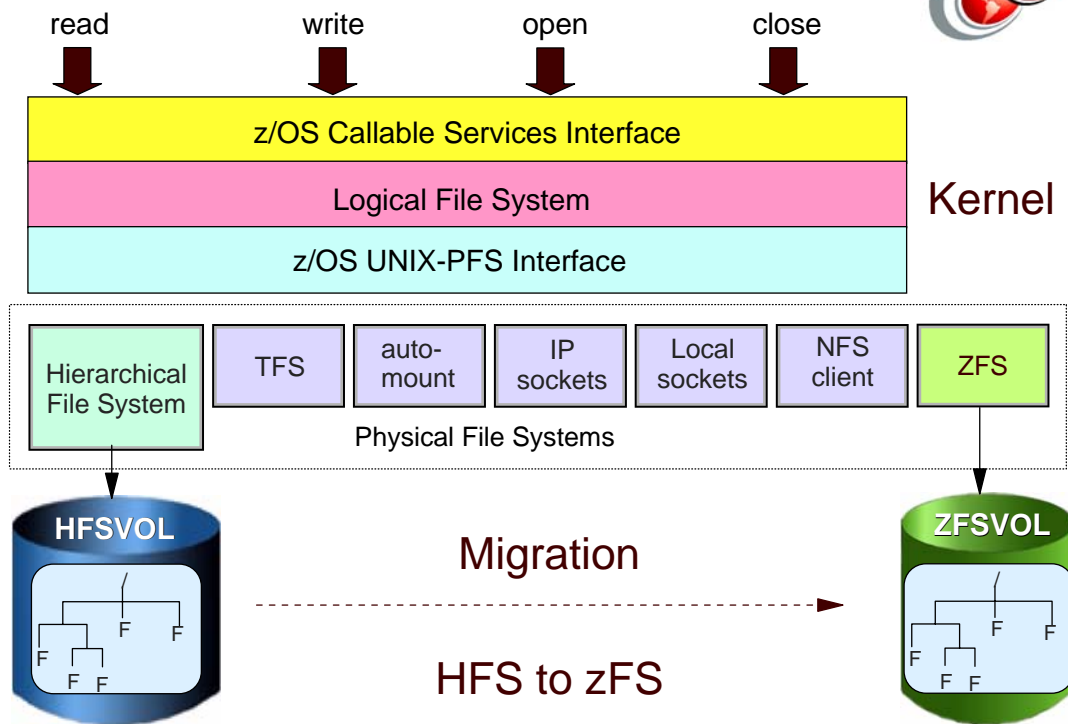
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UNIX System Services (z/OS UNIX)



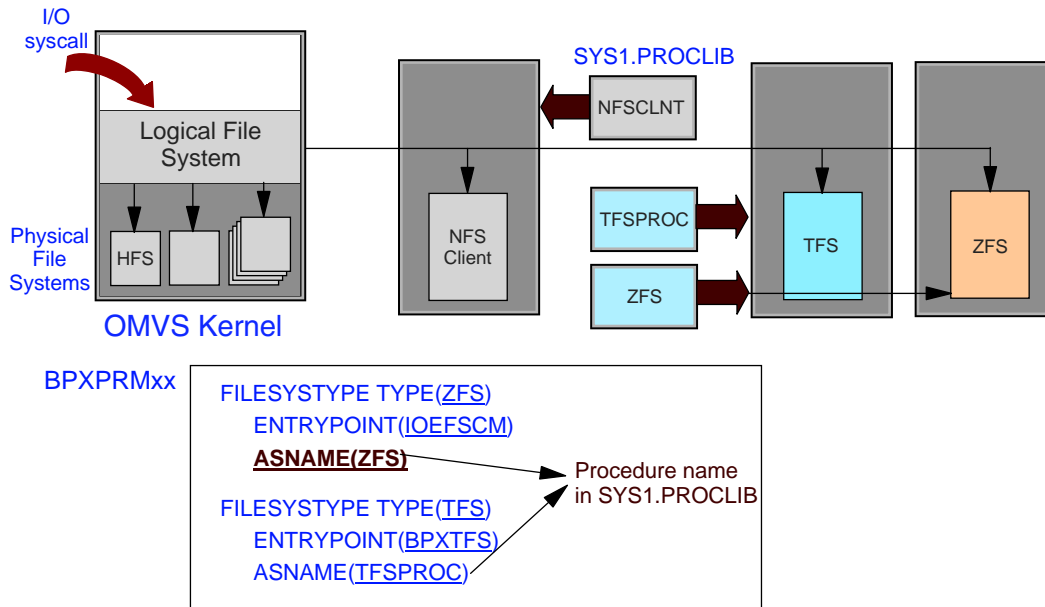
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Requests to LFS to PFS to Files



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zFS Colony Address Space



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zSeries File System (zFS)



- ❑ zFS is the strategic UNIX Systems Services file system for z/OS
- ❑ The Hierarchical File System (HFS) functionality has been stabilized
 - HFS is continuing to ship as part of the operating system and will be supported in within terms of a customer's applicable support agreement
- ❑ IBM intends to continue enhancing zFS functionality, including RAS and performance capabilities, in future z/OS releases
 - All requirements for UNIX file services are expected to be addressed in the context of zFS only



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zFS Migration Considerations z/OS V1R7



- ❑ Migrate from HFS file systems to zFS file systems (Recommended) - because zFS is planned to become a requirement in a future release
- ❑ zFS is the strategic file system
 - HFS may no longer be supported in future releases - necessary to migrate HFS file systems to zFS
- ❑ Migration tool available with z/OS V1R7 - BPXWH2Z
- ❑ HFS and zFS file system types in mount statements and command operands are now generic file system types that can mean either HFS or zFS
 - Based on the data set type, the system will determine which is appropriate



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Migration Tool



- ❑ Use a migration tool to handle many details needed for the migration of HFS file systems to zFS, including the actual copy operation - z/OS V1R7
 - Migration tool - BPXWH2Z
 - An ISPF based tool for migration from an HFS file system to zFS
 - It has a panel interface that enables you to alter the space allocation, placement, SMS classes, and data set names
 - A HELP panel is provided
 - Uses a new pax utility for copy available with z/OS V1R7



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zFS and z/OS UNIX V1R9 Enhancements



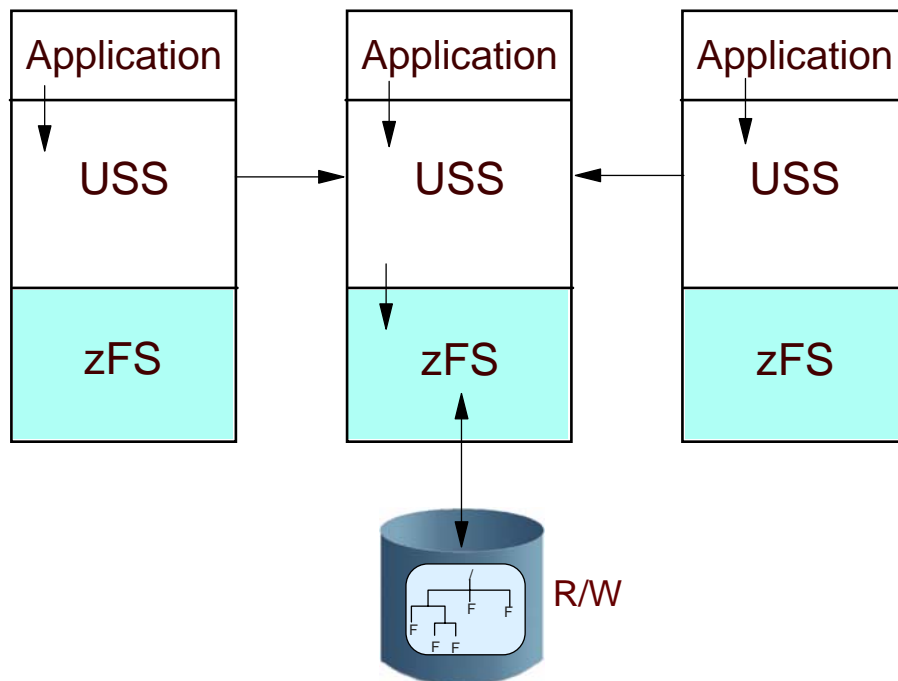
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Sysplex Sharing Mode Prior to V1R9

V1R2 to V1R6 systems

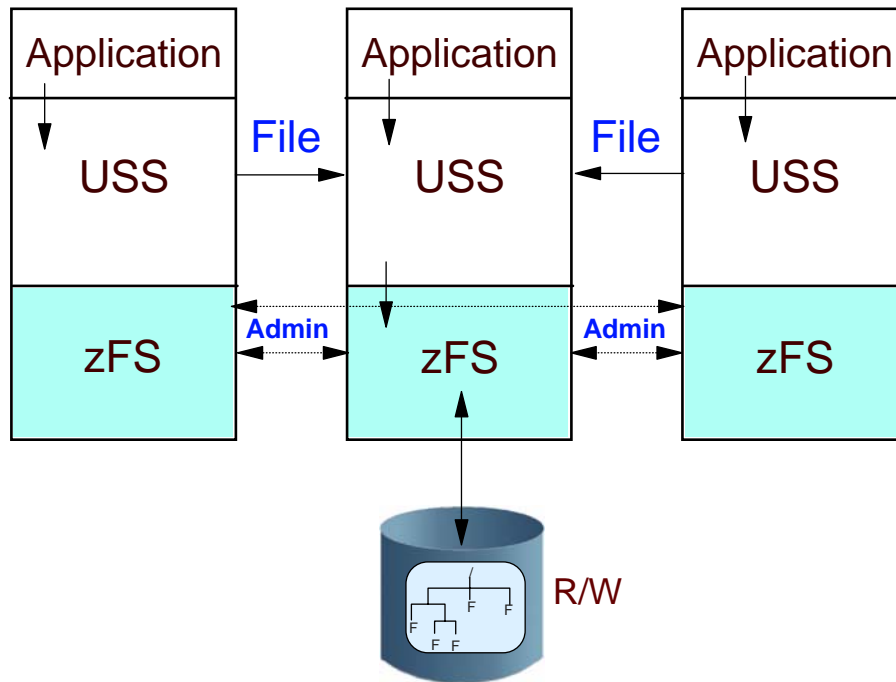


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zFS (V1R7) added IOEZFS Group



V1R7 and V1R8 systems



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zFS V1R9 Enhancements



- ❑ **IOEAGFMT batch utility authorization enhancement**
 - Formerly required UID=0 to format an aggregate
- ❑ **Improved dynamic grow**
 - Formats only a portion of “large” extent
- ❑ **Concurrent log recovery**
 - Possibility to support several concurrent mounts that require log recovery
 - `recovery_max_storage`
- ❑ **Improved hang detector**
 - Smarter to avoid reporting false hangs



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IOEAGFMT Format Batch Utility



- ❑ IOEAGFMT batch utility authorization enhancement
 - No need to have uid=0 to format a zFS aggregate with the IOEAGFMT batch utility
 - ALTER authority is sufficient to VSAM LDS
 - IOEAGSLV batch utility to salvage zFS aggregate has same enhancement
 - UPDATE authority is required to VSAM LDS
 - Support provided in V1R7, V1R8 via APAR OA18981
 - APAR OA20613 for z/OS V1R9
- ❑ READ authority to SUPERUSER.FILESYS.PFSCTL profile in the UNIXPRIV class for both utilities



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Improved Dynamic Grow



- ❑ zfsadm define -cylinders primary [secondary]
 - Specifies the primary and optionally, the secondary allocation size for the VSAM LDS in cylinders
 - The VSAM LDS must have a secondary allocation size specified, if you want to use dynamic grow
- ❑ aggrgrow option - specifies dynamic grow
 - IOEFSPRM member
 - mount commands
 - ISHELL specification on mounts



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Concurrent Log Recovery



- ❑ A new IOEFSPRM keyword, `recovery_max_storage=`
 - Indicate 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
 - The following specifications are:
 - Default Value 256M
 - Expected Value A number in the range of 128M - 512M.
 - Example: `recovery_max_storage=128M`



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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 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 determining that a task has remained in the same location for a predefined period of time, it attempts to determine why it is hung



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Hang Detection



- ❑ The hang detector flags the task as a potential hang and either issues message IOEZ00524I and produces a dump or issues IOEZ00547I to the the console
 - If the message is removed, it means that the hang condition console
- ❑ If on a subsequent iteration the hang detector recognizes that this task has finally progressed, it will DOM the message

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.



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Hang Detection



- ❑ To start investigating:
 - Enter D OMVS,W
 - Checks 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



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z/OS V1R9 Improved Hang Detection



- ❑ `hang_detection_interval=45` - default is 45 seconds
 - Improved hangs to avoid reporting false hangs
- ❑ Allow hang detection to be turned on and off with modify command with an operator command
 - `F ZFS,HANGDETECT,ON` - to turn on
 - `F ZFS,HANGDETECT,OFF` - to turn off
 - Determines whether to dump on a hang detect
 - `hang_detection=on` is default



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Hang Detection Considerations



- ❑ To start investigating:
 - Enter the `D OMVS,W` command
 - Checks 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



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Hang Detection Considerations



- ❑ Enter the `F ZFS,QUERY,THREADS` command to determine if any zFS threads are hanging and why
- ❑ Enter the `D A,ZFS` command to determine the zFS ASID
- ❑ Enter the `F ZFS,QUERY,THREADS` command at one to two minute intervals for six minutes
 - Interrogate the output for any user tasks (tasks that do not show the zFS ASID) that are repeatedly in the same state
 - If there is a hang, this user task will persist unchanged over the course of this time span and if the information is different each time, there is no hang



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Hang Detection Considerations



- ❑ 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/>
```



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Final Considerations



- ❑ If steps do not clear the hang, do one of following:
 - Enter the F ZFS,HANGBREAK command to attempt to break the hang condition
 - 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
 - The hang message can remain on the console for up to one minute
 - Command issues message IOEZ00025I and does not mean the system cleared the hang



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Final Considerations



- ❑ Enter F ZFS,QUERY,THREADS command to check the output for indication the hang is clear which can clear the current hang condition only to encounter yet another hang
 - You might have to enter the F ZFS,HANGBREAK command several times.
- ❑ If users are hung in the file system, forcefully unmount the file system by entering the F ZFS,ABORT command

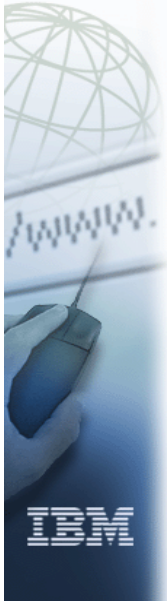


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HFS to zFS Migration Tool - BPXWH2Z Consideration APAR OA18196



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REXX EXEC - BPXWH2Z Migration Tool



- ❑ The REXX is located in library SYS1.SBPXEXEC which is concatenated to SYSPROC
 - ❑ ISPF Option 6 command line, Enter
 - bpxwh2z
 - ❑ Command line flag options:
 - -v Additional messages are issued at various points in processing
 - -c Summary information goes to a file when background (bg) is selected once you are in the application. If this is not specified, summary information goes to the console
- `bpxwh2z -c` - `bpxwh2z -v` - `bpxwh2z -vc`



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Migration Tool - APAR OA18196



- New Function - BPXWH2Z HFS to ZFS Migration Utility
- Enhancements are as follows:
 - 1) Multi-volume conversion support
 - Pre-allocation of a multi-volume zFS no longer required
 - 2) Minimum zFS allocation verification
 - An HFS file system that is too small for zFS file system and fails on zFS allocation - minimum is 6 tracks
 - 3) Panel usability enhancements
 - New zFS name can be changed on change allocation panel
 - 4) New option for exact HFS name match
 - New -e option on BPXWH2Z call



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Using the Migration Tool



- From ISPF Option 6, Enter:
 - bpxwh2z
- When the first panel is displayed
 - Enter HFS data set name to migrate
 - Then hit Enter

```
----- DATA SET SPECIFICATION ---- Enter required field  
Command ==>
```

```
Use the HELP command for usage information on this tool.  
Enter the name of the HFS file system to migrate to a zFS file system.  
Note that a data set pattern can be used.  
If the file system is not currently mounted it will be mounted on a  
temporary directory during the migration.
```

```
File system name: OMVS.ROGERS.TEST_
```



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Using SMS if Required



- ❑ Alter SMS classes and volume if required
 - Then hit the Enter key to see the allocations

```
----- CLASS AND VOLUME DEFAULTS -----
Command ==>

The volume or SMS classes for zFS allocations will default to the
same names as the current HFS allocation. You can change these
individually for each new allocation. If you want the default for
each new allocation to be set to specific values other than that of
the current HFS allocation, enter those values here and Press Enter.

Default volume . . . . . : _____
Default data class . . . . : _____
Default storage class . . : _____
Default management class : _____
```



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Migrate in Foreground



A - Alter allocation

```
----- DATA SET LIST ----- Row 1 to 1 of 1
Command ==> fg_

Use the HELP command for full usage information on this tool
Select items with D to delete items from this migration list
Select items with A to alter allocation parameters for the items
Enter command FG or BG to begin migration in foreground or UNIX background
-----
# HFS data set .. OMVS.ROGERS.TEST Utilized: 62%
Save HFS as .. OMVS.ROGERS.TEST.SAV
Initial zFS .. OMVS.ROGERS.TEST.TMP Allocated: N
HFS space Primary : 25 Secondary: 5 Units .. CYL
zFS space Primary : 25 Secondary: 5 Units .. CYL
Dataclas : HFS Mgmtclas : HFS Storclas: OPENMVS
MOUNTED Volume : SBOX1F Vol count: 1
***** Bottom of data *****

Migrating OMVS.ROGERS.TEST
creating zFS OMVS.ROGERS.TEST.TMP
copying OMVS.ROGERS.TEST to OMVS.ROGERS.TEST.TMP Blocks to copy: 2832
IGD01009I MC ACS GETS CONTROL &ACSENVIR=RENAME
IGD01009I MC ACS GETS CONTROL &ACSENVIR=RENAME
IDC0531I ENTRY OMVS.ROGERS.TEST.TMP ALTERED
IDC0531I ENTRY OMVS.ROGERS.TEST.TMP.DATA ALTERED
mount /u/rogers/tmp OMVS.ROGERS.TEST ZFS 1
***
```



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Allocation Options Prior to OA18196



----- CHANGE ALLOCATION ATTRIBUTES -----

Command ==> _

Use the HELP command for usage information on this tool.
Change the allocation attributes for this new zFS file system.
If the file system is already allocated enter Y for preallocated and the name of the data set as the temp name. The attributes will not be used.

```
File system name . . . OMVS.ROGERS.HFS
Save HFS as . . . . . OMVS.ROGERS.HFS.SAV
Temp name for zFS. . . OMVS.ROGERS.HFS.TMP
Preallocated zFS . . . N

Primary allocation . . 10
Secondary allocation . 5
Allocation units . . . CYL (CYL or TRK)
Data class . . . . . HFS
Management class . . . HFS
Storage class . . . . OPENMVS
Volume . . . . . SBOX39
```



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Allocation Options with OA18196



----- CHANGE ALLOCATION ATTRIBUTES -----

Command ==>

Use the HELP command for usage information on this tool.
Change the allocation attributes for this new zFS file system.
If the file system is already allocated enter Y for preallocated and the name of the data set as the Initial zFS name. The attributes will not be used.

```
File system name . . . OMVS.APAR.TEST
Save HFS as . . . . . OMVS.APAR.TEST.SAV
Initial zFS name . . . OMVS.APAR.TEST.TMP
Final zFS name . . . . OMVS.APAR.TEST
Preallocated zFS . . . N
Primary allocation . . 1
Secondary allocation . 1
Allocation units . . . CYL (CYL or TRK)
Data class . . . . . HFS
Management class . . . HFS
Storage class . . . . OPENMVS
Volume . . . . . SBOX1L
Volume count . . . . . 1
```

change zFS
name

multi-volume



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APAR OA18196 - Migration Tool



The new option came with APAR OA18196, and the option is "-e" to specify the HFS data set name exactly. In the example, two HFSes are involved and just that one exactly matching is selected:

```
READY
ISPSTART CMD(BPXWH2Z -eVC OMVS.HERING.HFS.TEST)
Not running UID=0 - attempting to set UID=0
-getting ds list for OMVS.HERING.HFS.TEST
Skipping matching patterns of input data set name OMVS.HERING.HFS.TEST.FS2
-getting ds info for OMVS.HERING.HFS.TEST
-getting ds info for OMVS.HERING.HFS.TEST.SAV
-getting ds info for OMVS.HERING.HFS.TEST.TMP
Migrating OMVS.HERING.HFS.TEST 15:50:18
creating zFS OMVS.HERING.HFS.TEST.TMP
copying OMVS.HERING.HFS.TEST to OMVS.HERING.HFS.TEST.TMP Blocks to copy: 220
- cd /tmp/bpxwh2z.HERING.15:50:18.hfs; /bin/pax -rw -peW -XCM .
/tmp/bpxwh2z.HERING.15:50:18.zfs
IDC0531I ENTRY OMVS.HERING.HFS.TEST.TMP ALTERED
IDC0531I ENTRY OMVS.HERING.HFS.TEST.TMP.DATA ALTERED
Migration complete for OMVS.HERING.HFS.TEST 15:50:27
HERING.HERIJOB.JOB04075.D0000103.? was preallocated (no free was done).
READY
END
```



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Migration Tool ITSO Redpaper REDP4328



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Migration Tool - REDP4328



Supported functions

- Supports using the standard pax utility of the system running the migration
- Supports any version of pax picked up via the PATH environment variable
- Automatically detects whether the version of pax is at a z/OS V1R7+
- Automatically adds all the missing mount points if pax is previous to R7
- Supports using copytree for the copy processing
- Provides an extra migration utility called copymigr that does the same as pax R7 for releases previous to R7



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Migration Tool - REDP4328



Migration processing

- Interactive definition of planned migrations
- Migration processing via TSO Batch Job
- Option to decide whether the target zFS structure must be empty
- Several intermediate interruption possibilities for stopping migration
 - Processing can be continued in a next run

Link to Redpaper Draft

<http://www.redbooks.ibm.com/redpieces/abstracts/redp4328.html>



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Migration Tool - REDP4328



- ❑ Description of migration tool MIGRTOOL
 - Installation Instructions, Scenario 1: Getting the data directly to z/OS
 - `ftp www.redbooks.ibm.com`
 - `cd redbooks/REDP4328/`
 - `get zfs.migrtool.unload.bin zfs.migrtool.unload`
 - Scenario 2: Getting the files to your workstation first
- ❑ Tool customization and migration processing

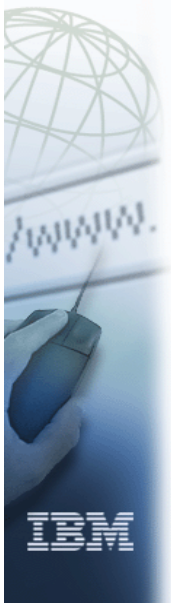


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z/OS UNIX V1R9 Enhancements



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z/OS UNIX V1R9 Agenda



- Application enablement enhancements
 - More accurate monitoring of resources
- Simplification enhancements
 - Improve management of USS shared file system in sysplex environment
- Availability enhancements
 - AUTOMOVE consistency
- Performance enhancements
- Miscellaneous enhancements
 - USS parmlib health check
 - F BPXOINIT,.....
- Application portability enhancements
 - New SUSv3 support



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Application Enablement Enhancements



- SMF 92 recording enhancement
 - A subtype 14 record is added to the SMF 92 records for reporting file and directory deletion and renaming
 - SMF 92 recording now monitors the deletion and renaming of USS files and directories using subtype 14 records
- Monitor when files are deleted or renamed
- Monitor when directories are deleted or renamed
- More accurate monitoring of resources

In a shared file system mode, recording occurs on the user's system where the command was issued



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Application Enablement Enhancements



- ❑ SMFPRMnn parmlib member in use for monitoring
- ❑ Subtype 14 records with SMF Type 92 recording
 - time of the delete or rename
 - rename indicator
 - file type
 - file serial number
 - file serial number of parent
 - unique device number for file or directory
 - file system name
 - file or directory name and length
 - new name and length



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Command Changes for USS CDS



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OMVS Couple Data Set Commands



- ❑ Output of `D XCF,COUPLE,TYPE=BPXMCD`S command has been enhanced to include the USS CDS information
- ❑ Output of `SETXCF COUPLE,ACOUPLE=(AlternateCDS),TYPE=BPXMCD`S command has been enhanced to better describe the specific error



OMVS couple data set



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Simplification Enhancements



- ❑ Output of following command has been enhanced to include the USS CDS format information
 - `D XCF,COUPLE,TYPE=BPXMCD`S
 - Provide USS CDS information to help users manage the shared file system configuration
 - Make the functions easier to understand and use
 - Improve system programmer and operator productivity



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D XCF,COUPLE,TYPE=BPXMCDS



```
IXC358I 18.21.35 DISPLAY XCF 182
BPXMCDS COUPLE DATA SETS
PRIMARY DSN: SYS1.XCF.OMVS02
VOLSER: SBOX63 DEVN: 836F
FORMAT TOD MAXSYSTEM
12/18/2003 10:29:20 8
ADDITIONAL INFORMATION:
    FORMAT DATA
    VERSION(2)
    MOUNTS(1000) AMTRULES(50)
ALTERNATE DSN: SYS1.XCF.OMVS03
VOLSER: SBOX64 DEVN: 8068
FORMAT TOD MAXSYSTEM
12/18/2003 10:29:21 8
ADDITIONAL INFORMATION:
    FORMAT DATA
    VERSION(2)
    MOUNTS(1000) AMTRULES(50)
BPXMCDS IN USE BY ALL SYSTEMS
```



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Change to SETXCF Command



- In this example, the primary CDS was formatted with MOUNTS value of 500 and AMTRULES value of 50
- The alternate CDS was formatted with MOUNTS value of 400 and AMTRULES value of 50
- The alternate CDS is not compatible with the primary as it has less value for MOUNTS
 - So the command 'SETXCF COUPLE,ACOUPL...' failed
 - The alternate CDS must be formatted with equal or greater value for MOUNTS and AMTRULES

```
SETXCF COUPLE,ACOUPL=(POSIX.OMVS.CDS03,AUXVOL),TYPE=BPXMCDS
```



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Change to SETXCF Command



- ❑ Previously, the information provided for the reason of the failure was:
 - ALLOWABLE SIZE OF BPXFSMPT RECORDS IS LESS THAN CURRENT PRIMARY RELEVANT BPXMCDS COUPLE DATA SET FORMAT INFORMATION
 - BPXFSMPT RECORDS is the internal record name of USS
 - The users would have a hard time to determine why the alternate CDS was incompatible



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New Messages for Command Failure



```
SETXCF COUPLE,ACOUPL=(POSIX.OMVS.CDS03,AUXVOL),TYPE=BPXMCDS
IXC309I SETXCF COUPLE,ACOUPL REQUEST FOR BPXMCDS WAS ACCEPTED
IXC260I ALTERNATE COUPLE DATA SET REQUEST FROM SYSTEM 405
SY1 FOR BPXMCDS IS NOW BEING PROCESSED.
DATA SET:  POSIX.OMVS.CDS03
IEF196I IEF237I 0483 ALLOCATED TO SYS00038
IXC255I UNABLE TO USE DATA SET 407
POSIX.OMVS.CDS03
AS THE ALTERNATE FOR BPXMCDS:
ALLOWABLE SIZE OF BPXFSMPT RECORDS IS LESS THAN CURRENT PRIMARY
RELEVANT BPXMCDS COUPLE DATA SET FORMAT INFORMATION
PRIMARY
  FORMAT LEVEL:      VERSION(2)
  FORMAT KEYWORDS:  MOUNTS(500)  AMTRULES(50)
ALTERNATE
  FORMAT LEVEL:      VERSION(2)
  FORMAT KEYWORDS:  MOUNTS(400)  AMTRULES(50)
IXC250I ALTERNATE COUPLE DATA SET REQUEST FAILED FOR DATA SET 408
POSIX.OMVS.CDS03 FOR BPXMCDS:
CONSISTENCY CHECKING FAILED FOR THE NEW ALTERNATE DATA SET
IEF196I IEF285I  POSIX.OMVS.CDS03                                KEPT
IEF196I IEF285I  VOL SER NOS= AUXVOL.
```

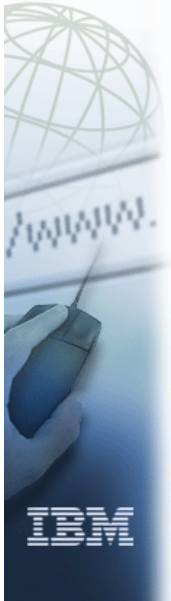


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AUTOMOVE Consistency with z/OS V1R9



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AUTOMOVE Consistency



- ❑ Various shutdown, and recovery scenario processing changed to honor the specified AUTOMOVE settings
 - More consistent and predictable shutdown and recovery actions are performed based on the file system AUTOMOVE attribute
- ❑ Shared file system availability is improved through more consistent and predictable shutdown and recovery actions based on the file system AUTOMOVE attribute
 - Consistent and predictable behavior during shutdown and recovery
 - Easier administration

Mount Command and AUTOMOVE



❑ Mount command and shared file system support

AUTOMOVE(indicator,sysname1,..,sysnameN) | NOAUTOMOVE | UNMOUNT

- When AUTOMOVE is specified for a file system and the file system's owner goes down, AUTOMOVE indicates that ownership of the file system can be automatically moved to another system participating in shared file system support - AUTOMOVE is the default
- When NOAUTOMOVE is specified for a file system, this indicates that ownership should not be moved to another system participating in shared file system if the file system's owner should crash
- When UNMOUNT is specified for a file system, this indicates that the file system will not be moved and will be unmounted if the file system's owner should crash - This file system and any file systems mounted within its subtree will be unmounted



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Mount Definition Attributes



- ❑ AUTOMOVE - The file system is eligible to move to any system
- ❑ NOAUTOMOVE - The file system is not eligible to move and is typically for system-specific file systems
- ❑ UNMOUNT - The file system is unmounted during shutdown or recovery processing and this is typically for system-specific file systems
- ❑ System list - A list of eligible or ineligible systems to move the file system to is provided



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AUTOMOVE Consistency



□ The AUTOMOVE attribute

- Specified on a MOUNT statement in the BPXPRMxx parmlib member or
- On the MOUNT command



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BPXPRMxx Parmlib Member



```
FILESYSTYPE TYPE(ZFS) /* Type of file system to start */
                ENTRYPPOINT(IOEFSCM) /* Entry Point of load module */
                ASNAME(ZFS) /* Procedure name */
MOUNT FILESYSTEM('OMVS.&SYSNAME..&SYSR1..ROOT.ZFS')
        MOUNTPPOINT('/&SYSNAME.') /* z/OS root filesystem */
        TYPE(ZFS) MODE(READ) /* Filesystem type ZFS */
        AUTOMOVE /* Mounted for read/only */
        /*
ROOT FILESYSTEM('WTSCPLX2.SYSPLEX.ROOT')
        TYPE(ZFS) /* TYPE OF FILE SYSTEM */
        AUTOMOVE
        MODE(RDWR) /* (OPTIONAL) CAN BE READ OR RDWR.
                    DEFAULT = RDWR */
        /*
MOUNT FILESYSTEM('OMVS.&SYSNAME..ETC.ZFS')
        /* ZFS for /var directory */
        MOUNTPPOINT('/etc')
        TYPE(ZFS) /* Filesystem type ZFS */
        MODE(RDWR) /* Mounted for read/write */
        NOAUTOMOVE
```



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Terminology



- ❑ PFS capabilities for a specified mount mode (RDWRIRO)
 - Sysplex-unaware – file system can only be locally accessed by one owner system in the specified mount mode (RDWR or RO) - All other systems access the file system through function shipping to the owner.
 - For example: HFS is sysplex-unaware for RDWR mounts
 - Sysplex-aware – file system can be locally accessed by all systems in the specified mount mode
 - For example: HFS and ZFS are sysplex-aware for RO mounts
 - NFS is sysplex-aware for RDWR and RO



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Sysplex-unaware - Sysplex-aware File Systems



```
D OMVS,F,N=FS1*
BPXO045I 16.50.49 DISPLAY OMVS 796
OMVS      000E ACTIVE          OMVS=(BE)
TYPENAME  DEVICE  -----STATUS-----  MODE  MOUNTED  LATCHES
HFS              26 ACTIVE                      RDWR  02/27/2007  L=35
NAME=FS1.HFS                                16.50.23  Q=35
PATH=/fs1
OWNER=SC65      AUTOMOVE=Y CLIENT=Y
```

Indicates a function-shipping client

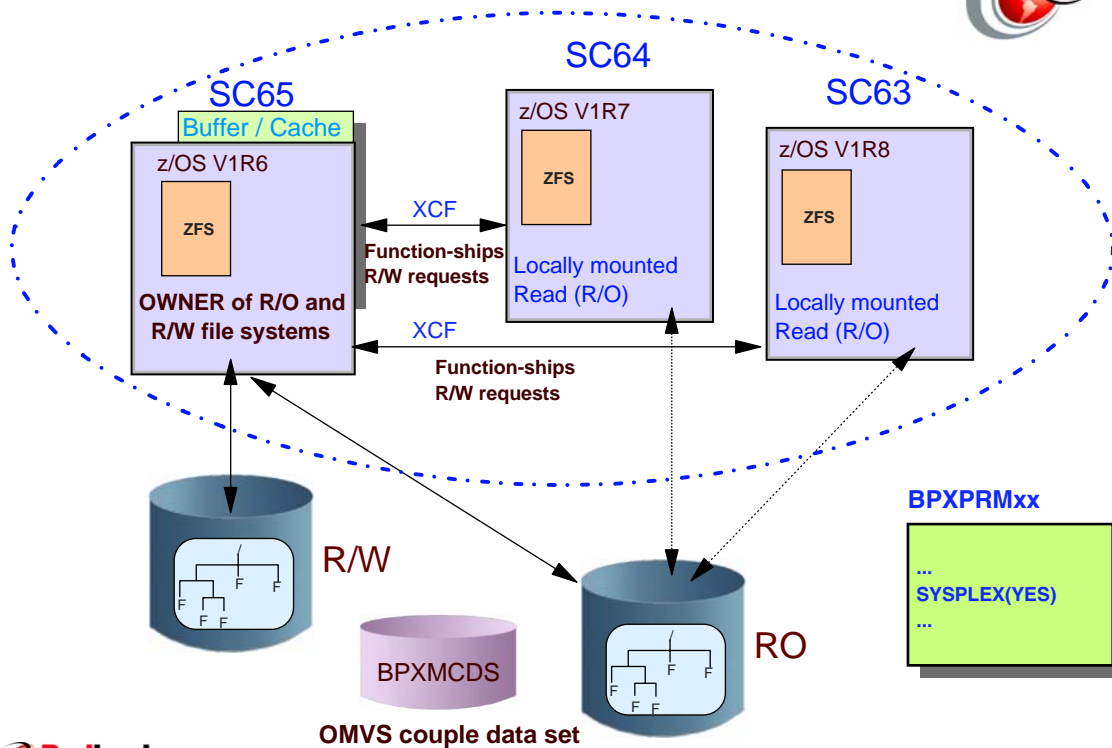
```
D OMVS,F,N=FS1*
BPXO045I 16.53.03 DISPLAY OMVS 800
OMVS      000E ACTIVE          OMVS=(BE)
TYPENAME  DEVICE  -----STATUS-----  MODE  MOUNTED  LATCHES
HFS              26 ACTIVE                      RDWR  02/27/2007  L=35
NAME=FS1.HFS                                16.50.23  Q=35
PATH=/fs1
OWNER=SC65      AUTOMOVE=Y CLIENT=N
```

Indicates a sysplex-aware file system mounted locally
on the client system



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Shared File System Mode



z/OS V1R9 Enhancements



- ❑ **Current problems with AUTOMOVE settings**
 - Inconsistencies in the processing of the various shutdown and recovery scenarios and PFS capabilities resulted in confusing results, impacting desired availability
- ❑ **In z/OS V1R6, support was changed - a file system mounted with NOAUTOMOVE or a system list were converted to AUTOMOVE if mounted in a sysplex-aware mount mode - This support is now removed and is honored as specified**
- ❑ **z/OS V1R9 to honor the specified AUTOMOVE setting**
 - Benefits for recovery and shutdown processing are more predictable, and process as desired
 - File system availability increased
 - Administration is easier

Prior Behavior to z/OS V1R9



- ❑ NOAUTOMOVE – sysplex-aware mounts previously converted to AUTOMOVE
- ❑ System list – sysplex-aware mounts previously converted to AUTOMOVE
- ❑ Automount-managed file systems are unmounted by a soft shutdown operation if this system is the file system owner and the file system is not being locally used
- ❑ If the file system is being accessed by another system then it is moved to that system (for AUTOMOVE or System List - (Unchanged behavior in R9))



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Shutdown and Recovery Scenarios



- ❑ “Soft shutdown processing”
- ❑ Member gone recovery on hard failures
- ❑ PFS termination
- ❑ Multi-file system moves using
 - SETOMVS FILESYS,FROMSYS=sy1,SYSDNAME=sy2



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AUTOMOVE Settings and Shutdowns



New behavior

- ❑ Allow NOAUTOMOVE and System List on MOUNTs for sysplex-aware file systems
 - Do not convert to AUTOMOVE
- ❑ Base shutdown and recovery processing primarily on the AUTOMOVE setting
 - Sysplex-aware and sysplex-unaware characteristics are no longer considered
 - Soft shutdown processing:
 - F BPXOINIT,SHUTDOWN=FILESYS
 - F BPXOINIT,SHUTDOWN=FILEOWNER
 - F OMVS,SHUTDOWN



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Member Gone Recovery / Partition Recovery



- ❑ Hard failure
- ❑ After F OMVS,SHUTDOWN completes, all other systems perform Member Gone

Automove setting	Old Behavior	New Behavior
NOAUTOMOVE	Sysplex-aware mount previously converted to AUTOMOVE	The file system becomes UNOWNED. The file system remains unowned until the prior owner system restarts.
UNMOUNT	Moved to another owner for sysplex-aware	File system is unmounted, as well as all file systems mounted within it.
AUTOMOVE	Move the file system to any system	Move the file system to any system. If no new owner then the file system becomes UNOWNED.
System List	Sysplex-aware mount previously converted to AUTOMOVE	Move the file system to any specified eligible system in the system list. If no new owner then the file system as well as all file systems mounted within it are unmounted.



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Soft Shutdown Processing



- Soft shutdown processing:
 - F BPXOINIT,SHUTDOWN=FILESYS
 - F BPXOINIT,SHUTDOWN=FILEOWNER
 - F OMVS,SHUTDOWN

Automove setting	Old Behavior	New Behavior
NOAUTOMOVE UNMOUNT	Sysplex-aware mount previously converted to AUTOMOVE	An attempt to UNMOUNT the file system occurs. The UNMOUNT will fail if other file systems are mounted on it.
AUTOMOVE	Move the file system to any system	Move the file system to any system.
System List	Sysplex-aware mount previously converted to AUTOMOVE	Move the file system to any specified eligible system in the system list.



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PFS Termination



- F OMVS,STOPPFS=ZFS
- C NFSMVSCS
- PFS has hard failure and terminates

Automove setting	Old Behavior	New Behavior
NOAUTOMOVE	Sysplex-aware mount previously converted to AUTOMOVE	The file system is unmounted, as well as all file system mounted within it.
UNMOUNT	Moved to another owner for sysplex-aware	The file system is unmounted as all file systems mounted within it.
AUTOMOVE	Move the file system to any system	Move the file system to any system. If no new owner then the file system is unmounted as well as all file systems within it.
System List	Sysplex-aware mount previously converted to AUTOMOVE	Move the file system to any specified eligible system in the system list. If no new owner then the file system as well as all file systems mounted within it are unmounted.



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z/OS V1R9 Behavior for MOUNTs



Move multiple file systems to specific target

➤ SETOMVS FILESYS,FROMSYS=SY1,SYSNAME=SY2

Automove setting	Old Behavior	New Behavior
NOAUTOMOVE	Sysplex-aware mount previously converted to AUTOMOVE	Move is not attempted.
UNMOUNT	Moved to a specified target for sysplex-aware	Move is not attempted.
AUTOMOVE	Move the file system to any system	Move is attempted to the target system.
System List	Sysplex-aware mount previously converted to AUTOMOVE	Move is attempted to target system. The system list is ignored.



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z/OS V1R9 Behavior for MOUNTs



Move multiple file systems to any system

➤ SETOMVS FILESYS,FROMSYS=SY1,SYSNAME=*

Automove setting	Old Behavior	New Behavior
NOAUTOMOVE	Sysplex-aware mount previously converted to AUTOMOVE	Move is not attempted.
UNMOUNT	Moved to any target for sysplex-aware	Move is not attempted.
AUTOMOVE	Move the file system to any system	Move is attempted to any system.
System List	Sysplex-aware mount previously converted to AUTOMOVE	Move is attempted to target system only.



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Migration Coexistence Considerations



❑ Migration

- Review BPXPRMxx ROOT and MOUNT statements and make sure AUTOMOVE value is the desired behavior for sysplex-aware file systems

❑ Coexistence

- New support only applies to V1R9 - so a mixture of behaviors until V1R9 is the lowest-level release level
- zFS READ-ONLY with UNMOUNT attribute
 - Prior releases will ignore, V1R9 will honor
- zFS READ-ONLY mounted on V1R9 with NOAUTOMOVE
 - Member gone on prior releases will take ownership and convert to AUTOMOVE



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SUSv3



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SUSv3 Support with z/OS V1R9



- ❑ Single UNIX Specification, Version 3 (SUSv3) is the latest UNIX standard to come from The Open Group
 - SUSv3 ratified in 2001
- ❑ Language Environment C run-time APIs are compatible with most of SUSv3, although not fully compliant
- ❑ C applications use APIs and expect behaviors that were not implemented in the Language Environment C run-time prior to z/OS V1R9
 - Now, easier to develop, port, or deploy C/C++ applications on z/OS



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SUSv3 Support with z/OS V1R9



- ❑ z/OS V1R9 has updated the XL C/C++ run-time Library with changes designed to meet the X/Open System Interface extension as defined in the Single UNIX Specification, Version 3
- ❑ z/OS V1R9 has enhancements to make it easier to develop, port, or deploy contemporary C/C++ applications on z/OS in the following areas:
 - Support for the thread option (pthread interfaces)
 - Addition of any other missing headers, APIs, and functionality



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