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
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- 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…

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

- 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
- Minimal configuration
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- 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
- Minimal configuration
- Base configuration information
- Storage group
- Storage class
- 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...

- SMS configuration
- Minimal configuration
- Base configuration information
- Storage group
- Storage class
- Management class
- Data class
- 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
DFSSdss 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
```
DFSMShsm 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)
DFSMShs 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
• ALLLDATA(*) 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

Physical disk

Physical Size

Logical Size

DS8000 Controller Cache

M

N

Copy on Write

New! Repository volume

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

Logical volumes (track tables)

Logical volumes (track tables)

FlashCopy NOCOPY

FlashCopy NOCOPY

Copy on Write

Goal:
Smaller amount of total physical GB for Repository

Server

N'

M'

FlashCopy SE to Space Efficient volumes
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 &ACSENV&R2 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?