



This is a presentation no the Best Practices for Catalog and VSAM

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Agenda

- Best Practices For Catalogs
- Best Practices for VSAM

Catalogs and VSAM Best Practices will be discussed

Best practices for catalogs

- **INSTALL THE MAINTENANCE!**
 - ▶ Many customers are anywhere from 50-90 PTFs downlevel
 - ▶ Failure to install fixes can result in broken catalogs or incorrect behavior
 - ▶ Only installing HIPER maintenance is ***not good enough***
- **Backing up Catalogs**
 - ▶ Should ALWAYS run a DIAGNOSE and EXAMINE prior to backup
 - Catalog should be closed by CAS command, or an IDCAMS VERIFY of the catalog should be run prior to the DIAGNOSE/EXAMINE
 - ▶ Failures in either of these may result in a bad backup and a restore may fail or the catalog may not be correct

It is important that customers install maintenance and run a DIAGNOSE and EXAMINE prior to backup

Best practices for catalogs

▪ Definition of a Catalog

▶ Omit:

- RECORDSIZE (defaults to 32400)
- BUFFERSPACE
- FREESPACE

▶ Code:

- CONTROLINTERVALSIZE(4096)
- BUFND/BUFNI/STRNO – discussed later
- Space in CYLINDERS is best

▶ Optional:

- SHAREOPTIONS(3 4) is default – means “shared catalog”
 - If catalog is not shared, you can specify SHR(3 3)
 - Must be on a shared UCB if you are sharing the catalog with other systems!!!!!!
 - Verify that EACH SYSTEM using that shared catalog is on a UCB that is marked “shared”!!!!
- ECSHARING
 - Should only be used for shared catalogs
- INDEX component CISIZE – generally 1536 but based on key compression may need to be higher

Catalog definition

Best practices for catalogs

- **ALWAYS** define a **Secondary Allocation**
 - ▶ Catalogs can only exist on a single volume
 - ▶ Message IEC361I is issued when the percentage of maximum extents exceed the customer limit
 - Limit is set by `MODIFY CATALOG,NOTIFYEXTENT(xxx)`
 - Default messages are issued when 80% of max extents are reached
 - Non-deletable message is issued when 90% of max extents are reached
 - Provides warning to installation that a catalog is reaching its limit
 - ▶ **User responsibility to maintain sufficient space on the volume to allow the catalog to extend properly**
 - Failure to do this may result in extend failures affecting production jobs

Secondary allocation definition

Best practices for catalogs

■ Reorganization of Catalogs

- ▶ You can delete the catalog after you EXPORT it, redefine it with parameters you desire
- ▶ Do NOT reorganize because of CI/CA splits
- ▶ Do reorganize if you need to:
 - Consolidate extents
 - Expand the size of the Catalog
 - Remove IMBED and REPLICATE
 - APAR OA10952 needs to be installed
 - Increase maximum RECORDSIZE
 - All Catalogs should use maximum of 32400
 - Generally found in older Catalogs
- ▶ Reorganize using IDCAMS EXPORT and IMPORT commands
- ▶ Constantly increasing keys may require frequent reorganization
 - For example, if a Julian date is part of the data set name
 - When those are deleted, the space is lost
 - Simple solution is put day-in-year first, year after the day-in-year

Catalog reorganization

Best practices for catalogs

- **BUFNI, BUFND, STRNO For Catalogs**
 - ▶ Values should be set high enough based on Catalog usage
 - If SYSZRPLW/catalogname shows up in RMF, you need to bump the STRNO values for that catalog
 - IDCAMS ALTER allows you to change BUFNI, BUFND, and STRNO
 - ▶ z/OS 1.7 will automatically tune Catalog STRNO, BUFNI, and BUFND
 - Values are unique based on the system sharing the catalog
- **Distribution of Catalog Entries**
 - ▶ Worry about application recovery
 - ▶ Segregate application data sets into separate catalogs
 - ▶ Disaster Recovery, disaster recovery, disaster recovery!

Catalog usage and application recovery

Best practices for catalogs

- **Multi-level Aliases**
 - ▶ Can be used to further segregate HLQs
 - ▶ For example if all your production data sets start with “PROD” and you want to distribute them between multiple catalogs (for DR and recovery purposes)
 - ▶ You can define PROD.PAYROLL to point to another catalog and all new data sets cataloged will go into that catalog.
 - ▶ Existing PROD.PAYROLL data sets will be found in the original catalog
 - You may want to move them to the new catalog with REPRO MERGECAT
 - ▶ You must set the ALIASLVL to 2 when you do this
 - Maximum value is 4

Usage of multi-level aliases

Best practices for catalogs

- EXPORT of a Catalog
 - ▶ Specify INFILE on the EXPORT
 - Requires Catalog be on a DD statement in the JCL
 - ▶ On the DD statement for the Catalog, use AMP=('BUFND=xxx','BUFNI=yyy')
 - ▶ For BUFND use the number of CIs/CA in the data component
 - Found in LISTCAT output
 - ▶ For BUFNI divide HURBA for index by index CIsizes and add 5
 - Found in LISTCAT output
 - ▶ For BUFNO use a number of 30 to 40 on the output data set
 - ▶ Can provide significant improvement in EXPORT performance
 - ▶ Refer to APAR II10752 for issues about Catalog Performance

Catalog export

Best practices for catalogs

■ IMPORT of a Catalog

- ▶ You should use the LOCK keyword on the IMPORT
- ▶ Prevents other users from inserting data while the catalog is being imported
- ▶ The catalog is defined first and without LOCK, incorrect entries could be inserted damaging the catalog
- ▶ To lock a catalog the user must have at least read authority to the IGG.CATLOCK profile
- ▶ Use ALIAS if the Catalog is cataloged in the current master catalog
 - Will reconnect any aliases from the exported copy when the master catalog pointed to this catalog

■ Caching catalogs

- ▶ VLF is the preferred cache mechanism
- ▶ If VLF is not enabled, In-storage cache is used
 - In-storage cache limits the storage used
 - VLF can be tuned based on output from RMF

Best practices for catalogs

- **Sharing Catalogs**
 - ▶ Specific protocols are used to ensure the integrity of a shared catalog
 - ▶ Shared catalogs **MUST** be:
 - SHAREOPTIONS(3 4) (this is the default when defining a Catalog)
 - On a shared UCB
 - ▶ Common mistake is that one system may **NOT** have the UCB defined as shared
 - This will result in catalog integrity issues and possible broken catalogs
 - ▶ Issue **MODIFY CATALOG,ALLOCATED** on all systems
 - Verify that the catalog is shown as properly shared ('R' or 'E') on all systems

Shared Catalogs

Best practices for catalogs

- **Serialization for Catalogs**
 - ▶ Catalogs shared only within a Sysplex can:
 - Convert the SYSIGGV2 RESERVEs using GRS Conversion RNLs
 - Use Enhanced Catalog Sharing
 - Greatly reduces I/O to VVDS and improves performance
 - ▶ Catalogs shared outside of a Sysplex:
 - Must provide specific SYSIGGV2 entries in the SYSTEMS EXCLUSION RNL
 - Example: RNLDEF RNL(EXCL) TYPE(SPECIFIC) NAME(SYSIGGV2) RNAME('catalog.name ')
 - If catalog is less than 20 chars, must pad with blanks to 20
 - If catalog is > 20 chars must pad with blanks to 44
 - Consult “z/OS Planning for Global Resource Serialization” manual
 - These catalogs cannot use Enhanced Catalog Sharing
 - ▶ We strongly recommend SYNCHRES=YES be used (GRS)
 - ▶ If using MIM, contact MIM for appropriate values to be used

Best practices for catalogs

- **Serialization for VVDS's**
 - ▶ VVDS's shared only within a Sysplex can:
 - Convert the SYSZVVDS RESERVEs using GRS Conversion RNLs
 - ▶ VVDS's shared outside of a Sysplex **MUST NOT** be converted
 - ▶ SYSVTOC and SYSZVVDS must be in the same list
 - Both either in converted or exclusion
- **DDR Swap or TDMF usage**
 - ▶ Catalog has an exit for ENF 28 to recognize when a volume is being swapped, and ECS catalogs will be quiesced if they are on that volume
 - ▶ You must manually enable the catalog to re-insert it into ECS

VVDS Serialization, DDR Swap or TDMF usage

Best practices for catalogs

- **REPRO MERGECAT**
 - ▶ Is intended to move entries to a new catalog
 - ▶ FROMKEY and TOKEY are allowed
 - Allows skipping of broken entries in the catalog
 - ▶ Changes VVDS entries for VSAM or SMS-managed volumes to point to new catalog!
 - Do NOT use REPRO MERGECAT to create a backup catalog!
 - Consult DFSMS Managing Catalogs for information on creating backup catalogs!
 - Depending on the installation requirements, there are several options available for creating backups documented in Managing Catalogs

Moving entries to a new catalog

Best practices for catalogs

- Test your Disaster Recovery!
 - ▶ Test your disaster recovery!
 - ▶ Test your disaster recovery!
 - ▶
- Products exist for recovering and correcting broken catalog entries
 - ▶ ICFRU – integral part of the z/OS 1.7 product
 - ▶ Mainstar Catalog Recovery Plus

Disaster recovery should be tested

Best practices for catalogs

- Catalog Statistics command added in z/OS 1.7
 - ▶ F CATALOG,REPORT,CATSTATS[(catalogname)]
 - ▶ F CATALOG,RESET,CATSTATS[(catalogname)]
 - ▶ Displays information about I/O activity, BUFNI, BUFND, and STRNO for each catalog
 - ▶ DOC APAR OA15323 describes these new commands

```
*CAS*****
*   ADDS  UPDATES   GETS  GETUPD  DELETES  BUFNI  BUFND  STRNO *
*
* SYS1.ICFCAT.VNETWRK
*     0     0       1     0       0       1     2     2 *
* PPPACK.USERCAT
*     0     0      12     0       0       1     2     2 *
* SYS1.MVSRES.MASTCAT
*     7     6  2,439     6       0       5     5     3 *
*CAS*****
```

Catalog Statistics command

Best practices for catalog

- Do not vary a volume offline on one system and reinitialize it or restore it
 - ▶ The other systems do NOT KNOW this has happened
 - ▶ Vary the volume offline on ALL systems
 - ▶ You must unallocate all volumes on that catalog
- Do not delete an alias for a Catalog from the Master Catalog while jobs are running
 - ▶ Extends of data sets will fail and the DSCB and Catalog entries will not match
- Do not delete the '.CATINDEX' component of a Catalog
- Do not IMPORT a catalog without the LOCK function

Things to avoid

Best practices for VSAM

- **INSTALL THE MAINTENANCE!**
 - ▶ Many customers are anywhere from 50-90 PTFs down-level
 - ▶ Failure to install fixes can result in broken VSAM data sets
 - ▶ Only installing HIPER maintenance is ***not good enough***
- **EXAMINE in z/OS 1.6**
 - ▶ Provides information on key compression and recommends the appropriate index CISIZE
 - ▶ Provides information on how many CIs are lost for the data set if the index CIs size is not large enough
 - ▶ Consult APAR OA11334 for more information

Must Dos

Best practices for VSAM

- Definition of VSAM data sets
 - ▶ Many types of data sets, so it's difficult to give specific parameters
 - ▶ For Key-sequenced data sets (KSDS) always specify an explicit allocation for the index, *including a secondary*
 - ▶ LSR usage will generally give better performance for direct processing
 - IMS, CICS, SMB
 - ▶ The CISIZE you choose may not match the sizes supported by some application programs
 - IMS and CICS support .5K, 1K, 2K, and 4K increments
 - If you think you need a 1536 CISIZE, choose 2K for these programs

VSAM Dataset definition

Best practices for VSAM

- Enable the Index Trap!
 - ▶ V SMS,MONDS(IGWVSAM.BASE.INDEX.TRAP),ON
 - For normal VSAM
 - ▶ V SMS,MONDS(IGWVSAM.INDEX.TRAP),ON
 - For VSAM RLS
 - ▶ The index trap will prevent a broken index
 - Message IRM123E is issued for a VSAM hit
 - Message IRM124E is issued for a Catalog hit
 - Message IGW400I is issued for RLS and an ABEND0F4 is issued
 - ▶ APARs OA03570 (Base VSAM) and OW55096 (VSAM RLS) are required to be installed

Best practices for VSAM

- **When NOT to reorg VSAM Data Sets**
 - ▶ As mentioned earlier do NOT reorg simply because the CI/CA splits go up
 - The splits insert more room for similar keys that may be inserted
- **When you DO need to reorg a VSAM data set**
 - ▶ To remove IMBED/REPLICATE
 - OA10952 must be installed on IDCAMS
 - ▶ To reclaim lost CA's because of increasing keys that have been deleted
 - If the keys are all processed and deleted, the CA that contained them will NOT be reused
 - This will cause CAs to be "lost" to the VSAM data set
 - Changing organization of key can remove this problem
 - EXAMINE can tell you how much lost space is in the data set
 - ▶ To reduce extents
 - Beginning in z/OS 1.7, extent consolidation and > 255 extents allowed

Re-org VSAM dataset

Best practices for VSAM

- Improving performance
 - ▶ Do not use small secondary amounts for KSDS or VRRDS
 - Extending is not a quick function
 - ▶ Use EXAMINE (z/OS 1.6) to determine the best index csize
 - Reduces # of levels of index, and number of sequence set records
 - ▶ For sequential processing, larger CI sizes are better
 - ▶ For direct processing, smaller CI sizes are better
 - ▶ Striping allows direct processing to be spread across several volumes, and helps improve sequential processing
 - ▶ Increase STRNO, BUFNI, BUFND until you see no increase in performance
 - Or, use SMB (System-Managed Buffering)
 - VSAM Demystified has formulas for figuring out these values depending on what type of activity you are doing

Performance improvements

Best practices for VSAM

- **Prevention of errors**
 - ▶ Install maintenance!
 - ▶ Backup data sets, preceded by EXAMINE to verify contents
 - EXPORT/IMPORT will reorganize data sets when imported
 - ▶ **Space constraint relief**
 - SMS option allowing best-fit or reduction of space requested
 - If multiple volumes are specified, Best-fit allows those volumes to be allocated to satisfy the space
 - For a single volume, Space reduction allows the allocation to succeed using smaller space than originally requested
 - Both options remove the 5-extent limit
 - ▶ **Attempt to close or quiesce the data set**
 - ABENDs or system failure may break the data set
 - Run VERIFY and EXAMINE when these cases occur

Best practices for VSAM

- SMS-managed VSAM data sets support:
 - Space Constraint Relief/Best-fit
 - Extent Consolidation
- Extended-Format
 - ▶ Data set must be SMS-managed
 - ▶ Allows the use of:
 - Compression (for KSDS)
 - Data sets greater than 4GB (Extended Addressability)
 - EA ESDS cannot have any AIXes defined over it
 - Partial Release (except for RRDS/LDS)
 - System-Managed Buffering
 - Striped data sets

VSAM datasets

Additional information

- Catalog:
 - ▶ z/OS DFSMS Managing Catalogs (SC26-7409)
 - ▶ z/OS DFSMS Access Method Services for Catalogs (SC26-7394)
- VSAM
 - ▶ VSAM Demystified (SG24-6105)
 - ▶ z/OS DFSMS Using Data Sets (SC26-7410)
- To search for Non-Defect Oriented Problems for both VSAM and Catalog:
<http://www.ibm.com/support/search.wss?rs=538&tc=SWJ30&dc=DB520+D800+D900+DA900+DA800+DA460+DB300+DB540+DB400&dtm>

To get to Support for DFSMS to search for Non-Defect Oriented Problems for both VSAM and Catalog, click on the link shown here.

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