Making Storage Administration Easier
Session ID: BC121s1

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Session Agenda

- Disk Backup & Restore
  - Overview
  - How Disk works
  - Useful tasks
- Allocate DASD Space and Placement
  - Overview
  - How Allocate works
  - Useful tasks

Storage administration challenges

- Storage administrators have a lot of tasks to do
  - Managing backups, recovery, security, etc…
- Teams are getting smaller and workloads are increasing
- Knowledge gaps are increasing
  - Midcareer professionals are difficult to find
  - Often responsibilities fall to someone without deep product knowledge

Managing backups and recovery

- Backups of important resources like data sets and volumes
- Determine the frequency and types of backups
- Maintain the backups and expiration of data
- Ensure security and access control to backups
- Determine the recovery procedures
- These various tasks can be improved by using Disk Backup & Restore
  - Similar products are IBM's DFSMShsm and BMC FDR

DISK BACKUP AND RESTORE

Disk overview

- Disk is a storage management product for your enterprise environment
  - Provides a complete solution for making backups, restoring backups, and recovering data as well as management of your data sets and volumes
- Disk address spaces and tasks
  - Disk is primarily used by batch jobs
    - Batch utilities used to create backups, restoring backups, and recovering data
    - Schedule functions to run when needed
  - Different from DFSMShsm which is always running
- Disk can be invoked to recall migrated data sets
  - Creates a started task called DMSAR
    - Processes automatic restores and then terminates

Disk overview (continued)

- Disk user interfaces
  - Products such as Vantage Storage Point can interface with Disk
  - Disk provides ISPF panels to enable users to create the batch jobs to perform storage management tasks
  - Users can generate their own JCL to perform storage management tasks
- Integration with other Broadcom Storage products
  - CA 1 Flexible Storage works with Disk for management of tapes
  - CA 1 Flexible Storage also include VTape function
  - Vantage Storage Point objects for accessing Disk
  - For most customers, all storage products available under existing license

Broadcom Storage Solution Components

Vantage StoragePoint™

-- Point and Click GUI for all storage management --
--- Storage agnostic reporting, Automation, Monitoring and Management ---

Security

- **Access Controls** (ACF2, Top Secret, IBM RACF, AAM, Cleanup)
- **Trusted Access Manager for Z**
- **Compliance Event Manager**
- **CA 1™ Flexible Storage™**

Disk Backup and Restore

-- Full System Backups / Image Copies --
--- Supports Incremental and USS file-level Backups ---

CA 1™ Flexible Storage™

-- Storage backup, archive management --
--- Compression, Encryption, Zero Trust Security and immutable backups ---

Allocate DASD Space and Placement

-- Storage space and allocation automation --

Storage

Disk FILES overview

- Disk manages your storage management environment using a repository
  - Repository is called the FILES which can be either a data set or a database
  - FILES contains a logical collection of sub-files (tables if a database is used)
  - Sub-files contains the various storage management artifacts
    - Backups, recoveries, runtime parameters, etc.

FILES definition as database or data set

- Each FILES can be defined as either a data set (FDS) or database (FDB)
  - FDB is a Datacom database
    - Database data sets can be defined with different formats including encrypted
    - Unix functions require FDB
    - Easier recovery processes
  - FDS data set is a simple file managed with BDAM by Disk
    - Optional logging allows for recovery
- Multiple FILES can be used
  - Can be mixed FDS and/or FDB
- Disk functions specify the FILES to use in JCL
  - Supports different FILES based on DD statements
  - Installation process sets variables that are insert into Disk JCL

FILES – Subfiles

- FILES is subdivided into SUBFILES (tables in an FDB)
  - DSNINDEX – One entry for each Backup or Archive copy
  - ARCHVOLS – One entry for each ARCHVOL (Tape or Disk)
  - UNXINDEX – One entry for each Unix file Backup or Archive
  - UNXPATHS – One entry for each Unix file path Backup or Archive copy
  - ARCHCMDS – Queued Archive Requests
  - RESTCMDS – Queued Restore Requests
  - DMSPARMS – Control concurrent TSO Dynamic Restores
  - DMSPOOLS – Status of tape pools
  - MIGRECAT – File entry for Sequential Migrate to Tape
  - RACFENCD – RACF discrete Profile
  - RETEXCLD – Archive Exclusion entry
  - DASDSPCB – Billing data for disk space consumption

DSNINDEX subfile record

- Each DSNINDEX record represents data set or volume
- DSNINDEX added during a backup or archive
- DSNINDEX record deleted during a purge or expire
- Used by Disk to know what / where was backed up / archived
  - DSNINDEX connects to ARCHVOL record via a unique key value
- Multiple DSNINDEX records for different backed up / archive of same resource

DSNINDEX subfile continued…

- Records can be shown with a LISTD command

```
2025.274  OCT 01, 2025                        D A T A   S E T   N A M E   I N D E X                                    PAGE    1
WEDNESDAY 11.21 AM                                                                                                  CA DISK r14.0

                          SOURCE DEV  DS ALLOCATION DIRECTORY    WRITTEN             ARCHIV  FIRST    BLOCK   K/M/G/T FLAGS
DATA SET NAME             VOLUME TYPE ORG TYPE  QTY BLKS MBRS  TIME   DATE   EXPDATE   KEY    BLOCK    COUNT    BYTES  1 2 3 4 6
------------------------- ------ ---- --- --- ----- ---- ----- ------------ -------- ------ -------- -------- ------- ----------
CLAYTON.UNITTEST.LARGE    WORK13 3390 PSE TRK 45013    0     0 1319 2025.262 2025.266 G25041        1    38495   1.17G 1200E80000
CLAYTON.UNITTEST.LARGE2   WORK17 3390 PSE TRK 45296    0     0 1311 2025.262 2025.266 G25213        1        2  46.92K 1200E80000
CLAYTON.UNITTEST.EMPTYPDS WORK02 3390 PO  TRK     1   10     0 1129 2025.245 2025.249 ¢99998        1        1   6.23K 0800880008
CLAYTON.UNITTEST.EMPTYPS  WORK02 3390 PS  TRK     1    0     0 1222 2025.245 2025.249 ¢99994        2        1   5.85K 0800880008
CLAYTON.UNITTEST.FILES    WORK02 3390 DA  CYL    10    0     0 1128 2025.245 2025.249 ¢99999        3      301   8.02M 0800880000
CLAYTON.UNITTEST.JCL      WORK51 3390 PO  CYL     5   30     4 1128 2025.245 1999.365 ¢99999      304        1  25.06K 0800880000
```

ARCHVOLS subfile record

- Each ARCHVOLS record represents the back up or archive
  - Beware that terminology can be confusing
  - ARCHVOL is used for the record in the FILES and the archived media
- One ARCHVOL may be referenced by many data sets
  - Multiple DSNINDEX records would contain the same archive key
- ARCHVOL record added during a backup or archive or merge processing
- ARCHVOL record is deleted during a purge or expire
- Used by Disk to know find the back up / archive data

ARCHVOLS subfile continued…

- Records can be shown with a LISTV command

```
2025.274  OCT 01, 2025                          A R C H I V E   V O L U M E S                                    PAGE    3
WEDNESDAY 11.21 AM                                                                                          CA DISK r14.0

ARCHIV                                 WRITTEN              DATA      BLOCK   K/M/G/T VOL FLAGS     COPY   TRUE  SEQ  DEVICE   KEY
 KEY   DATA SET NAME                 TIME   DATE   EXPDATE  SETS      COUNT    BYTES  CNT 1 2 3 5   KEY    VOL   NO  TYP UNIT CHAIN
------ --------------------------- ------------ -------- ------- --------- ------- --- -------- ------ ------ --- -------- ------
Q99994 TEST.QATEST.ARC0.DMSC.       1222 2025.245 1999.000       3       303   8.03M   1 00030000        DASD89   1 3390DISK
           D2025245.T122219
Q11999 TEST.QATEST.ARC0.DMSC.       1412 2025.267 1999.000       2     40853   1.25G   1 008B0000        Q11999   1 3590DYN1
           S2025267.T141252                                                                                       DLMVSIZ1
Q13172 TEST.QATEST.ARC0.DMSC.       1708 2025.267 1999.000       3    205893   6.28G   1 008B0000        Q13172   1 3590DYN1
           S2025267.T170855                                                                                       DLMVSIZ1
Q11999 TEST.QATEST.ARC0.DMSC.       1412 2025.267 1999.000       2     40853   1.25G   1 008B0000        Q11999   1 3590DYN1
           S2025267.T141252                                                                                       DLMVSIZ1
```

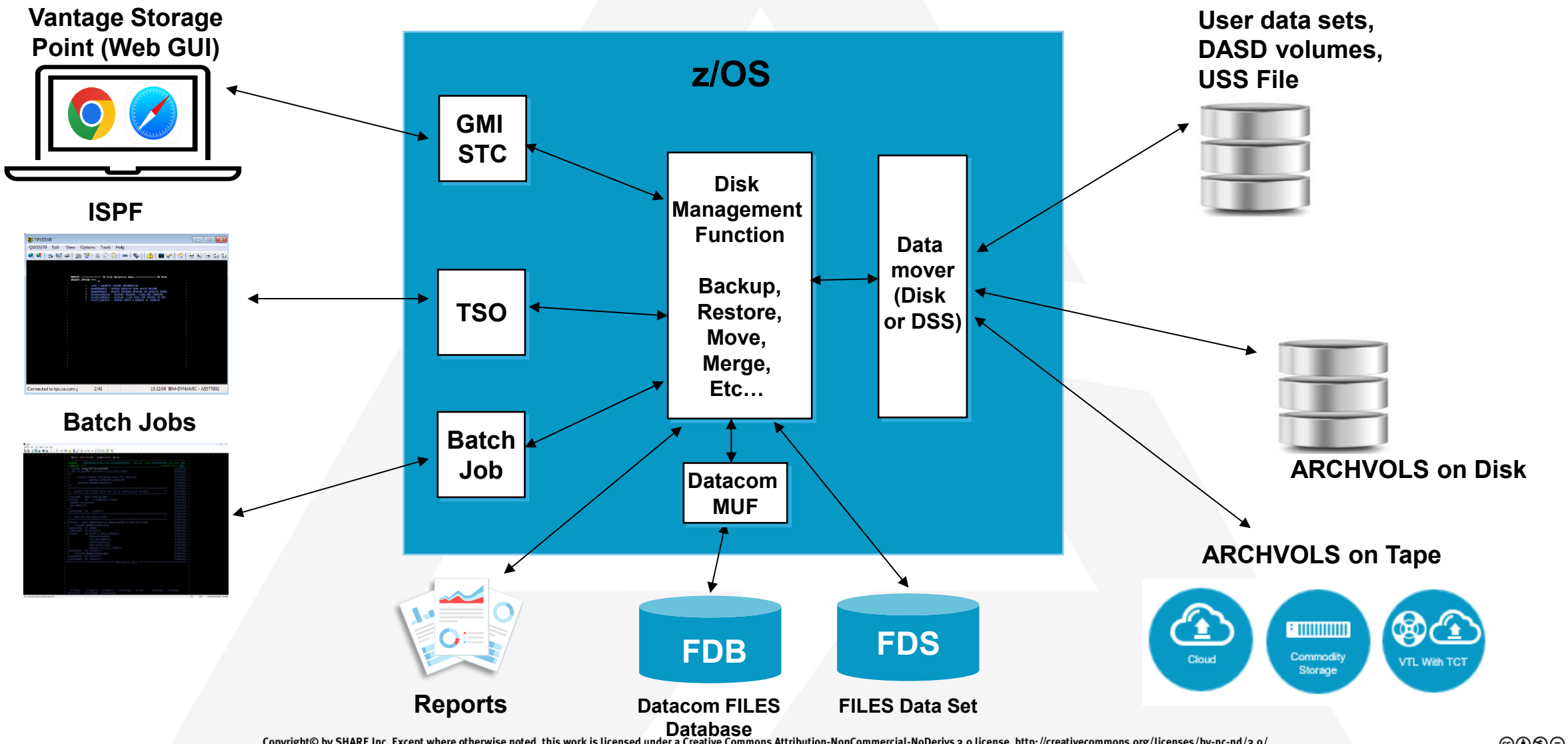
ARCHVOL archived media (Tape or DASD)

- Data sets with data for all the data sets or volumes archived / backed up
- Internally Disk includes metadata on the data
  - Provides alternative recovery option if FILES was lost or corrupted
  - Utilities can rebuild the records in the FILES from the archived media
- Archived media can be DASD, tape, etc…
  - Tape is the recommended media type
- Disk perform dynamic allocation of the ARCHVOLS to create these data sets
  - Single ARCHVOLS or duplex ARCHVOLS can be created
  - SYSPARMS can be used to customize how they are created dynamically
    - Data set name, catalog status, output type, etc…

Disk primary functions

- Run as a batch job
  - Backup / Archive
  - Restore / Recover
  - Merge
  - Delete / Expire
  - Move / Copy
  - Idle space release and other data set utilities
  - FILES management utilities
- Run as started task
  - Automatic restore of archived / migrated data sets

Disk Backup & Restore Environment



HOW DISK WORKS

Disk Backup and Restore

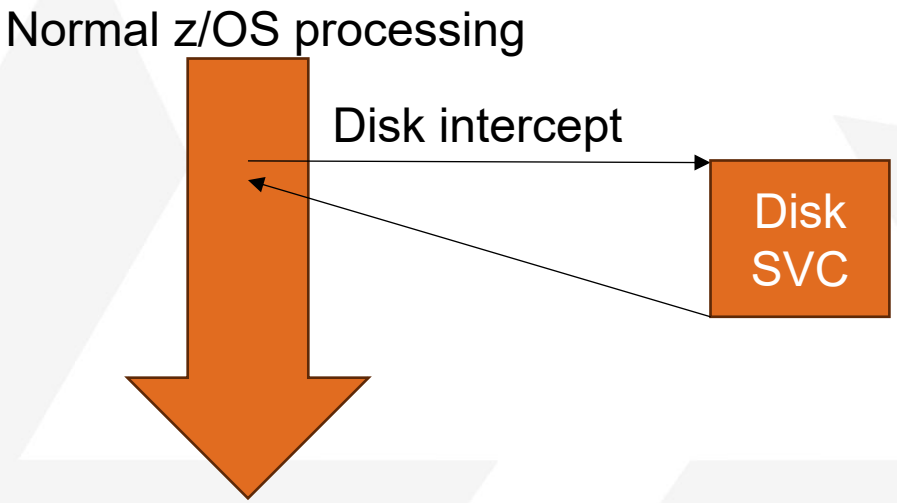
- Disk assumes System Storage Administrators are aware of low-level storage implementation details
  - Disk frequently mentions z/OS control blocks and internals
- Most z/OS storage concepts are high level and unchanged from decades ago
  - Software emulates older physical devices
  - Most commonly you'll hear about DASD / 3390 and volumes or packs
  - Storage allocated in cylinders and tracks from original concepts
  - Data sets contain labels dating back to physical labels
  - Data set information can be kept in catalogs to quickly reference

Volume Table of Contents (VTOC) & Catalog

- Data set are defined within a volume using a table of contents
  - VTOC contains all the information about the data sets defined on the volume
  - IBM provides APIs to mappings for data sets related control blocks
  - Primary control block that will be read is called the data set control block (DSCB)
    - Different types contain data set / volume attributes
- Catalog has 2 types (Master Catalog and User Catalog)
  - Master catalog is often made up of other user catalogs
  - User catalogs can map anything but would commonly be used per volume
  - IBM utilities and APIs exist for reading and managing catalogs
- Disk is primarily a VTOC reader and a catalog scanner
  - VTOC is read to access Data Set Control Blocks
  - Catalogs read with IBM interfaces such as the catalog search interface (CSI)

How Disk intercepts z/OS operations

- Intercepts are added to the z/OS operating system
  - Commonly called the Disk ZAPs
- Intercepts invoke the Disk SVC
  - Disk SVC can be tailored for your environment / operations



Disk SVCs

- SVC can change how the format 1 DSCB is updated
  - Bypass updates that would occur when Disk runs
  - Override default z/OS behavior to know when data sets were open for update
- Provides additional information for the data set utilization (DSU) report
- Disk customization supports adding exceptions to updating the format 1 DSCB
  - Exceptions for certain programs
  - Exceptions for certain data set names
  - Exceptions for certain jobs (default) or accounting codes
  - Exceptions for certain volumes

COMMON TASKS WHEN USING DISK

Backup & Archive Overview

- Backup processing is usually related to the recovery process
  - Archiving used to reduce DASD space
- Varies based on business needs for that data set
  - Determine frequency of backups
  - Determine when to backup
  - Determine priority of backup / recovery
    - Impact of the outage during recovery
  - Determine who is responsible for backup / recovery
  - Logical relationships between data sets needed for backup / recovery
    - Application logic might intersect between different data at different points in time

Backup & Archive Overview

- Uses DSCL with DMS PROC for comprehensive criteria to pinpoint selection
  - Scan VTOCs, and/or FIND commands
- Support for various data set configurations and definitions
  - Honor or bypass SMS Management Classes
  - Single volume and multi-volume data sets
- Different types of backup functions supported by Disk
  - Incremental, Full Volume, Periodic
  - Fast backup / archive can bypass data sets which were not updated
    - Simply updates Disk subfiles to contain new dates

Restore Overview

- Disk provides several methods for restoring data sets:
  - Explicit / immediate restore
  - Automatic (DMSAR) restore
  - Deferred restore
- Disk performs the restore by finding the DSNINDEX in the FILES
  - When multiple data sets are restored the order is dependent on ARCHVOL sequence

Data set archive and automatic restore

- Data sets archived by Disk can remain cataloged but to a pseudo volume
- When data sets are used Disk intercepts can automatically restore the data set
- Function uses a started tasks for automatic restore called DMSAR
- Automatic restore with Vantage Storage Point can optimize performance
  - DMSAR started task begins when needed and can remain active
  - DMSAR can be called to restore a list of data sets

RECOVER overview

- Disk provides recovery options for data sets, volumes, and/or VTOCs
- Support for VSAM and non-VSAM
- Support for SMS and non-SMS managed data sets
- Options to rename data sets
- Recovery is performed with logical processing which allows the following
  - Volume Defragmentation
  - PDS‘s to be compressed
  - VSAM data sets to be reorganized
  - Extents to be consolidated
  - Automatic Rebuild for AIX

MERGE overview

- MERGE provides several functions for ARCHVOLs
- Combine partially used data set ARCHVOLs to remove expired data
- Normally ignores VBACKUP ARCHVOLs
- Expired entires are not moved to new ARCHVOLs
- Transition ARCHVOLS through migration layers (ML)
  - For example use merge to move from ML1 on DASD to ML2 on TAPE
- Create new copies with duplexing or triplexing
  - Primary (1st), Copy (2nd) and Tertiary (3rd) ARCHVOL

IXMAINT Overview

- Management of the FILES mostly involves the management of the DSNINDEX
- Function for management of these records is called “Index Maintenance” with the IXMAINT utility
- Disk provides 2 main commands with the IXMAINT utility
  - DSNDELETE command
    - Delete expired DSNINDEX entries
    - Should be regularly scheduled to keep FILES well maintained
  - PURGE command
    - Delete data sets regardless of their expiration dates
    - Delete unexpired data sets even if they are SMS-managed
    - Delete all DSNINDEX records pertaining to a volume

Disk ISPF panels

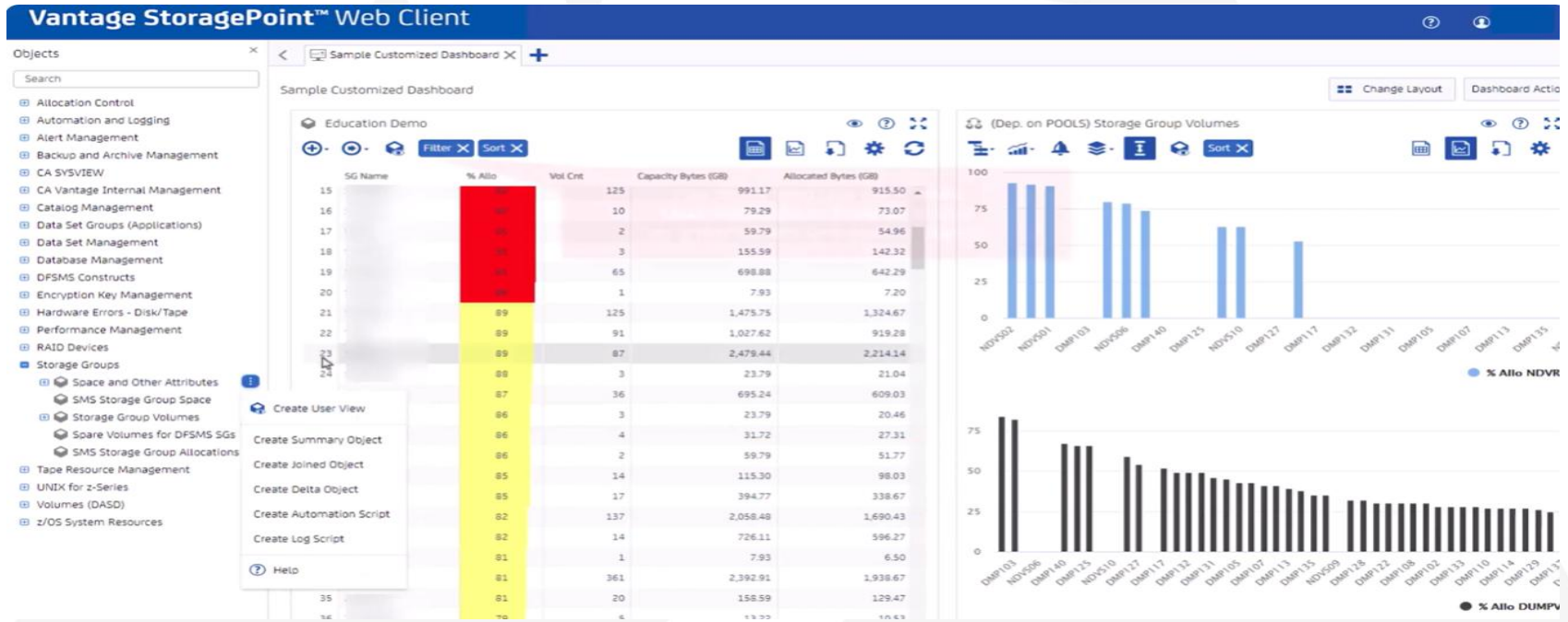
- Traditional ISPF panels for accessing Disk information
- Customizable panels to allow Storage Administrators additional options
- Access to information directly from the FILES without needing to create JCL
- Requires additional customization

```
DMS023 --------- CA Disk Condensed Selection Menu --------- CA Disk
SELECT OPTION ===>

              1 REPORTING FUNCTIONS
              2 LIST FUNCTIONS (QUEUED ARCHIVE/RESTORE REQUESTS, INDEX ENTRIES
              3 ARCHIVE, BACKUP, AND RESTORE FUNCTIONS
              4 RELEASE, COMPRESS, AND MIGRATE FUNCTIONS
              5 ARCHIVE MANAGEMENT AND MISCELLANEOUS FUNCTIONS
              6 DSCL FUNCTIONS
```

Disk and Vantage Storage Point

- Disk works with Vantage Storage Point for automatic restore function
  - Provides additional functions as mentioned
- Web interface to accessing storage information and Disk information
  - Objects can extract information from Disk



QUESTIONS ON DISK?

ALLOCATE DASD SPACE AND PLACEMENT

Storage administration space management

- Managing storage usage and free space
- Data sets, catalogs, volumes
- Managing SMS classes
- ACS routines
- These tasks can be improved by using Allocate DASD Space and Placement

Allocate overview

- Allocate DASD Space and Placement provides a centralized point of control for all data set allocations on your z/OS system
- Allocation Selection Routines (ASRs) provide High Level Language control of allocations
- Access to over 280 variables gives a view of Allocation, Disk Space, and SMS attributes in 13 phases of a data set lifecycle
- Enforcement of standards is simplified
- Legacy allocations can be overridden without altering production JCL
- Disaster Recovery adjustments can be made from a central point

Key Features

Controls Data Set Creation, Extend, and Delete

- Can change almost any parameter except data set name
  - Redirect to new volume, DASD pool, or Storage Group
  - Fix problems with the allocation
- Eliminate allocation errors by preventing ‘space not available’ situations
  - Find volumes with more space
  - Reduce request until they fit
- Add volumes to a data set (STOPx37 replacement)
  - Extend the request to new volumes
- Prevent IEF377I NOT CATLGD 2 situations
  - Delete, rename, or uncatalog the existing catalog entry

HOW ALLOCATE WORKS

How does it work?

- Allocate intercepts system related data set actions
- Uses information created by Storage Administrator such as:
  - Volume pool tables
  - Allocation Selection Routine (ASR)
    - CLIST like language
    - ASR contains environments invoked during different phases of a data set
    - ASRs test values and determine actions & controls

Start-up Processing

- Reads system parameters from VKGPARMS member
- Compiles the Allocation Selection Routine (ASR)
- Reads and validates the Storage Group Definitions
- If all the above are valid then setup intercepts and exit points in z/OS
  - Similar concept to Disk
  - z/OS exits and intercepts to key z/OS activities

ASR Environments

- Rules in each environment for each phase of a data set life-cycle
  - ACS SMS Allocation
  - ALLOC Non-VSAM allocation (batch or SVC 99)
  - DEFINE VSAM allocation
  - EOV Out of space/Add volume for non-VSAM
  - EOV_VSAM Out of space/Add volume for VSAM
  - EXTEND Control of Secondary Extents
  - OLD Already existing data set
  - SPACE Prevent 'NOT CATLG 2‘s logic and DADSM Space Acquisition
  - PREALLOC Prevent 'Not CATLG 2’s for Disk ARCIVE or HSM MIGRAT
  - RELEASE Idle Space Release
  - RENAME Dataset Rename
  - SCRATCH Dataset Scratch

Volume Selection Logic

- Set &STORGRP to one or more names
- Available volumes are based on &UNIT
- System Resource Manager (SRM) selects volume
- Security checked
- Volumes checked for sufficient space
- Free space threshold checked
  - Can be flagged as second choice volume

STOP NOT CATLOG 2 (SNC2) Option

- Environments used for SNC2 processes:
  - SPACE: Delete, Rename, Uncatalog
  - OLD: Uncatalog only
- Invoke SNC2 with these values : &STOP_NOT_CATLG2 or &SNC2

  N - Leaves the existing catalog entry unaltered

  R - Rename the existing data set

  D - Delete and uncatalog the existing data set

  U - Uncatalog the existing non-SMS-Managed data set
- ASR can check
  - Catalog status of data set being allocated
  - To see volser where data set is already cataloged

REDUCE TO FIT (RTF) or DOES IT FIT (DIF)

- Prevent Space Not Available (SNA) job failure
  - SMS and non-SMS
  - VSAM and non-VSAM
- Two variables can beu used ALLOC, DEFINE, EXTEND, EOV and EOV_VSAM
  - `&REDUCE_BY  or  &RB  [ SET &RB = nn ]  --  Value (01 – 99)`
  - `&MINIMUM_PERCENT  or  &MP  [ SET &MP = nn ]  --  Value (01 – 99)`
- &REDUCE_BY is performed automatically when a volume can not be found for the allocation or extent

COMMON USAGE OF ALLOCATE

START and MODIFY Command & Options…

- S VAM
  - The default action from VKGPARM PLSACTN is install
- RESIDENT=
  - Y - Task to keep running to wait for a future operator command (Recommended)
  - N - Task to terminate after it has completed processing the current command.
- If resident then MODIFY commands used otherwise START commands

START and MODIFY Command & Options…

- F vam,xxxxxx or S vam,PARM=('xxxxxx')
  - INSTALL - Rebuild the active system parameter table
  - REMOVE - Initiate a normal shutdown
  - PARMREF - Rebuild the active system parameter table
  - REFRESH - Update parameter files changed since VAM was installed
  - STATUS - Shows the status of the task and members installed

REFRESH Commands

- To refresh all active VAM members including VKGPARMS issue command:

  F VAM,PARMREF

- To refresh all active VAM members, except VKGPARMS, issue command:

  F VAM,REFRESH

- To change the active member for either the ASRs issue:

  F VAM,REFRESH,PROG=

- To change the active member for the Storage Groups issue

  F VAM,REFRESH,STORGP=

ASR example in ACS environment

```
IF &VAMENVIR = 'ACS' THEN
 DO
  IF &DSN = USERID.SMS.** THEN
   DO
     WRITE 'ACS SMS  &DSN'
     SET &SC = 'TSO'
     SET &DC = 'DEFAULT'
     SET &MC = 'TSO'
     SET &SG = 'TSOSG'
   END
  IF &DSN = USERID.SMS.DCAVG.** THEN
   DO
     SET &DC = 'DCAVG'
   END
  EXIT CODE(0)
 END
```

Syntax Check ASRs | TESTASRS

- During testing, the ASRs will be modified frequently.
- To avoid the possibility of an ASR compile failure during your testing, be sure to syntax-check your ASR member with the TESTASRS job in the CCTVJCL
  - Condition Codes from TESTASRS:
    - 0 -- ASRs compiled successfully
    - 1 -- ASRs compile failed
- If VAM successfully installed, but a later ASR refresh fails, VAM will continue to run with the previously successfully compiled ASR
- Messages in VAM task (SYSPRT DD) will indicate where and what problem exists

QUESTIONS ON ALLOCATE?

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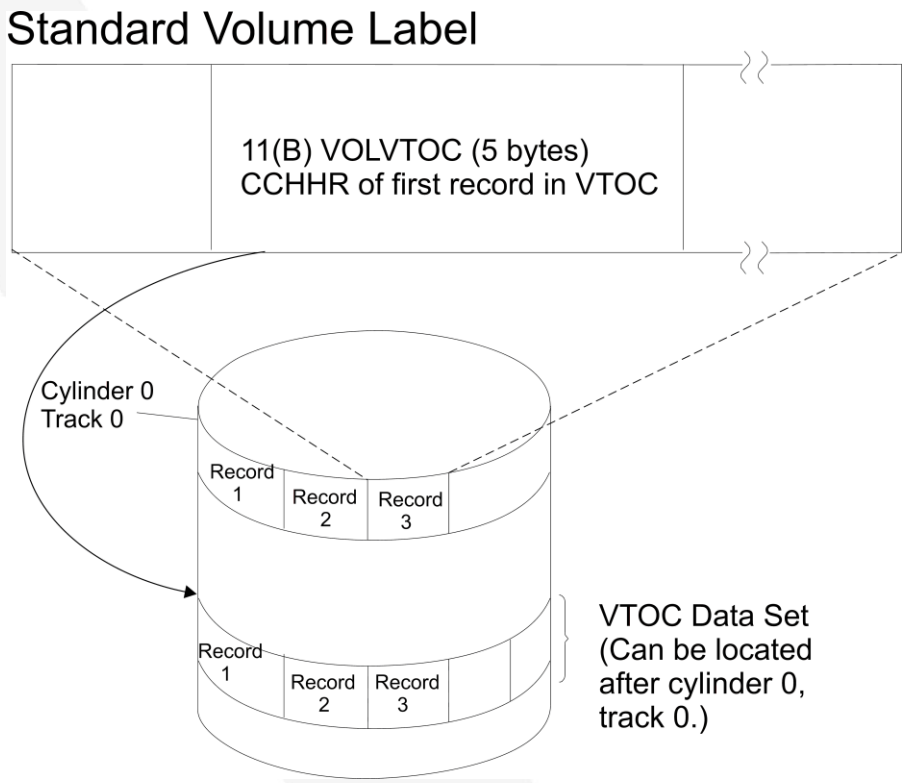
ADDITIONAL INFORMATION ON DISK

Volume Table of Contents (VTOC)

- Data set are defined within a volume using a table of contents
- VTOC contains all the information about the data sets defined on the volume
- It is possible to read the VTOC to find data set information
- IBM provides many APIs and record mappings for data sets and data set related control blocks
- Primary control block that will be read is called the data set control block or DSCB
  - Several different DSCBs exist to map different information about the space on the volume

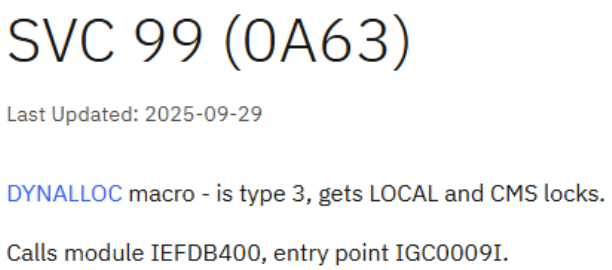


How Disk finds data sets

- Disk is primarily a VTOC reader and a catalog scanner
- VTOC is read to access Data Set Control Blocks
  - Format 0 – Free DSCB
  - Format 1 – Data Set Name, Attributes and Extents 1 thru 3
  - Format 8 – Same as Format 1 but for EAS eligible data sets
  - Format 2 – ISAM (obsolete)
  - Format 3 – Chained descriptor of extents beyond the 3 found in Format 1 / 8
  - Format 4 – DSCB for the VTOC
  - Format 5 – Free Space Descriptor
  - Format 6 – Shared Cylinder Allocation
  - Format 7 – Free Space Descriptor (3390-9 +)
  - Format 9 – Points to format 3 for data sets on EAV volumes (Format 8)

z/OS storage usage

- Internally many storage functions are performed using operating system supervisor calls (SVCs)
- IBM documents most of the SVCs some with more details than others
  - See IBM Diagnosis Reference – SVC Summary for a list of them
  - For example SVC 99 is used to allocate a data set



SVC 99 (0A63)

Last Updated: 2025-09-29

DYNALLOC macro - is type 3, gets LOCAL and CMS locks.

Calls module IEFDB400, entry point IGC0009I.

- Internally all of the functions in z/OS are invoked through different SVC calls
- Disk and other vendor products perform some of their tasks by hooking into IBM SVCs

ADSMVS60 – Disk SVC for non-VSAM

- Without the Disk SVC IBM code (SU60) would update the format 1 DSCB
- Disk SVC allows Disk data set management functions to bypass updating the format 1 DSCB
  - Allows Disk to more efficiently manage storage and know when data sets were open for update
- Provides additional information for the data set utilization (DSU) report
- Source code for Disk SVC is provided for customers that need to modify it
- Disk SVC is installed using the sample called USERMOD1
- Disk customization supports adding exceptions to updating the format 1 DSCB
  - Exceptions for certain programs
  - Exceptions for certain data set names
  - Exceptions for certain jobs (default) or accounting codes
  - Exceptions for certain volumes
- Customizable exceptions installed with sample called USERMODM

ADSMVS60 – Disk SVC format 1 fields

- Fields in the format 1 DSCB that can be updated
  - Field 1 – Last used date (IBM defined)
  - Field 2 – Last modified date (Disk defined field)
  - Field 3 – Job name or account code (Disk defined field)
  - Field 4 – Count of updates (Disk defined field)
  - Field 5 – Changed bit (IBM defined)
  - Field 6 – SVC mode (Disk defined field)
- For more details on the VTOC fields maintained by Disk SVC in tech docs
  - Installing -> Configure Your Product -> Customization Options -> The Disk SVC

VTOC Fields Maintained by the Disk SVC

The following fields are maintained in the F1-DSCB for each data set:

1

Last use date.
Format: ydd
Bytes: 3
Offset (DEC): 75

ADSMVS60 – Disk SVC modes

- Mode 4 – Minimum number of updates (default)
  - Determines when dates and changed bit are updated
    - Last used date updated at most once per day
  - Last modified date and changed bit updated when opened for updates (output)
    - Incremental backups can cause more than one update because they reset the bit
  - Open Count reflects how often the DSCB was opened for update
- Mode 5 – Operates like Mode 4 except Disk fields are not updated
  - IBM fields 1 and 5 are updated
  - Only Disk field 6 is used to know the SVC mode
  - Disk fields 2, 3 and 4 are not updated
  - Works like default IBM SU60 with the benefit of the Disk exception processing
- Mode 6 – Maximum number of updates to format 1 DSCB
  - Like Mode 4 but open count is updated for any open, not just for updates
  - Caution should be used for shared PDS which do not use cross-system enqueue packages because DSCB could be corrupted

IDATMSTP – Disk “SVC” for VSAM

- VSAM version of the Disk SVC ADSMVS60
- Commonly referred to as the VSAM date stamp or time stamp module
- Same functionality as Disk SVC but not an SVC
  - When installed Disk module replaces the IBM code
  - Bypasses updates for Disk management functions
- Disk VSAM timestamp update installed using the sample called USERMOD3
- Customizable exceptions installed with sample called USERMOD4

XCOPY overview

- Create a subset of daily backups to send offsite
  - Group application data or “mission critical” on a tape set
  - Reduce number of tapes and expense for offsite storage
  - Eliminates double backups that impact application window
- Subset is not full tape copy - only partial
  - Based on data set names and patterns
  - New tape sets can have different expiration dates
- Output can be to different type of media
- Input tapes and data sets not changed

ADDITIONAL INFORMATION ON ALLOCATE

REDUCE TO FIT (RTF)...

- When the value of SEC for non-VSAM has been adjusted by RTF or your ASR logic, the value of SEC must be reset to its original value, or else…
  - In EOV and EXTEND, the size of the first extent on the next volume will be the value that was last set by RTF or your ASRs, which could be a very small amount.
- In the EXTEND environment, add statements to reset SEC to its original value and to do RTF

Tape Support

- Enforce standards for tape allocations
- Can perform device conversions
  - TAPE to TAPE
  - Disk to TAPE
  - TAPE to DISK

ASR ALLOC example

```
IF &VAMENVIR = 'ALLOC' THEN
 DO
  IF &DSN = USERID.TEST.RTF1.** THEN
   DO
    SET &STORGRP = 'POOLREF1'
    SET &MINIMUM_PERCENT = 50
    SET &REDUCE_BY = 10
   END
  IF &DSN = USERID.TEST.RTF2.** THEN
   DO
    SET &STORGRP = 'POOLREF2'
    SET &MINIMUM_PERCENT = 25
    SET &REDUCE_BY = 10
   END
  EXIT CODE(0)
 END
```

ACS Environment

- For every SMS allocation request
- Allocate receives control after IBM ACS processing
  - ACS processing limited to setting 4 construct names
    - Management Class
    - Data Class
    - Storage Class
    - Storage Group
  - Can look at, set, or remove any of the SMS constructs
  - Can be a direct replacement for ACS routines
- SMS allocation can also be checked in ALLOC and DEFINE
  - Provides much more control than IBM's ACS

ALLOC Environment

- For every new non-SMS non-VSAM allocation
  - Batch or dynamic
  - VSAM allocated via SVC 99 (e.g., JCL VSAM defines)
- Not entered for direct DADSM requests (SVC32)
  - IEHMOVE and DSS
- Values of most Output variables can be changed
- Allocations seen in ALLOC are also seen in SPACE
  - If allocation was not denied in ALLOC
- JCL values can be allowed, modified or ignored
- Values not specified in JCL can be added

DEFINE Environment

- Entered for every new non-SMS VSAM Define request
  - DEFINE cluster, AIXs and GDG (SCR/NSCR only)
- Most output variables can be changed
- Data and Index components can have separate storage groups via variables
- Can remove unwanted VSAM parameters
- Exclude VVDS
- MODEL or UNIQUE parameters
  - Attempts to mount the volume in the VOLUMES parameter

ALLOC / DEFINE and SMS

- SMS allocations can be intercepted in ALLOC & DEFINE
- Adjust primary and secondary values
- Add Reduce To Fit (RTF) or Does It Fit (DIF) variables to prevent Space Not Available (SNA)

EOV Environment for non-VSAM

- Dynamically add volumes to avoid B37 or E37's
- Entered for non-SMS non-VSAM data sets when attempting to allocate another secondary extent and the extend fails because...
  - Current volume can not hold another extent, or...
  - Data set has maxed out extents, and...
  - No more candidate volumes are available
- EOV entered only if a secondary space quantity was coded...
  - EOV will not prevent D37 abends if no secondary was specified
  - Change Sec. quantity to GT 0 in ALLOC

EOV Environment for non-VSAM

- Assign volume from any STORGRP or simply ASR variable &POOLSUB = 'Y’
- Volume will be selected that:
  - Is not currently allocated to the data set
  - Is of the same device type
  - Has sufficient space to hold allocation amount
  - Maintains free-space threshold requirements
- Allocate will not process the following in EOV:
  - VIO data sets
  - PO and PDSE data sets
  - Data sets that have more than one open DCB
  - Data sets that have either an ABEND or EOV exit coded in the DCB parameter list

EOV_VSAM Environment

- Dynamically add a Volume to a VSAM data set to continue writing to data set
- Entered for non-SMS VSAM data sets when...
  - Current volume can not hold another extent, or...
  - Data set has used all available extents, and…
  - No more Candidate volumes are available
- The primary quantity is used for the first extent on new volume

EOV & EOV_VSAM for SMS

- Allocate prepares an SMS allocation to receive another volume
  - It will appear to SMS that the candidate volume was present when the original allocation occurred

EXTEND Environment for non-VSAM

- Entered for SMS or non-SMS non-VSAM data sets
- Generally used to increase size of the secondary quantity
- Invoked when taking a secondary extent on current volume
- A secondary quantity must have been in JCL (or added in ALLOC) to enter environment
- Restrictions:
  - If request is rejected in the ASR then the job will abend with E37-0C

EXTEND Environment for VSAM

- Entered for SMS or non-SMS VSAM data sets when allocating a secondary quantity on existing volume
- Some restrictions exist for these data sets:
  - VSAM clusters defined to IMS
  - KSDS clusters defined with KEYRANGE
  - VSAM clusters associated with SNAPSHOT copies and ZFS UNIX File Systems
  - VSAM allocations made by IBM's Media Manger Services

OLD Environment

- Entered for non-SMS non-VSAM data sets
  - Helps correct JCL errors
  - JCL UNIT value conflicts with catalog info for existing cataloged data sets
- Available for disk and tape data sets
- Data sets automatically bypassed:
  - SMS-Managed
  - Non SMS-Managed with no UNIT value
  - VSAM
  - Archived or migrated data sets
- Variable can indicate conflict between JCL and catalog
- Variable contains valid unit to prevent JCL error

PREALLOC Environment

- Entered for SMS or non-SMS non-VSAM permanent data sets
- Eliminate NOT CATLG 2's when catalog points to pseudo volume
  - Supports both Disk and DFSMShsm
  - Exceptions for GDS's
- Options available
  - Can delete catalog entry without triggering automatic restore
  - Can test to see if cataloged to pseudo-vol
  - Can remove catalog entry

RELEASE Environment

- Entered for SMS or non-SMS non-VSAM data sets to release unused space
  - Entered via Batch or TSO
- Generally used to deny space release operation
  - Use WRITE to notify “offender”

```
IF &VAMENVIR = 'RELEASE' THEN
  DO
    IF &HLQ = SYS% THEN                    /* IF SYSTEM DATA SET        */
      DO
        WRITE 'YOU MAY NOT RELEASE SPACE FROM A SYSTEM DATA SET'
        EXIT CODE(8)                       /* THEN DISALLOW THE RELEASE */
      END
  END
```

RENAME Environment

- Entered for SMS or non-SMS non-VSAM data sets when attempting to perform a rename
- Generally used to deny rename operation
- Enforces standards
  - Prevent renaming test data sets to production names

```
IF &VAMENVIR = 'RENAME' THEN
  DO
    IF &HLQ = SYS% THEN                    /* IF SYSTEM DATA SET       */
      DO
        WRITE 'YOU MAY NOT RENAME A SYSTEM DATA SET'
        EXIT CODE(8)                       /* THEN DISALLOW THE RENAME */
      END
  END
```

SCRATCH Environment

- Entered for SMS or non-SMS non-VSAM data sets when attempting to perform a deletion
- *Generally used to deny scratch operation*
- WRITE statement recommended

```
IF &VAMENVIR = 'SCRATCH' THEN
  DO
    IF &HLQ = SYS% THEN                    /* IF SYSTEM DATA SET        */
      DO
        WRITE 'YOU MAY NOT SCRATCH A SYSTEM DATA SET'
        EXIT CODE(8)                       /* THEN DISALLOW THE SCRATCH */
      END
  END
```

SPACE Environment

- Entered for every new non-SMS non-VSAM allocation when obtaining space for allocation
- ASR's in space can maintain control of utilities that bypass normal allocation
  - For example DSS
- Limited number of Output variables
- Insure "proper" placement of data sets
- Can be used to prevent "NOT CATLG 2" problems

SPACE – NOT CATLG 2

- For Rename process, specify value for LLQ
  - &STOP_NOT_CATLG2_NODE or &SNC2N
  - Example: SET &SNC2N = 'NOTCAT‘
  - For &SNC2N to be activated, &SNC2RC must be specified after &SNC2N
  - Default value: 'SNC2'
- Check Return Code: &STOP_NOT_CATLG2_RC or &SNC2RC
  - Contains the return code of the function performed to correct the SNC2
  - If ‘0’, the function was successful
  - All Return Codes documented in User Guide under this variable
  - Note: This variable can be specified only once in ASR group

Diagnostics

- When a job abends, the most useful tool for L1 & L2 is DIAGS
- Check/Specify these Sysparms settings
  - PLSOPT98 (Y) -- Messages only be issued to the JESYSMSG DD
  - PLSOPT99 (Y) -- Provides more extensive diagnostics
- F VAM,DIAGS=jobname
  - Run your job and DIAGS will be written to the joblog
  - F VAM,DIAGS=<blank> to disable the diagnostics

Diagnostics - Special DD Names

- EOV and EOV_VSAM diagnostics
  - //V37DIAGS DD DUMMY
- UCB related information
  - //UCBDIAGS DD DUMMY
- Quota High and Low Watermarks details
  - //QWMDIAGS DD DUMMY
- OLD environment diagnostics, why it was or was not bypassed
  - //TRACEOLD DD DUMMY
- Unit conversion diagnostics (tape to disk, disk to tape, tape to tape)
  - //DMPBYTES DD DUMMY
- Details of every volume in storage group in LSPACE processing
  - //SPACETRC DD DUMMY
- Output from SVC traces directed to this DD
  - //SVCTRACE DD SYSOUT=*