z/OS DFSMS V2R4
and Continuous Delivery Projects

July 2019

Agenda

- Trademarks
- Session Objectives
- *For each Project, as necessary*
  - Overview
  - Usage & Invocation
  - Interactions & Dependencies
  - Migration & Coexistence Considerations
  - Installation
  - Appendix

Trademarks

- See url http://www.ibm.com/legal/copytrade.shtml for a list of trademarks.
- Additional Trademarks:
  - None

Session Objectives

z/OS DFSMS V2R4 and Continuous Delivery projects

- (SPE) zFS File Level Backup and Restore Capability
- (SPE) DFSORT Exploitation of zHPF for Sort Work Data Sets
- DFSORT Functional Enhancements
- (SPE) TVS Auto Commit Support
- RMM RAS Enhancements, Part 2
- RMM Mandatory Defaults Table Enhancements
- Catalog Customer Requests
- Data Set Level Encryption, Phase 2

(SPE) zFS File Level Backup and Restore Capability
Components: **DFSMShsm, DFSMSdss**

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Overview

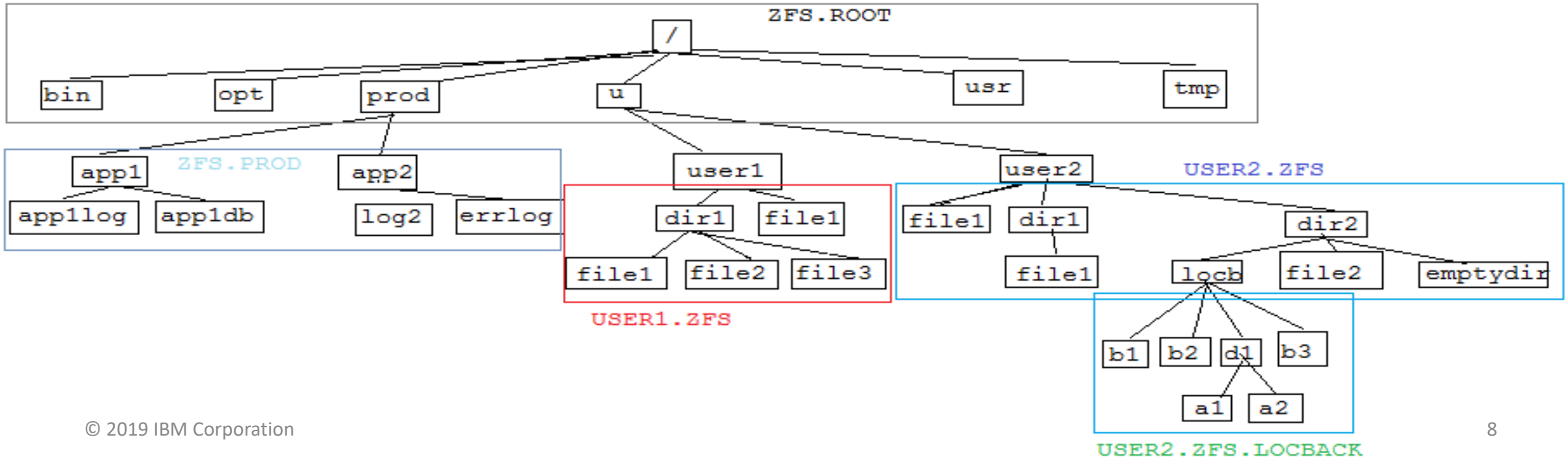
- **Who**
  - Storage Administrators and UNIX users
- **What**
  - Manage backup and recovery of z/OS UNIX files (zFS) at the **file level** using DFSMSdss and DFSMShsm
- **Wow**
  - Storage Administrators are enabled to manage the backup and recovery of UNIX files (within zFS filesystems) using the same products that they use for standard z/OS data sets!
  - Storage Administrators can recover one or more individual files!
  - Every day UNIX users can use UNIX user commands to create backups and recover individual files without the storage administrator!
  - Replace Spectrum Protect USS Client functionality which goes End of Support in April 2020

Usage & Invocation: DFSMShsm UNIX File Backup

- **BACKDS / BACKFILE**
  - **TARGET(DASD|TAPE)** – HSM backup to DASD or Tape (Override MGMT Class target)
  - **RECURSE(NOCROSSMOUNTS|CROSSMOUNTS)** – How to Traverse Directory structure. Leave Current Filesystem(No|Yes)
  - **CHANGEDONLY|TOTAL** – Modification date > Backup date
  - **RETAINDAYS(nn)** – How additionally long the backup should be kept (same for Data Sets)
  - **CC(STANDARD|PREFERRED|REQUIRED)** – zFS File Snapshot processing – No compressed filesystems
- **Considerations**
  - Initial backup of a file can take longer due to CDS I/O overhead
  - Backing up a large number of files will considerably grow the BCDS
  - Command backups generally go to ML1 DASD
  - No Automatic Backup support
  - Backup versions managed by assigned management class for SMS managed file systems and SETSYS values for nonSMS managed
- **Tasking level**
  - Controlled by current data set backup tasks. (SETSYS DSBACKUP(DASD(nn) TAPE(nn)))

DFSMShsm UNIX file backup

- **Storage Administrator command**
- BACKDS ‘/u/user1/file1’ TARGET(TAPE)
- BACKDS ‘/u/user2/*’ RECURSE(NOCROSSMOUNTS) CC(PREFERRED) TARGET(DASD) CHANGEDONLY
  - `/u/user2/file1`
  - `/u/user2/dir1/file1`
  - `/u/user2/dir2/file2`
  - `/u/user2/dir2/emptydir`

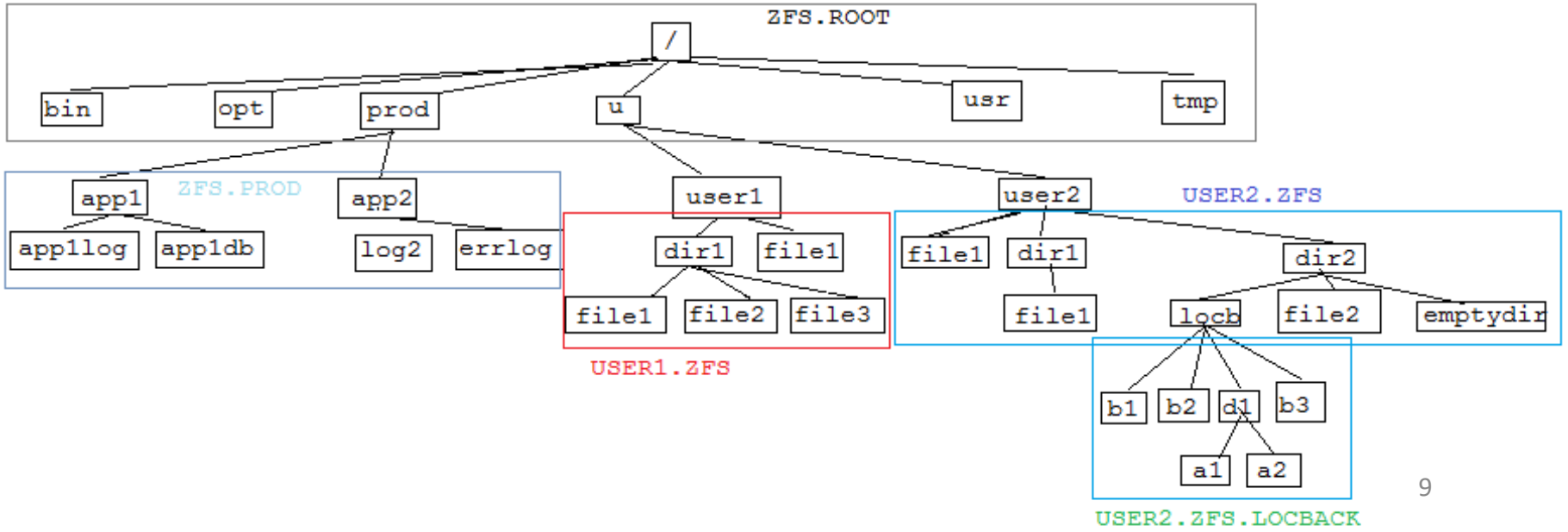


DFSMShsm UNIX file backup (cont)

- **TSO command:**
  - `HBACKDS (`*`filename`*`) WAIT|NOWAIT RECURSE(NOCROSSMOUNTS|CROSSMOUNTS) CHANGEDONLY RETAINDAYS(`*`nn`*`) CC()`
  - `HBACKDS ('/u/user1/dir1/file2')`
- **UNIX shell command:**
  - `hbackup [-chRXwvq] [-t DASD|Tape] [-r rdays] [-C STD|REQ|PREF] file ... file ... dir/ ...`

`hbackup -cR /u/user1/*`

/u/user1/dir1/file1
/u/user1/dir1/file2
/u/user1/dir1/file3
/u/user1/file1



DFSMShsm Recursion and Wildcards

Directory processing and wildcards

- **BACKDS/HBACKDS '/u/dir1/' RECURSE(NCM)**
  - Backup all files in /u/dir1 and process sub-directories, but don't cross into a different filesystem

- **BACKDS/HBACKDS '/u/dir1/ab*.txt' RECURSE(NCM)**
  - Backup files in /u/dir1 that match the pattern, ab*.txt. Process sub-directories for files that match the pattern, but don't cross into a different filesystem

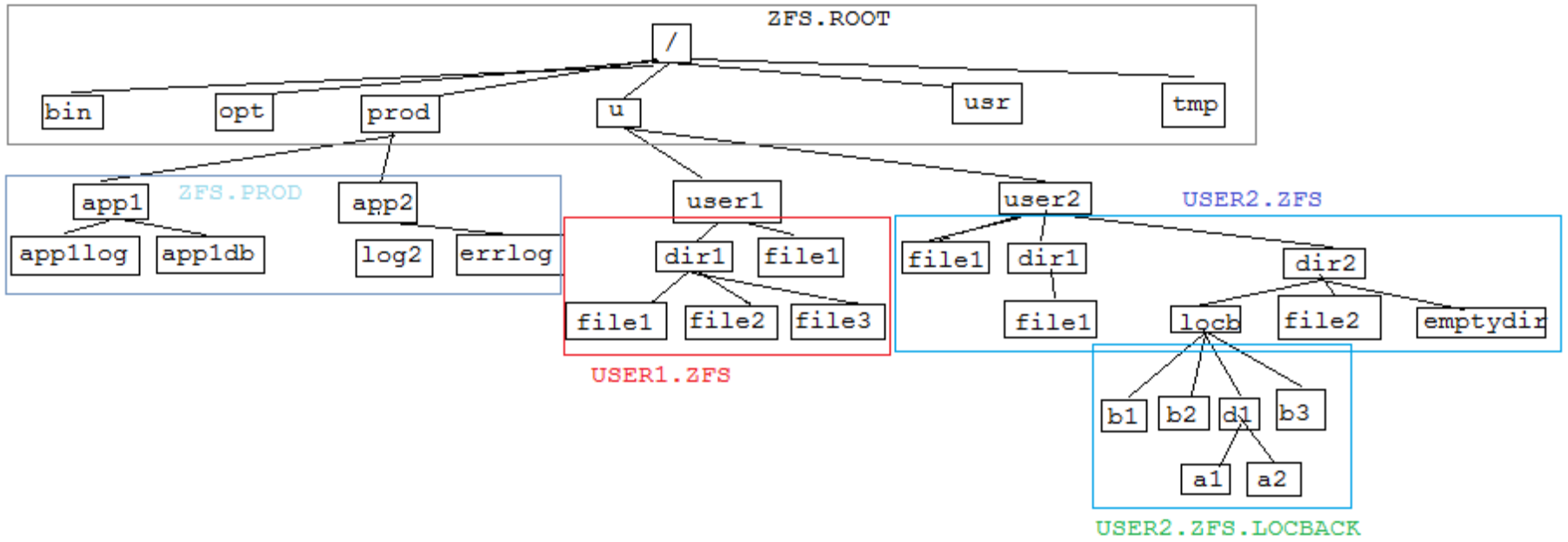
- **hbackup "/u/dir1/ab*.txt" vs. hbackup /u/dir1/ab*.txt**
  - The shell will expand wildcards that match names if "" is not used

DFSMShsm RECOVER

Storage Administrator

- **RECOVER *filename* DATE(*yyyy/mm/dd*) TIME(*hhmmss*) GENERATION(*gennum*)|VERSION(*vernum*) REPLACE RECURSE(NOCROSSMOUNTS|CROSSMOUNTS)**
- **RECOVER '/u/user1/file1' REPLACE**
- **RECOVER '/u/user2/dir2/*' REPLACE RECURSE(CROSSMOUNTS)**

  /u/user2/dir2/locb/b1
  /u/user2/dir2/locb/b2
  /u/user2/dir2/locb/d1/a1
  /u/user2/dir2/locb/d1/a2
  /u/user2/dir2/locb/b3
  /u/user2/dir2/file2
  /u/user2/dir2/emptydir/



DFSMShsm RECOVER (cont)

TSO command

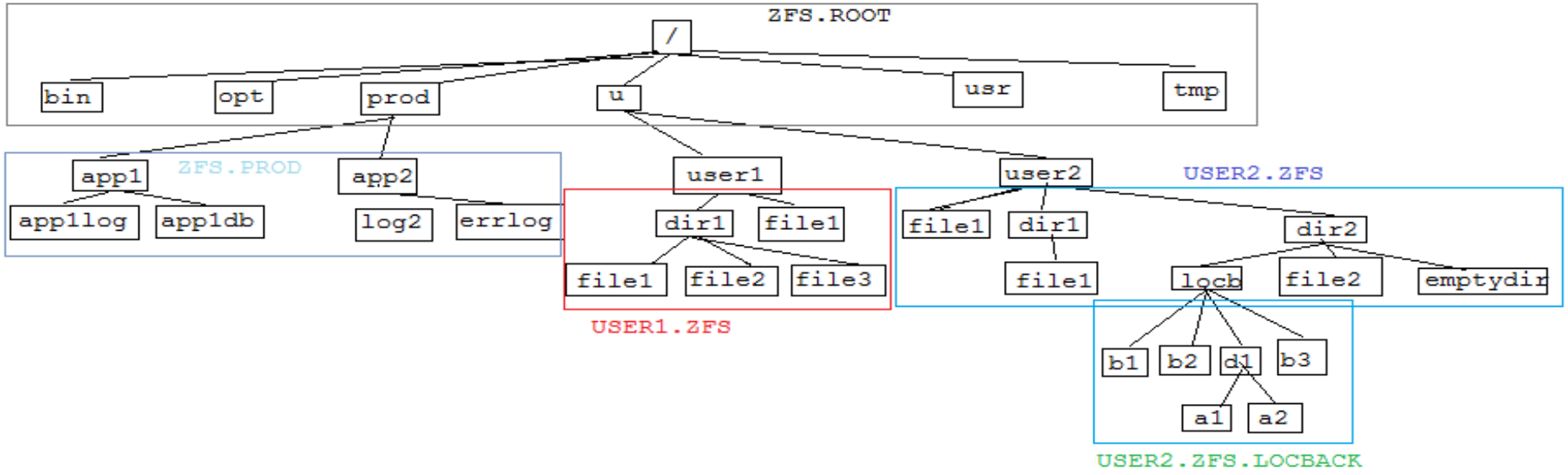
HRECOV '/u/user1/dir1/file2' REPLACE WAIT

UNIX shell command

```
hrecover [-hXRfvw] [-d date] [-t time] [-g gennum] [-V version] file ... file ... dir/ ...
```

Example:

```
hrecover -fR /u/file1
```



Convert Spectrum Protect Backups to DFSMShsm

Restore backup from Spectrum Protect into a temporary directory - /tmp/2017-07-08/
From the UNIX shell:

```
dsmc restore /prod/webapp1/ /tmp/2017-07-08/ -pitdate=7/8/2017 -subdir=yes -preservepath=Complete
```

Use DFSMShsm to create backups of those files and directories.
From the UNIX shell:

```
hbackup –N / -D 2017/07/08 /tmp/2017-07-08/
```

DFSMShsm LIST

Storage Administrator:

```
LIST FILENAME('/u/ibmuser/cicsdata/daily.runlog.txt') BCDS TERM
```

Terminal Output:

```
FILE=/u/ibmuser/cicsdata/daily.runlog.txt
BACK FREQ = ***, MAX ACTIVE BACKUP VERSIONS = ***
FROMFS=SYS1.USERS.ZFS

BDSN=DFHSM.BACK.TLHFR05.CICSDATA.DAILY.A4169 BACKVOL=BACK01
BACKDATE=14/06/18 BACKTIME=14:14:58 GEN=000 VER=003 UNS/RET= NO
EXTENDED ACL=YES RETDAYS=***** TYPE=FILE

BDSN=DFHSM.BACK.TCBOE16.CICSDATA.DAILY.A4169 BACKVOL=BACK01
BACKDATE=14/06/18 BACKTIME=14:13:52 GEN=001 VER=002 UNS/RET= NO
EXTENDED ACL=YES RETDAYS=***** TYPE=FILE
```

DFSMShsm LIST (cont)

Storage Administrator:
LIST FILELEVEL(‘/u/user1/’) BCDS OUTDATASET(ADMIN.FILELIST.OUTPUT)

TSO Command
HLIST FILELEVEL(‘/u/ibmuser/cicsdata/’) BCDS ODS(ADMIN.CICSDATA.OUTPUT)

UNIX shell command

```
hlist [-ARhXdtv] [-a mindays,maxdays][-V volser] path
```

Example:

```
hlist –X /u/ibmuser/cicsdata/
```

DFSMShsm Functions updated

AUDIT FILES() BCDS

BDELETE (HBDELETE, hbdelete)

FIXCDS

QUERY

CANCEL

ALTERPRI

ALTERDS

Security

File Access Control Lists (FACL) are checked, and saved in backup
Multi-Level Security attributes are saved

Storage Administrator

- Backup all files (BACKDS)
- Recover any file (RECOVER)

File owner, anyone with Read permissions to file

- Create backup (HBACKDS, hbackup)

File owner, Search permissions for intermediate directories, write permission for parent directory

- Recover Files (HRECOV, hrecover)

Usage & Invocation: DFSMSdss UNIX File

DUMP PATH(INCL('dir1/file1' 'file1')) WORKINGDIRECTORY(*'/u/user1/'*) - OUTDD(*DUMPDD*) TOLERATE(WRITERS) ADMINISTRATOR

- **PATH(INCLUDE(…))** - Files specified in the INCLUDE criteria will be backed up
  - Will include backing up attributes for directories along the path
    - Needed to recreate the directory upon Restore with the same attributes
- **WORKINGDIRECTORY** tells DFSMSdss where it will begin processing
  - INCLUDE paths will be concatenated to the Working Directory.
  - Attributes for directories along the Working Directory will **not** be backed up
- **ADMINISTRATOR** indicates that the user is DFSMSdss-authorized storage administrator if the user has READ access to the administrator RACF Profile.
  - File security checks will succeed regardless of the file's permissions/ACL for zFS files
- **TOLERATE(WRITERS)** indicates it is OK for DFSMSdss to backup the file even though it may be open with write intent.
- **CLONE** – Defaults to CLONE(NONE)
  - PREFERRED – Back up the file from a snapshot copy if possible
  - REQUIRED – Must back up the file from a snapshot copy
- **OUTDD** describes the output data set that will hold the backup contents
  - TAPE or DASD

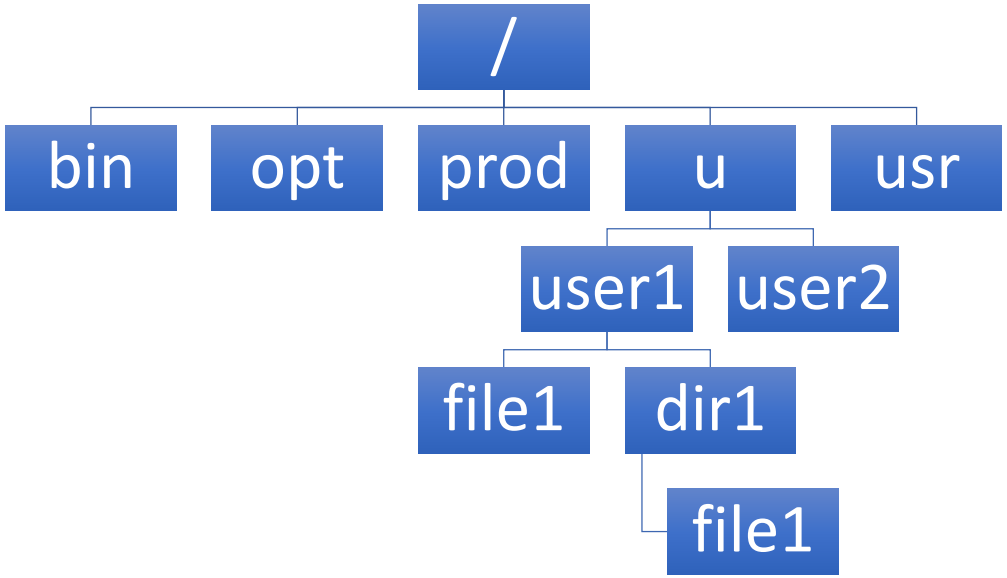
DFSMSdss UNIX File (cont)

- **RESET** – Set the last backup date to the current date/time on zFS Files
  - ATTRREFTIME/64 – VFS attributes
- **SHARE** – When processing a file, it will be opened to allow shared readers
  - This is the default – no option to disallow shared readers
- **REPLACEUNCONDITIONAL** – During Restore, regular files may be overwritten.

DFSMSdss Dump UNIX File

DUMP PATH(INCL('dir1/file1' 'file1')) WORKINGDIRECTORY(*'/u/user1/'*) -
OUTPUTDD(*DUMPDD*) TOLERATE(WRITERS) ADMINISTRATOR

```
ADR650I (001)-UDFLT (001) ALL PATHS ARE RELATIVE TO WORKING DIRECTORY /u/user1/
ADR454I (001)-UPRTT (001) THE FOLLOWING FILES WERE SUCCESSFULLY PROCESSED
                          - ./file1
                          d ./dir1
                          - ./dir1/file1
```



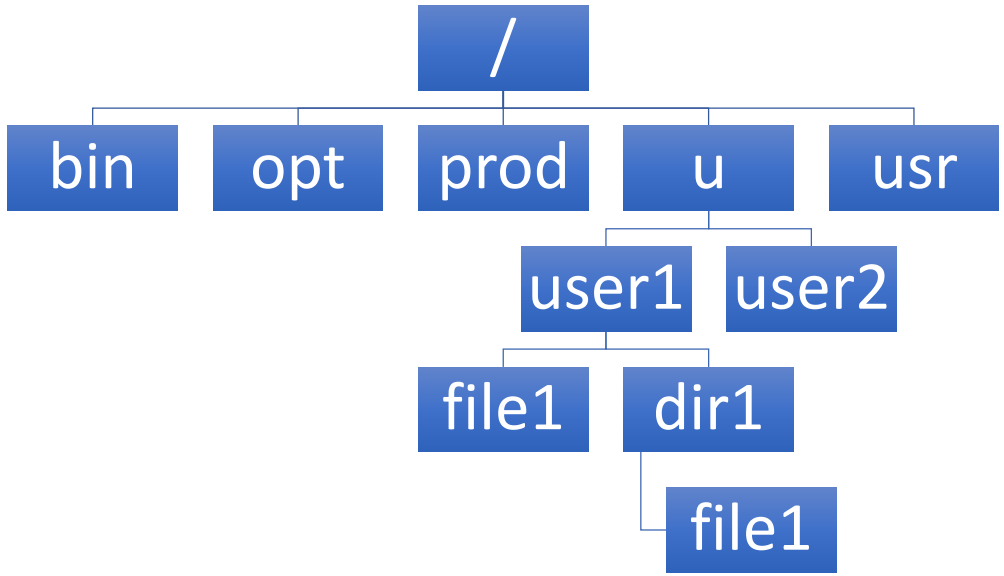
Dump contents:

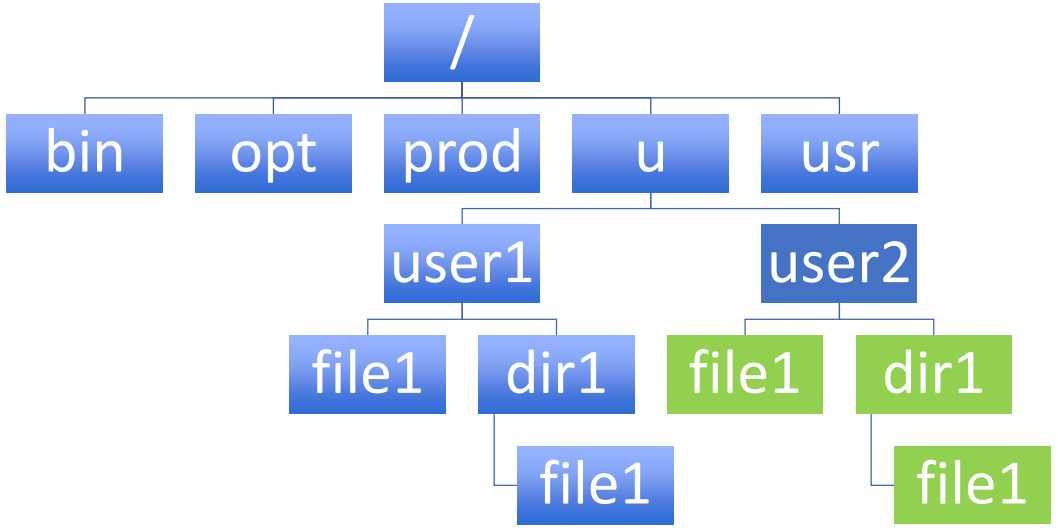
- **Attributes for files beginning after '/u/user1':**
  - **Files listed in ADR454I**
  - **DSS creates files on restore with source attributes**
- **ADR454I lists files with file type description:**
  - **'-' = regular file**
  - **'d' = directory**
    - **z/OS USS 'ls' file type**

DFSMSdss Restore UNIX File

RESTORE PATH(INCL('dir1/file1' 'file1')) WORKINGDIRECTORY(*'/u/user2/'*) - INPUTDD(*DUMPDD*) ADMINISTRATOR

```
ADR650I (001)-URFLT (001) ALL PATHS ARE RELATIVE TO WORKING DIRECTORY /u/user2/
ADR454I (001)-URPRTT(001) THE FOLLOWING FILES WERE SUCCESSFULLY PROCESSED
                          - ./file1
                          d ./dir1
                          - ./dir1/file1
```

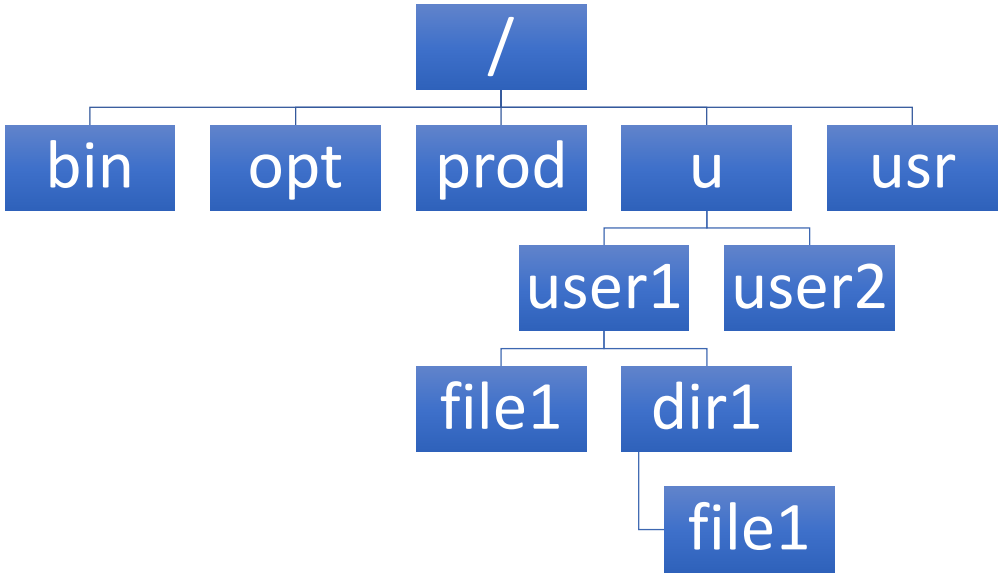


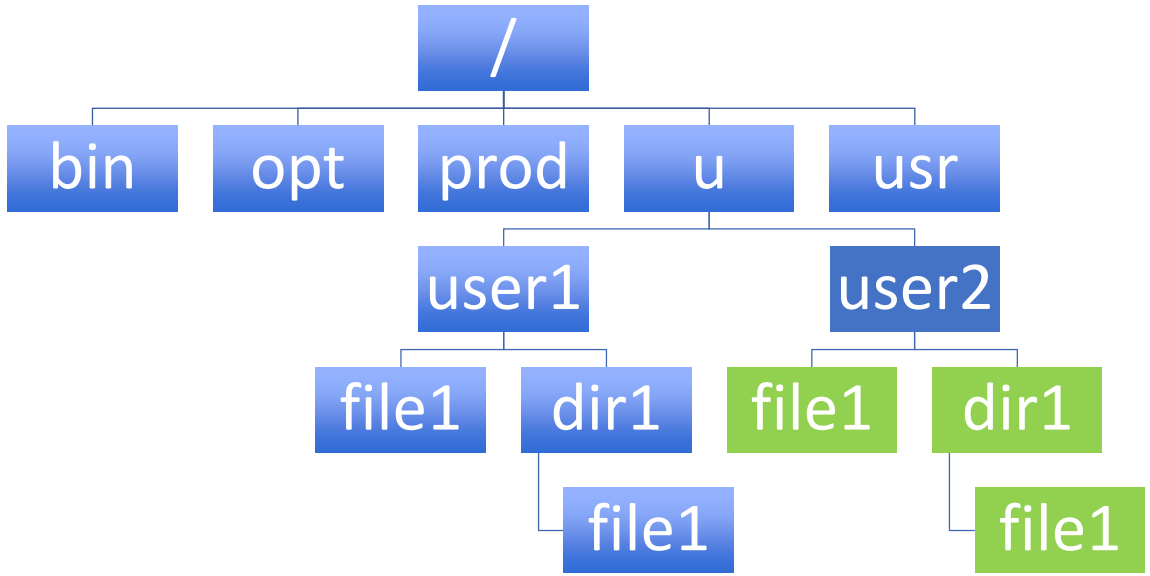


DFSMSdss Restore UNIX file – TYPERUN=NORUN

RESTORE PATH(INCL('*')) WORKINGDIRECTORY('*/u/user2/*') -
INPUTDD(*DUMPDD*) ADMINISTRATOR

```
ADR650I (001)-URFLT (001) ALL PATHS ARE RELATIVE TO WORKING DIRECTORY /u/user2/
ADR475I (001)-URPRTT(001) THE FOLLOWING FILES WERE SELECTED
                          - ./file1
                          d ./dir1
                          - ./dir1/file1
```





DFSMSdss Dump/Restore Limitations

- zFS file systems only
- **Absolute Path must be specified to a single file** (Maximum 1023 character paths)
  - No relative path specification
  - No wildcards (Restore allows for *include(*)* only).
  - Path resolving to a directory will process the directory attributes only
    - DSS will not support recursion
    - File members within a directory will not be processed
  - DSS special characters must be preceded by a backslash character (\):
    - Single quote
    - Semi-colon
    - Spaces
    - Hyphen
    - Comma
    - Backslash
- 255 path specifications in INCLUDE filtering
  - No filterDD
  - No BY Filtering

DFSMSdss Dump/Restore Limitations

- File Types
  - **Supported**
    - Regular Files
      - Sparse files – will **not** remain sparse
      - Hard Links
        - Data dumped for each encountered file
        - First file restored is data, subsequent in command is hard-linked.
    - Directory Files
    - FIFO Files
    - Symbolic Links
      - Only the reference is backed up, DSS will not attempt to resolve the reference
  - **Not Supported**
    - Socket Files
    - Special Character Files
- No Cloud support for backup output
- CLONE processing cannot be used for compressed-zFS
- Encrypted FS – file data decrypted in backup

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level:
  - **No** – Support will be available on z/OS V2R3, with coexistence APAR for z/OS V2R2

- Software Dependencies
  - None
- Hardware Dependencies
  - None
- Exploiters
  - None

Migration & Coexistence Considerations

- V2R3 New Function APARs
  - DFSMSdss – OA52836
  - DFSMShsm – OA52703
  - zFS – OA56145
  - UNIX System Services – OA54218
  - RACF – OA55165

- V2R2 Coexistence APAR
  - DFSMShsm – OA56356

Installation

- DFSMShsm Backup Control Data Set (BCDS) *will* grow larger when using support
- Max LRECL for BCDS must be 6544
- New records in BCDS
  - (Type 2) 312 bytes base length + length of UNIX absolute path
  - One for each file and directory
  - /u/dir1/recs/file1.txt will result in 5 Type 2 records being created.

Appendix

- Publications
  - z/OS DFSMSdss Administration
  - z/OS MVS System Messages, Vol 1

  - z/OS DFSMShsm Implementation and Customization
  - z/OS DFSMShsm Storage Administration
  - z/OS DFSMShsm Managing Your Own Data
  - z/OS DFSMShsm Diagnosis
  - z/OS DFSMShsm Data Areas
  - z/OS DFSMS Installation Exits
  - z/OS MVS System Messages, Vol 2

(SPE) zHPF for SortWork
Component: **DFSORT**

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Overview

- **Who**
  - All DFSORT customers who use zHPF Hardware
- **What**
  - Enable DFSORT's work data sets to support zHPF
- **Wow**
  - This support allows DFSORT to use the new channel programs available on the System z I/O architecture to ***reduce elapsed time and increase I/O rates***

- Who, What, Why: As a system programmer, I want to be able to use the latest I/O devices with my DFSORT work data sets so that I can get the performance benefits available with the new HW.

Usage & Invocation

- zHPF Usage
  - DFSORT will automatically take advantage of zHPF if it is available on your system
  - No user actions are necessary

- Notes
  - In V2R2, DFSORT was updated to enable zHPF support for SORTIN, SORTOUT, and OUTFIL when zHPF is available
  - With this SPE, DFSORT will be enabled to use zHPF support for DFSORT work data sets

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level: No
- Software Dependencies
  - SPE PI99290 is required to provide this support (Next Page)
- Hardware Dependencies
  - Presence of High Performance FICON (HPF) hardware
- Exploiters
  - None

Installation

SPE PI99290 is required to provide this support

- z/OS DFSORT V2R2 PTF **UI58461**
- z/OS DFSORT V2R3 PTF **UI58435**
- z/OS DFSORT V2R4 in BASE

Determining if this PTF is installed

If you see the following in the messages from a DFSORT run:

- ICE201I **3** RECORD TYPE ...
  - The **3** indicates you have 2019 z/OS DFSORT V2R4 functions and all of the earlier functions. You are completely up to date on DFSORT functional PTFs.
- ICE201I **B** RECORD TYPE ...
  - The **B** indicates you have z/OS DFSORT V2R2 PTF UI58461 or z/OS DFSORT V2R3 PTF UI58435, so you can exploit the performance improvements for DFSORT sort work files through System z High Performance FICON (zHPF).
  - If you do not see ICE201I B, ask your System Programmer to install z/OS DFSORT V2R2 PTF UI58461 or z/OS DFSORT V2R3 PTF UI58435, so you can exploit the new performance improvements.

Appendix

User Guide for DFSORT PTFs UI58435 and UI58461:

- http://www.ibm.com/support/docview.wss?uid=ibm10743111

Functional Enhancements
Component: **DFSORT**

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Session Objectives

The purpose of this session is to provide a brief overview, usage and invocation information for each of the following new z/OS DFSORT V2R4 functional enhancements.

- Support for Regular Expressions for INCLUDE/OMIT
- Support for Unicode data filtering in INCLUDE/OMIT
- Support for INCLUDE/OMIT/SORT/MERGE of ASCII free format numeric data
- Support for Encrypted PDSE datasets

Each enhancement will be described separately.

Regular Expressions for INCLUDE/OMIT

Overview

- **Who**
  - All DFSORT customers
- **What**
  - Enable DFSORT to support Regular Expressions to include/omit data using filters
- **Wow**
  - This support allows DFSORT users to be able to use Regular Expressions in their Batch jobs for additional filtering capabilities. Regular expressions contain a series of characters that define a pattern of text to be matched, which allows for more robust filtering capabilities.

- Who, What, Why: As an application programmer, I want to be able to filter the data using wildcards as search strings.

Regular Expressions for INCLUDE/OMIT

Usage & Invocation

- Regular Expressions Usage:
  - You can use Regular Expressions in the following comparison operands: COND, INCLUDE, OMIT, BEGIN, END, WHEN and TRLID.

- Examples:
- INCLUDE COND=(1,50,SS,RE,C'(iP).*[0-9]’)

  Explanation : Include all the records that start with the string IP/ip and have a number (0-9) following the string IP/ip (case insensitive)
- OUTFIL OMIT=(25,032,SS,REH,C'(.*Z+)|(.*\XC2\XF1.*)')

  Explanation : Omit all the records that contain a Z followed by any character OR the records that contain hex values of X’C2’ and X’F1’ aka ‘B1’

Unicode data filtering for INCLUDE/OMIT

Overview

- **Who**
  - All DFSORT customers
- **What**
  - Enable DFSORT to support Unicode data formats UTF-8, UTF-16, UTF-32 on INCLUDE/OMIT to filter the Unicode data.
- **Wow**
  - This support allows DFSORT users to use Unicode data formats in their Batch jobs to filter the data.

- Who, What, Why: As an application programmer, I want to be able to use Unicode data formats to filter the data.

Unicode data filtering for INCLUDE/OMIT

Usage & Invocation

- Unicode Usage:
  - You can use Unicode data formats in the following comparison operands: COND, INCLUDE and OMIT.

- Examples:
- INCLUDE FORMAT=UTF8,COND=(5,4,LT,11,4)

  Explanation : Include the records if UTF8 format data at position 5 for 4 characters is **less than** UTF8 format data at position 11 for 4 characters.

- OMIT COND=(21,40,UTF16,EQ,151,40,UTF16)

  Explanation : Omit the records if UTF16 format data at position 21 for 40 characters is **equal** to UTF16 format data at 151 for 40 characters.

- OUTFIL INCLUDE=(21,4,UTF32,NE,31,4,UTF32)

  Explanation : Include the records if UTF32 format data at position 21 for 4 characters is **not equal** to UTF32 format data at 31 for 4 characters.

ASCII free format of numeric data

Overview

- **Who**
  - All DFSORT customers
- **What**
  - Enable DFSORT to support ASCII Free format of numeric data for SORT, MERGE,INCLUDE or OMIT.
- **Wow**
  - This support allows DFSORT users to use ASCII free format of numeric data for SORT, MERGE INCLUDE and OMIT.

- Who, What, Why: As an application programmer, I want to be able to Sort, Merge, Include or Omit with ASCII free format numerical data.

ASCII free format of numeric data

Usage & Invocation

- ASCII Formats Usage:
  - You can use the ASCII numeric formats in the following comparison operands: COND, INCLUDE, OMIT, SORT, MERGE.

- Examples:
- INCLUDE COND=(5,4,ASF,EQ,+14)

  Explanation : Include all the records that has **signed free form ASCII** numeric data equaling to +14, at position 5 for a length 4 bytes.

- SORT FIELDS=(10,16,CH,A,
  40,8,AUF,D)

  Explanation : SORT character data at position 10 for 16 bytes ascending and **unsigned free form ASCII** numeric data at position 40 for 8 bytes descending.

- OUTFIL OMIT=(25,44,ASF,LE,0)

  Explanation : Omit all the records that has **signed free form ASCII** numeric data less than 0, at position 25 for a length 44 bytes.

DFSORT support for PDSE Encryption

Overview

- **Who**
  - All DFSORT customers
- **What**
  - Enable DFSORT to encrypt PDSE datasets.
- **Wow**
  - This support allows DFSORT users to use write to encrypted PDSE datasets.

- Who, What, Why: As a data owner, I wish to have data in my PDSEs automatically encrypted so I can secure my data without changing my application programs.

DFSORT support for PDSE Encryption

Usage & Invocation

- PDSE Encryption Usage:
- Any member data **written** to an encrypted PDSE using DFSORT will be encrypted on disk with no changes necessary for application developers.
- Any member data **read** from an encrypted PDSE using DFSORT will be decrypted with no changes necessary for application developers.

Notes :

- Must be Version 2 PDSEs.
- Users encrypting/decrypting during DFSORT processing must have authority to the key label

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level: No
- Software Dependencies
  - None
- Hardware Dependencies
  - None
- Exploiters
  - None

Migration & Coexistence Considerations

- The following are the new DFSORT/ICETOOL reserved words which are no longer allowed as symbols:
  - AUF
  - ASF
- If customers used any of these words as a symbol previously, they must change them. For example, if they used ASF, they can change it to asf.

Appendix

- The following Publications have been updated with information related to the topics presented.

z/OS DFSORT Application Programming Guide (SC23-6878-40)

z/OS DFSORT Messages and Codes (SC23-6879-40)

z/OS DFSORT: Getting Started (SC23-6880-40)

z/OS DFSORT Installation and Customization (SC23-6881-40)

z/OS DFSORT Tuning Guide (SC23-6882-40)

Automatic Commit
Component: **Transactional VSAM**

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Overview

- **Who**
  - System programmers, sysplex architects
- **What**
  - Transactional VSAM can provide automatic commits on behalf of batch jobs based on user specified parameters
  - Note that NOT all batch jobs are eligible for auto commits. Only batch jobs whose requests are independent from each other are good candidates. If a logical Transaction consists of two or more requests or it updates multiple data sets the job may not be a good fit.
- **Wow**
  - This solution makes it easier for eligible batch jobs to use Transactional VSAM as an access method to share recoverable data sets to eliminate the batch window
    - No application changes required
    - Minor JCL or SMS changes

Usage & Invocation

- With this support, Transactional VSAM (DFSMStvs) eliminates the requirement to add sync point commits to batch jobs before they can use DFSMStvs to share recoverable data sets with other recoverable subsystems (example CICS)
- DFSMStvs now provides automatic commits on behalf of batch jobs based on user specified parameters:
  - New parameter in the job step JCL

    //stepname EXEC positional-parm, TVSAMCOM=({minval},{maxval})
  - New system level parameter in the IGDSMSxx member of sys1.parmlib

    TVSAMCOM=({minval},{maxval}

Minval and Maxval: The minimum and maximum number of update requests to be performed by the application before DFSMStvs issues a commit.

DFSMStvs adjusts the commit frequency to a number between *minval* and *maxval* based on record lock contention analysis for the current unit of recovery (UR)

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level?: No.

  Toleration APAR OA49755 is required for V2R2 before using the function

- Software Dependencies
  - This support is also provided on z/OS V2.3
  - Please install toleration APAR in z/OS V2.2 before using the function
- Hardware Dependencies
  - None
- Exploiters
  - z/OS customers who can’t modify their batch jobs to use Transactional VSAM but who need 24/7 access their VSAM recoverable data sets in a CICS and batch jobs shared environment

Migration & Coexistence

Toleration APAR OA49755 is required for V2R2 before using the function

Installation

z/OS V2R3 APAR OA55176, base z/OS V2R4

Appendix

- The following Publications have been updated with information related to the topics presented.

DFSMStvs Planning and Operating Guide

MVS JCL Reference

MVS Initialization and Tuning Reference

MVS System Commands

MVS System Messages, Vol 8 (IEF-IGD)

MVS System Messages, Vol 9 (IGF-IWM)

Functional Enhancements
Component: **DFSMSrmm**

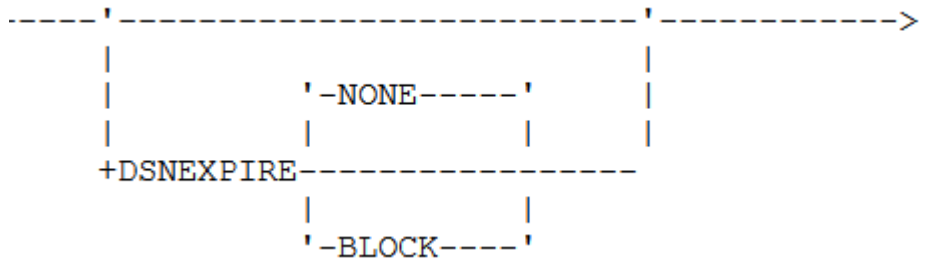
Arseniy Khobotkov Arseniy.Khobotkov1@ru.ibm.com

Overview

- **Who**
  - Tape administrators. Owners of products that write personal data to tape (for GDPR support)
- **Problem Statement / Need Addressed**
  - New European GDPR legislation with focus on forgetting data. However, tape data that is no longer needed is still accessible until whole tape is scratched.
  - EDM support was introduced in V2R3, but no way to search which volumes had EDM set
- **What**
  - Ability to prevent reading expired data sets, and other selected data sets
  - RMM SEARCHVOLUME supports EDM/NOEDM parameters
  - Warning messages when RMM CDS fills up
  - Warning messages when RMM subsystem interface down
  - ONLYIF support in PARMLIB
  - Other minor improvements
- **Wow**
  - Restricted access to expired tape data
  - Extended searching capability
  - Avoided down time due to reminder to increase CDS size
  - Avoided data loss when RMM subsystem interface not initialized by mistake
  - Easier to manage multiple RMM systems using 1 single PARMLIB member

Usage & Invocation - DSNEXPIRE (GDPR support)

- New PARMLIB option:

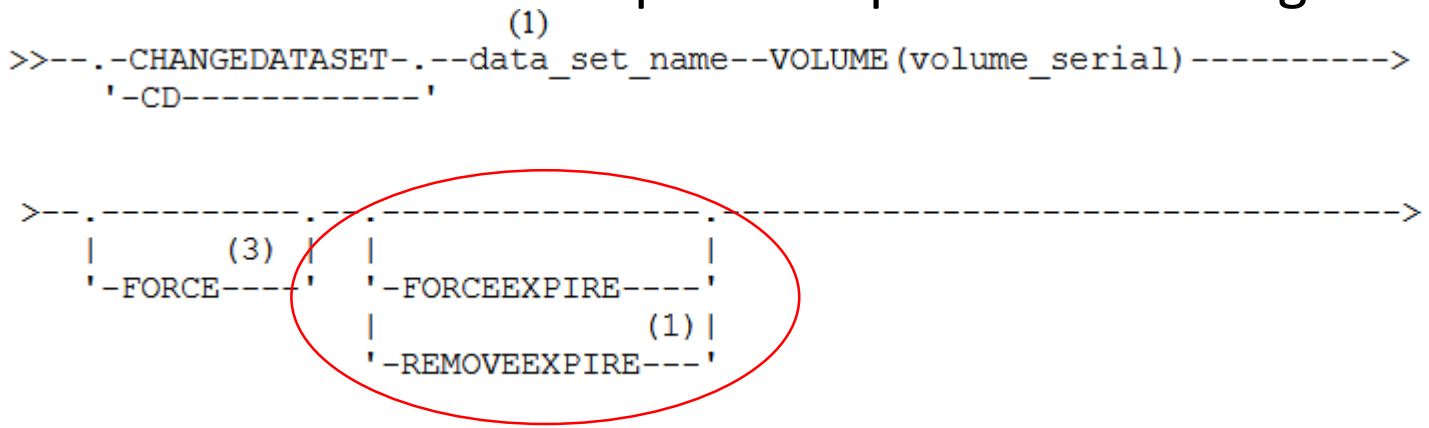


- **None** – default behavior
- **Block** – If an individual tape data set is expired, RMM will block read or write access to the data set. RMM looks at both the retention date and the expiration date to determine if a data set is accessible. Newly created tape data sets managed by VRSEL retention method are not blocked until housekeeping has a chance to retain them.
- Attempting to write or read data set, will cause ABEND S413 and message

EDG4066I VOLUME *volser* REJECTED. DATA SET BLOCKED BY DSNEXPIRE. IT IS EXPIRED AND NOT RETAINED BY A VITAL RECORD

Usage & Invocation - FORCEEXPIRE (GDPR support)

- It is now possible to block access to a specific tape data set using RMM command:



- If FORCEEXPIRE is specified, data set is also uncataloged (if UNCATALOG(YES) is in PARMLIB)
- Difficult to undo. Command “CHANGEDATASET dsname REMOVEEXPIRE FORCE” requires access to STGADMIN.EDG.FORCE security resource
- Data set expiration date is appended with “(ForceExpire)”
- Attempting to write or read data set, will cause ABEND S413 and message

EDG4067I VOLUME volser REJECTED. DATA SET BLOCKED BY FORCEEXPIRE.

Usage & Invocation - Minor Report Generator Changes

- Support for European and American dates
  - Now sorted correctly
  - Requires that the field is marked as a date in report generator:

```
Field name . . . . : XVLWTDAT
Enter "/" to select additional options:
   Use available changed values to convert report data
Or enter control information:
Substring position . .
Substring length . .
Orig field length  :    10    Field contains date  . . . .    Y or N
Column width . . . .  19      Show statistics if numeric      Y or N
Type . . . . . . . . C        Original field type  . . . : C
```

Usage & Invocation - Messages when RMM down

- New messages added to alert user when RMM Subsystem interface is down
- Similar to existing messages when RMM started task is not active
- Prevents data loss when RMM is not fully functional
- To completely stop RMM (and avoid messages) both RMM Started Task must be stopped and RMM Subsystem interface uninitialized
  - For example, using the following commands: “S DFRMM,OPT=RESET” and “P DFRMM”

RMM is stopped	RMM subsystem interface not initialized (new)
EDG4012D DFSMSrmm INACTIVE FOR action volser BY jobname, procname, stepname, ddname; ENTER ”RETRY”, ”CANCEL” OR ”CONTINUE	EDG4015D DFSMSrmm SUBSYSTEM INTERFACE INACTIVE FOR OPEN volser BY jobname, procname,stepname,ddname ENTER CANCEL, REJECT, OR RETRY AFTER FIXING PROBLEM
	EDG4016D DFSMSrmm SUBSYSTEM INTERFACE INACTIVE FOR CLOSE volser BY jobname, procname,stepname,ddname ENTER CANCEL, CONTINUE, OR RETRY AFTER FIXING PROBLEM
EDG8102D DFSMSrmm SUBSYSTEM NOT ACTIVE DURING function PROCESSING FOR volser - ENTER ”RETRY”, ”IGNORE”, OR ”CANCEL”	EDG8103D DFSMSrmm SUBSYSTEM INTERFACE NOT ACTIVE DURING function PROCESSING FOR volser-ENTER ’’IGNORE’’, ’’CANCEL’’OR ’’RETRY’’ AFTER FIXING PROBLEM

Usage & Invocation - ONLYIF

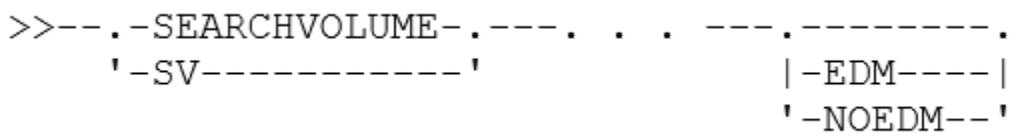
- New ONLYIF command in EDGRMMxx and EDGDEFxx PARMLIB members.
- ONLYIF allows to share a single RMM parmlib member among multiple instances of RMM on a SYSPLEX.
- Syntax:

  >---ONLYIF----SYSNAME(system_name)---------------->

- ONLYIF is valid before any command, including LOCDEF, MEDINF, MNTMSG,OPENRULE,OPTION,PRTITION,REJECT,SECCLS, VLPOOL, and DEFAULT
- The command after ONLYIF is only executed on the system with matching system name

Usage & Invocation - Search support for EDM

- New SEARCHVOLUME operands will be added:



- EDM: only volumes that are marked EDM (External Data Manager) managed will be returned
- NOEDM: only volumes without the EDM attribute are returned
- Also, EDM information is added to the Report Extract data set, and is available to the Report Generator
  - RXVEDM,*,1,CH EDM - Y/N

Usage & Invocation - Warning when CDS fills up

- CDS Utilization value (the High Used RBA / High Available RBA ratio) is the best indicator of possible shortage of space in CDS, even if it may be possible to insert records into a CDS with 100% utilization.
- New messages if CDS utilization is too high:
  - **EDG2120W CDS THRESHOLD** = *threshold_value* **REACHED - CDS IS** *percentage_value***% FULL.**
  - **EDG2122W THRESHOLD REACHED - CDS IS** *percentage_value***% FULL.**
- Issued once CDS utilization threshold is reached, and for each additional percent that is increased
- Threshold defined in PARMLIB using CDSFULL(nn). Default is 95%. If 0, messages are not issued.
- Works the same way as warning when journal is full (JOURNALFULL).

Usage & Invocation - EDGMKVRS sample

Can be used to create a backup of currently defined VRS policies

- Sample REXX script, stored in SYS1.SAMPLIB
- Can be called using sample JCL EDGJMVRS, also stored in SYS1.SAMPLIB
- Input: RMM Report Extract data set, created by RMM Housekeeping
- Output: List of RMM ADDVRS commands

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level: No

- Software Dependencies
  - None
- Hardware Dependencies
  - None.

Installation

- GDPR functionality (DSNEXPIRE and FORCEEXPIRE) is rolled down to V2R1 and up APAR: OA54871
- Search improvements for EDM will be rolled down to V2R2 and up using APAR OA56852. OA56852 will also include additional search support for FORCEEXPIRE and DSNEXPIRE.

Appendix - publications

- DFSMSrmm Implementation and Customization Guide (SC23-6874)
- DFSMSrmm Managing and Using Removable Media (SC23-6873)
- z/OS DFSMSrmm Application Programming Interface (SC23-6872)
- MVS System Messages Volume 5 (EDG - GFS) (SA22-7635)
- z/OS DFSMSrmm Reporting (SC23-6875)

Mandatory Defaults Table Enhancements
Component: **DFSMSrmm**

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Overview

- **Who**
  - Tape administrators, especially on those systems that are using non-IBM tape hardware, and systems using EDM (External Data Managers) other than HSM, OAM and TSM.
- **What**
  - New defaults table keywords: PGMNAME, EDM/NOEDM, POOL, CONTINUE
- **Wow**
  - Enables pooling for non-IBM libraries (MTLs and non-SMS managed tape data)
  - Allows customers that were using UXTABLE pooling to move away from using user exits
  - Allows to choose which programs manage their own tape data (in addition to the HSM and OAM)
  - Greater flexibility using defaults table, ability to combine defaults table entries

Usage – Defaults table selection criteria

- When a new tape data set is written, the defaults table is searched from the top down until a matching entry is found

- An entry only matches if all 4 selection criteria are satisfied
  - DSNAME mask – can contain wildcards. Default is **
  - JOBNAME mask – can contain wildcards. Default is *
  - PROGRAM NAME mask – can contain wildcards. Default is *. New, added in V2R4.
  - KEYDATE – matched against the EXPDT value specified in the DD statement. The default is * to select all dates. NOKEYDATE only matches if a key date is not specified.

Usage – Defaults table CONTINUE keyword

- If a matching defaults table entry is found, CONTINUE indicates to continue the search (otherwise the search stops)
- If more than one matching entries specify the same parameter, the value of the latest matching entry is used.
- In the following example, POOL depends only on the DSNAME, while retention method depends only on the JOBNAME
  - DEFAULT DSNAME(DSN1.**) POOL(POOL1) **CONTINUE**
  - DEFAULT DSNAME(DSN2.**) POOL(POOL2) **CONTINUE**
  - DEFAULT JOBNAME(JOB1) RM(EXPDT)
  - DEFAULT JOBNAME(JOB2) RM(VRSEL)
- If the first 2 entries did not have CONTINUE, a data set named DSN1.MYDSN written by JOB2 would never match line 4 of the defaults table to assign the VRSEL retention method.

Usage – Defaults table EDM keyword

- HSM and OAM tapes are marked as EDM, so they cannot be expired by RMM until released by HSM/OAM/TSM
  - RMM looks at the program name, which must match one of: ANZSRVR, ANRSERV, ARCCTL, ARCWCTL, CBROAM, DSMSERV

- To exclude some of these from being marked EDM, specify EDM(NO) in the defaults table, for example:
  DEFAULT PGMNAME(ANZSRVR) DSNAME(MYDSN.**) EDM(NO) CONTINUE

- To add additional products that manage their own tapes, specify EDM(YES) in the default table, for example:
  DEFAULT PGMNAME(TAPEPGM) EDM(YES)

Usage – Defaults table POOL keyword

- Works exactly the same way as UXTABLE's POOL, used to select a scratch pool
- Cannot be combined with KEYDATE, PGMNAME parameters, since this information is not available when pooling decision is made
- Only useful for non-SMS managed tapes and for Manual Tape Libraries if PL100_SET_IGNORE_SGNAME is set – usually this means non-IBM tape hardware.

- To exclude some of these from being marked EDM, specify EDM(NO) in the defaults table, for example:
  DEFAULT PGMNAME(ANZSRVR) DSNAME(MYDSN.**) EDM(NO) CONTINUE

- To add additional products that manage their own tapes, specify EDM(YES) in the default table, for example:
  DEFAULT PGMNAME(TAPEMGR) EDM(YES)

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level: No
- Software Dependencies
  - None
- Hardware Dependencies
  - Non-ACS POOLing support is usually exploited by non-IBM tape libraries.

Installation

- The REXX script EDGRDEF in SYS1.SAMPLIB is updated
  (Use sample JCL EDGJDEF to call this script)
- This script allows to convert a UXTABLE to the Defaults Table
- Now it supports conversion of POOL and PGM parameters

Appendix - publications

- DFSMSrmm Implementation and Customization Guide (SC23-6874)
- DFSMSrmm Managing and Using Removable Media (SC23-6873)
- z/OS DFSMSrmm Application Programming Interface (SC23-6872)
- MVS System Messages, Volume 5 (EDG-GFS) (SA38-0672)

Security Enhancement
Component: **Catalog**

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Overview

- **Who**
  - Storage Administrators
- **What**
  - New Catalog XFacilit Delete Audit class named STGADMIN.IGG.DELAUDIT.[CatalogName]
- **Wow**
  - Another level of control to secure catalogs with the ability to document deletion of datasets with SMF 80 records.

Usage & Invocation

- A new Catalog XFacilit Delete Audit class called STGADMIN.IGG.DELAUDIT.[CatalogName] allows users with read access to it the ability to delete datasets within the stated Catalog without other authority.
- Any users without read authority to the XFacilit class will need Alter authority to the dataset in order to delete it.
- If the XFacilit class is not defined, the authority checking will work as it does now, i.e. the user will require either Alter to the Dataset or Catalog.
- If access is granted via the XFacilit class defined with AUDIT(ALL(READ)), an SMF type 80 record will be cut to record the event.

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level: **Yes**, otherwise systems without fix would use existing authority checking
- Software Dependencies
  - None
- Hardware Dependencies
  - None
- Exploiters
  - None

Appendix - publications

- z/OS DFSMS Managing Catalogs

Data Set Level Encryption, Phase 2
Basic and Large Format
Components: **DFSMSdfp, DFSMSdss, DFSMShsm, DFSORT**

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Overview

- **Who**
  - z/OS Security administrators
- **What**
  - Protect sensitive data in basic and large format sms-managed data sets by requesting data set level encryption via security policy
- **Wow**
  - Allows applications using standard BSAM and QSAM APIs to encrypt data with no, or minimal, changes
  - Allows applications using EXCP to encrypt data with use of new access method encryption callable service

High Level Function / Solution Description

- This solution enables sequential basic format and large format SMS-managed data sets as a supported data set type for data set encryption
  - Allows access via BSAM, QSAM and EXCP
  - Allows create using key label
  - The user must have SAF authority to both the data set and the key label
  - The data will remain encrypted during backup, migration and replication
- For applications using the standard BSAM/QSAM APIs, no, or minimal, application changes are required
- For applications using EXCP, application changes are required. New access method callable service designed for EXCP applications to access encrypted basic and large format data sets
- Note:
  - Sequential basic and large format data sets are DASD only
  - This enhancement will not support encryption of temporary data sets, including VIO data sets

Creating encrypted data sets (today)

- A data set is defined as an encrypted data set when a **key label** is supplied on *data set create of a **supported data set type** for data set encryption*
- A **key label** can be supplied in any of the following sources (*in order of precedence as follows*):
  - **Security policy:** RACF data set profile DFP segment
  - **Explicitly:** JCL, Dynamic Allocation, TSO Allocate, IDCAMS DEFINE
  - **SMS policy:** Data class
    - To allocate via ISPF 3.2, can specify a data class with key label

Preparing system for new encryption data set types

When a key label is specified during data set create

- To allow the system to treat ***basic and large format data sets*** as a supported data set type, the following new resource in the FACILITY class must be **defined:**

  STGADMIN.SMS.ALLOW.DATASET.SEQ.ENCRYPT

For supported data set type,

- To allow the system to create encrypted data sets when the key label is specified via a method *outside of the DFP segment in the RACF data set profile*, the user must have at least **READ authority** to the following new resource in the FACILITY class.

  STGADMIN.SMS.ALLOW.DATASET.ENCRYPT

For unsupported data set type,

- By default, the system will ignore the key label. However, to fail the allocation, the user must have at least **READ authority** to the following new resource in the FACILITY class.

  STGADMIN.SMS.FAIL.INVALID.DSNTYPE.ENC

Restrictions

- Similar to extended format encryption
  - System data sets (such as Catalogs, SHCDS, HSM data sets) must not be encrypted, unless otherwise specified
  - Data sets used before ICSF is started must not be encrypted
  - Sequential basic and large format data sets with a BLKSIZE of less than 16 bytes cannot be encrypted

  - Encrypted data sets only supported on 3390 device types
  - DFSMSdss REBLOCK keyword is ignored on COPY and RESTORE functions. DFSMSdss ADRREBLK installation exit will not be called for encrypted data sets

New encrypted basic and large format data set

- Similar to extended format data sets
  - Encryption cell (VVDS: non-VSAM NVR) contains encryption metadata:
    - Key label; Encryption type (AES256); Encryption mode (XTS); ICV; Key verification value
  - Data set encryption flag in VTOC Format 1/Format 8 DSCB (DS1ENCRP)
  - Allocation message IGD17150I indicates data set is an encrypted data set with derived key label

- **NEW: Encrypted basic and large format data sets will have an enhanced physical format.**
  - Each physical block will have an 8-byte prefix.
    - Not included within DCB, DCBE, JFCB or DSCB
    - Transparent on reads/write within the BSAM/QSAM application
    - May affect space calculations

Usage & Invocation

- Access via BSAM, QSAM
  - Transparent to application except for DASD space calculations (due to prefix)

- Access via EXCP
  - Application changes will be required
    - With EXCP, caller creates channel program for I/O
      - The EXCP program must account for 8 byte prefix on each block
      - The EXCP program must encrypt the data before writing and decrypt after reading
  - IBM will provide access method encryption callable services so that the resulting data set will be compatible with the access methods

Encrypted basic and large format – Physical format

To support the encryption mode of XTS, must uniquely encrypt each encrypted block of a basic or large format data set. To satisfy this requirement, the physical data set will be modified as follows:

- An 8-byte prefix (blockID) will be added to each physical block of the data set, where the prefix will have the following characteristics:
  - The prefix will not be encrypted
  - The prefix will not be included in the physical block size of the data set stored in the blocksize fields in the DSCB, DCB, [JFCB], etc.
  - The prefix will not be required on WRITE or PUT requests, nor returned on READ and GET requests.

Encrypted basic and large format – User blocksize

For applications using BSAM, QSAM or EXCP, based on the enhanced physical blocks, the following interface changes may result in application changes if the application derives the optimal blocksize:

- For those application that calculate track capacity or blocks per track via TRKCALC, they must take into account the 8-byte block prefix for encrypted basic and large format data sets.
- ISITMGD will be modified to return the length of the block prefix for the opened data set. The returned value will be 8 for encrypted basic and large format data sets. The returned value will be zero for data sets that are not encrypted basic or large format data sets.

System Determined Blocksize (SDB) will take into account the 8-byte prefix when deriving the optimal user blocksize.

Basic and large format encryption – EXCP callers

For applications using EXCP channel programs, application changes will be required to access the data. In this case, the access methods do not automatically get control therefore cannot process the data on behalf of the caller. The following changes will be required if you wish compatibility with the access methods:

- Prior to OPEN,
  - The application must set a new DCBE flag to indicate that the EXCP application understands how to process encrypted data sets: DCBE DSENCRYPT=OK.
    The DCB can be for BSAM, BPAM, QSAM or EXCP.
- Prior to the first I/O request,
  - The application must call the new data set encryption callable service to perform the ‘connect’ function
    - DEB address OR encryption cell info, data set name

Basic and large format encryption – EXCP callers (cont)

- During I/O requests,
  - The application will be responsible for maintaining the blockID. On output, creating the 8-byte prefix required for each block. On input, retrieving the 8-byte prefix found on each block
  - On input/output, the application must call the new data set encryption callable service to perform the ‘encrypt’/’decrypt’ function
    - Connect token
    - List of blockIDs (ICV 8-byte value)
    - List of source buffers
    - List of source buffer lengths
    - List of target buffers for output (optional. If not provided, encrypt into same buffer)
- Before or after CLOSE,
  - The application must call the new data set encryption callable service to perform the ‘disconnect’ function

How to detect that support is installed

- New DFA field indicating ‘basic/large format encryption’ support installed.
  - DFADSENCRYPT

Offset	Type	Len	Name	Description
82 (52)		2		Reserved
84 (54)	ADDRESS	4	DFADSENCRYPT	Address of data set encryption callable service
88 (58)		24		Reserved

Interactions & Dependencies

- To exploit this item, all systems in the Plex must be at the new z/OS level: No, APARs will be available for lower releases
  ** Availability is planned for post z/OS V2R4 General Availability **

- Software Dependencies
  - ICSF installed and configured with a CKDS
  - AES master key loaded in Crypto Express
- Hardware Dependencies
  - Crypto Express3 Coprocessor or later
  - Feature 3863, CP Assist for Cryptographic Functions (CPACF).
- Exploiters
  - NONE

Installation

- Main support APAR OA56622 will be provided on z/OS V2R4, V2R3 and V2R2
  - Will reference all related APARs

Appendix

- Updated Publications
  - z/OS DFSMS Using New Function
  - z/OS DFSMSdfp Storage Administration
  - z/OS DFSMSdfp Advanced Services
  - z/OS DFSMS Using Data Sets
  - z/OS DFSMS Macro Instructions for Data Sets
  - z/OS MVS JCL Reference
  - z/OS MVS System Messages, Vol 8 (IEF-IGD)