Making the Most of DFSMSdss and SMS: Hints, Tips, and Best Practices in your z/OS Environment

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Agenda

- **System Managed Storage Overview**
  - What is SMS
  - Benefits of SMS
  - SMS Configurations
  - ACS Routines
  - Best Practices
- **DFSMSdss Best Practices**
  - Converting nonSMS data to SMS without data movement
  - Keywords related to SMS processing
  - SG ACS and renaming data sets
  - Volume Selection
  - VSAM CA Size Requirements
- **FlashCopy Hints and Tips**

What is system managed storage?

- Lets the operating system take over storage management tasks
  - Data set allocation
  - Backup management
  - Space management
  - Availability management
- Reduces number of people needed to manage storage

What is SMS?

- SMS is an MVS subsystem
  - Manages the current storage management policy (active configuration)
  - Reduces end user data set creation & allocation complexity
  - Increases installation control of DASD, tape, and optical storage
- There is one SMS and one SMS address space per instance of MVS (z/OS)
- SMS runs in both the user's and the SMS address space

SMS Design Considerations

- Clearly separate the domains of users, data and storage media
- Introduce the role of storage administrator
- Preserve customer investment in JCL and other structures

Why should I use it?

- Reduce out of space abends (X37)
- Reduce device fragmentation
- Balance allocations across a pool of devices
- Improve storage utilization
- Help achieve device independence

Some Basic Terms

- SMS configuration
- Minimal configuration
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- ACS routine

Some Basic Terms…

- SMS configuration
- Minimal configuration
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- ACS routine

- **A configuration is a storage management policy**
- **It contains elements which define that policy:**
  - **Storage groups & volumes**
  - **Storage classes**
  - **Management classes**
  - **Data Classes**
  - **Automatic Class Selection (ACS) routines**
  - **Optical and tape libraries and drives**
  - **Aggregate groups**

Some Basic Terms…

- SMS configuration
- Minimal configuration
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- ACS routine

- **Base configuration information**
- **One storage class definition**
- **One storage group with at least one volume**
- **A storage class ACS routine**
- **A storage group ACS routine**

Some Basic Terms…

- SMS configuration
- Minimal configuration
- Base Configuration Definition
- Storage group
- Storage class
- Management class
- Data class
- ACS routine

- **System & system group names**
- **Default management class**
- **Default unit**
- **Default device geometry**

Some Basic Terms…

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- Management class
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- **Physical storage managed by SMS**
  - **Collection of DASD volumes**
  - **Volumes in tape libraries**
  - **Volumes in optical libraries**
  - **Virtual I/O storage**
- **Can be enabled, quiesced, quiesced new, disabled or disabled new**
- **Can be set to auto migrate, auto backup and/or auto dump**

Some Basic Terms…

- SMS configuration
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- ACS routine

- **Performance attributes**
  - **Direct & sequential millisecond response**
  - **Direct & sequential bias**
  - **Initial access response time**
- **Availability**
- **Accessibility**
- **Guaranteed space**
- **Guaranteed synchronous write**

Some Basic Terms…

- SMS configuration
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- Management class
- Data class
- ACS routine

- **Space management attributes**
  - **Expiration & retention attributes**
  - **Migration attributes**
  - **GDG management attributes**
- **Backup attributes**
  - **Backup frequency**
  - **Backup versions**
  - **Backup retention**
- **Class transition attributes**
- **Aggregate backup attributes**

Some Basic Terms…

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- Storage group
- Storage class
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- ACS routine

- **RECORG or RECFM**
- **LRECL**
- **Space**
- **DSNTYPE**
- **Volume count**
- **VSAM attributes**
- **RETPD or EXPDT**
- **Compaction**

Some Basic Terms…

- SMS configuration
- Minimal configuration
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- ACS routine

- **Used to determine SMS classes and storage groups**
- **Used for both data sets and objects**
- **Can override specifications of SMS classes and groups on:**
  - **JCL DD statements**
  - **Dynamic allocation requests**
  - **DFSMSdss COPY, RESTORE & CONVERTV**
  - **DFSMShsm RECALL & RECOVER**
  - **IDCAMS DEFINE, ALTER & IMPORT**
  - **OAM STORE, CHANGE & class transition**

SMS Best Practices

- ACS Routines
  - REMINDER - ACS processing is uncaptured time
  - Use FILTLISTs with wildcards
    - Don’t use long FILTLISTs with complete DSN’s
  - Use SELECT statements whenever possible
    - Allows you to exit the routine a little faster
- CDS’s
  - Ensure CDSs have REUSE specified
  - Ensure CDSs have plenty of space
  - Separate the ACS and COMMDS

SMS Best Practices (cont)

- Configuration
  - See OA33127 and apply the PTF
    - After R11, null volume entries are not dealt with well
  - II14602 describes how to ‘prevent’ OA33127’s loop
    - If all else fails, the IBM Support Center can help

DFSMSdss Keywords related to SMS

- STORGRP keyword
  - Specifies that all online volumes in the Storage Groups be dynamically allocated
  - Can specify up to 255 storage group names
  - Do not need to specify SELECTMULTI keyword
  - Catalog filtering is used to find data sets but DSS will only select data sets for volumes in the specified storage groups
    - May cause an increase in job run time
  - Can be used for COPY, DUMP, and RELEASE commands
  - Customers have used this to determine which volumes in a storage group data sets have been copied to

DFSMSdss Keywords related to SMS

- STORCLAS keyword
  - Specifies a storage class name for DFSMSdss to pass to ACS
  - Does not guarantee that the storage class specified will be assigned to the data set
    - Must specify BYPASSACS to guarantee specified STORCLASS is assigned to target
  - You can also use a guaranteed-space defined storage class to placed data sets on specified OUTDD/OUTDYNAM volumes
    - SG ACS must use SC to determine storage group
  - Method to move data sets from all your storage classes, except two, into one storage class using BY FILTERING

```
COPY DATASET(INCLUDE(**)
   BY(STORCLAS,NE,(SCNAME1,SCNAME2))) -
   STORCLAS(SCNAME3) BYPASSACS(**) DELETE
```

SG ACS and renaming data sets using DFSMSdss

- Using RENAMEU to have ACS select storage group without STORCLAS keyword

```
PROC STORCLASACS
FILTLIST JOBC     INCLUDE ('**.DSTGT.**')

 /*    DSTARGET          */
   WHEN (&DSN = &JOBC)
  DO
  SET &STORCLAS = 'DSTARGET'
  EXIT CODE(0)

PROC STORGROUPACS
IF &STORCLAS='DSTARGET' THEN SET &STORGRP = 'FCTARGET'

ADRDSSU job :
COPY DS(INC(SYS1.DSSRC.DS01.XX1900)) -
  RENAMEU((*.DSSRC.**,*.DSTGT.**))
```

DFSMSdss Keywords related to SMS

- MGMTCLAS keyword
  - Specifies a management class to replace the source management class to pass to ACS
  - Specifying NULLMGMTCLAS provides a null management class to the input of the ACS routines
    - Also does not propagate source management class to target
  - You can also do BY FILTERING by MGMTCLAS name

```
COPY DATASET(INCLUDE(**)
   BY(MGMTCLAS,EQ,(MGTNAME1,MGTNAME2))) -
   STORCLAS(SCNAME3) DELETE
```

DFSMSdss Keywords related to SMS

- BYPASSACS keyword
  - Way to force the specified STORCLAS and MGMTCLAS to be assigned to target
  - ACS routines are not invoked

```
COPY DATASET(INCLUDE(**)
  MGMTCLAS(MGNAME1)
  STORCLAS(SCNAME3)
  BYPASSACS(**)
```

DFSMSdss Keywords related to SMS

- Using NULLSTORCLAS and BYPASSACS(**) keywords
  - Way to force the COPY and RESTORE of the data sets to be nonSMS managed
  - ACS routines are not invoked

```
COPY DATASET(INCLUDE(**)
  BYPASSACS(**)
  NULLSTORCLAS
  RENAMEU((SOURCE.**,TARGET.**))
  OUTDYNAM(TARGTV)
```

DFSMSdss and SMS volume selection

- SMS follows same sequence of steps as it does for normal allocations (outside of DSS)
  - Volumes must be defined in a storage groups selected for the data set by the storage group ACS routine
  - For data sets allocated for FlashCopy, SMS will attempt to select volumes in the same SFI as the source data set
  - Performance considerations:
    - When processing many (100's) of FC's, when accessing target, response time will be better when FC source and target reside in the same cluster on an DS8000
    - Keeping data sets from crossing extents pools is also a performance benefit

VSAM CA Size Requirements

- New in V1R10
- New VSAM allocations must have a control area size of 1, 3, 5, 7, 9, or 15 tracks
- IDCAMS will automatically force any allocations to abide
- When copying data sets that don't follow the CA size requirements DFSMSdss must process it using IDCAMS
  - Prevents use of Fast Replication
  - Must be able to obtain exclusive enqueue
- Tool available to perform this migration action
- Please refer to the zOS V1R10 Migration publication for more information
- Exception to the rule OA33531
  - Striped VSAM with spanned records
  - Not eligible to be extended into cylinder managed space

DFSMSdss COPY/DUMP/RESTORE FULL

- Bypass authorization checking, expiration date checking, or unused space checking
- ADMINISTRATOR keyword
- PURGE keyword
- ALLDATA(*) ALLEXCP keywords
- If all of the options are not specified DSS will read every VTOC track and find each F1 DSCB

DFSMSdss Parallel Processing

- DSS limits parallel processing to 80 sub tasks
- 24 subtasks in parallel per ASID gives you the maximum benefit
- DSS default limit is 80 subtasks per ASID
  - Can be overwritten via ADRPATCH (offset x'45')
  - Anything over 80 parallel subtasks could result in 878 abends

Enable or Disable DFSMSdss CSI usage?

- Good question, it depends. First a history…..
- Prior to V1R11, OA25644 introduced using CSI to locate data sets
  - Enabled via ADRPATCH
- Became the default in V1R11, but OA32120 changed it back
  - Reason: run times increased when specifying INCAT
- You should see a benefit when CSI is enabled when INCAT is not specified
- No benefit if input volumes or STORGRP is specified
  - CSI is not used by DFSMSdss
- If using CSI be sure to have fix provided in OA32165
  - Filter containing * in first character of qualifier will not select data sets
    - INCLUDE(DS(*.FILT or *P.FILT))

DFSMSdss DUMP/RESTORE on V1R12

- In V1R12 DSS began using BSAM to
  - Write bigger tape blocks
  - Use an EFSAM as DUMP output/RESTORE input on DASD
  - If backup is on EF SAM lower level releases cannot restore backup
  - Consider using COPYDUMP from an EFSAM to a Large SAM
    - Target blocksize has to match source
  - If backup is on tape DSS can restore it on lower releases

Incremental FlashCopy

- **'Change Recording' keeps track of changes made to source and target volumes after establishment of FlashCopy relationship**
  - Use 'Change Recording' along with BACKGROUND COPY and PERSISTENT
  - Supported only at full volume/LUN level
  - There can only be one incremental relation per volume but can coexist with other non-incremental relationships
- **During refresh:**
  - To maintain the incremental relationship, specify 'Change Recording' on each incremental FlashCopy
  - Only changed data is copied in the background
    - Previous increment BACKGROUND COPY does not have to complete before new increment is taken if the FlashCopy is in the same direction
  - A new FlashCopy increment can be performed in the reverse direction
    - Previous incremental BACKGROUND COPY going in the opposite direction must complete before performing an incremental in the other direction

Incremental FlashCopy Example

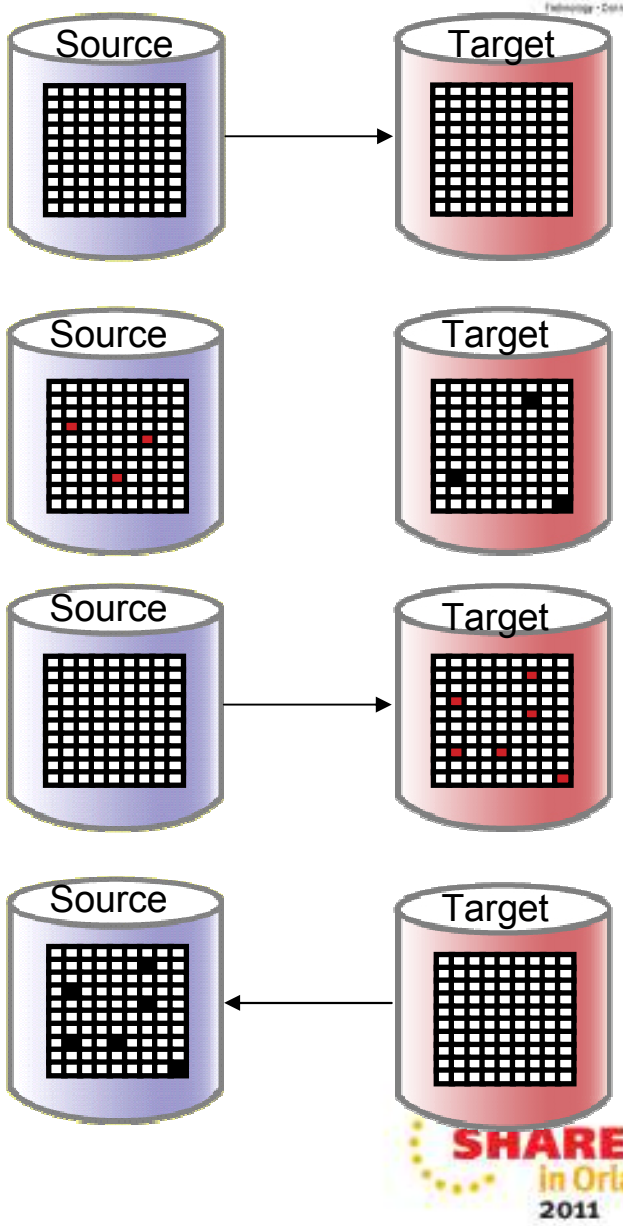
Establish FlashCopy A>B

Both A and B are updated

Resynchronize: B becomes an exact copy of A with new updates from A and updated tracks on B overlaid from A

or

Reverse the increment and A becomes an exact copy of B with new updates from B and overlay updated tracks on A from B

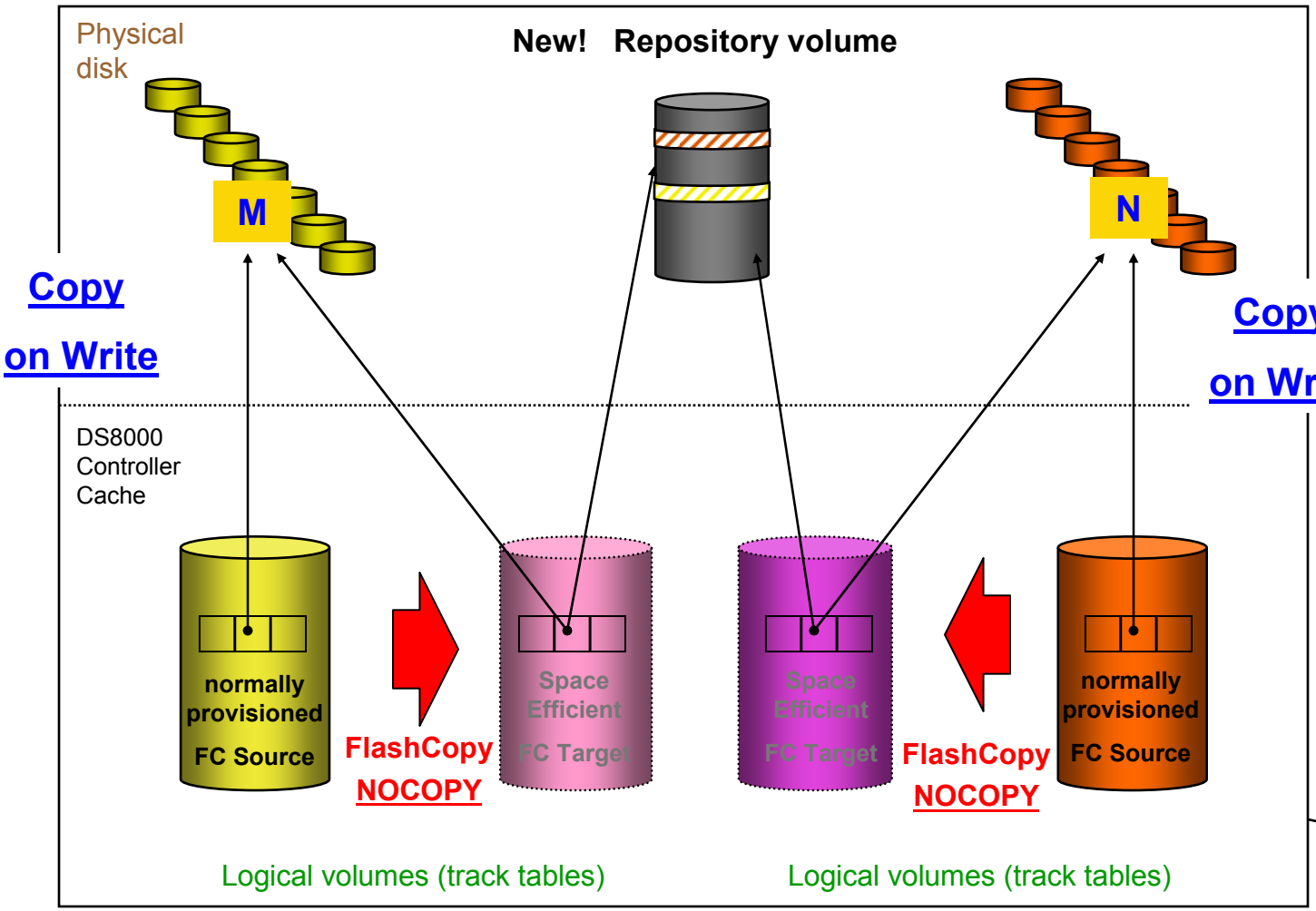


FlashCopy SE Relationships

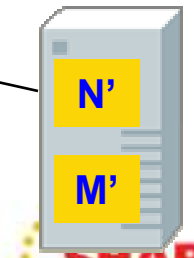
- **Full volume only**
- **NOCOPY only**
  - Background copy cannot be initiated to a SE volume by any means
- **Must specify FCTOSETGTOK(FAIL) during COPY**
- **Recommended Usage**
  - Use FlashCopy Space Efficient when economy is more important than performance and for short-lived relationships with low update rate on source volumes
    - Only a fraction of the space is required for target volumes
    - Short Term FlashCopy relationships
    - Good for read only applications
      - *Tape Backup, 24 hour online backup, etc*
    - The C vol in GM may be SE

FlashCopy SE to Space Efficient volumes

Goal:
Smaller amount of total physical GB for Repository



Note: Repository has a defined
1) Physical Size
2) Logical Size



Server

To COPY or to NOCOPY? That is the question!

- **BACKGROUND NOCOPY is typically the best choice to minimize activity within the physical box**
  - But…. You must ask why are you making a copy? And…. What type of application workload do I have?
  - For example:
    - Is the copy only going to be used for creating a tape backup?
      - *BACKGROUND NOCOPY should be used and the relationship withdrawn after the tape backup is complete*
    - Is the copy going to be used for testing or development?
      - *NOCOPY again is typically the best choice*
    - Will you need a copy of the copy?
      - *BACKGROUND COPY must be used so that the target will be withdrawn from its relationship after all of the tracks are copied thereby allowing it to be a source in a new relationship*
        - *Possibly use NOCOPY to COPY option*
        - *Most efficient when the source and target volumes are within the same cluster*
    - Is the workload OLTP (NOCOPY typically is the choice) or are there a large number of random writes and are not cache friendly (COPY may be the better choice)

DFSMSdss FlashCopy Batch Protection using SMS

- Forces data sets to be copied to a specific storage group when FlashCopy is used as the data mover
- Create a new storage group to contain the FlashCopy target eligible volumes
- Populate new SG with the FlashCopy target volumes for
- Modify SG ACS routine to direct allocations to the new SG when the value of the new ACS variable &ACSENVR2 is equal to 'FLASHCPY'
- Revalidate the ACS routine and re-activate the SMS configuration
- APARs OA32101 and OA32103

Reference Materials

- Publications:
  - SC35-0428: z/OS V1R10.0 Migration
  - GA22-7499: z/OS V1R12 Migration
  - GA22-7499 : DFSMSdss Storage Administration

Summary

- SMS Overview
- DFSMSdss Best Practices
- Questions?