Managing HSM so that HSM doesn't manage you!

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Agenda Topics

- Introduction
- HSM Status
- Control data sets and journal
- Information sources
- Return Codes and reporting
- Common causes for migration and backup failures
- Thrashing
- Storage Group thresholds
- Message automation
- Reorganizing Control Data Sets
- HSM Audits
- Monitoring

Session Abstract

- In the normal data center, DFSMShsm is an integral part of the overall production process. Do you know what is really happening in your HSM environment? Do you know what problems are lurking? We will provide suggestions on some of the error conditions that you can report on and monitor, using the DFSMS Report Generator and the latest tools to assist you.
- We will demonstrate how to use monitoring to do work for you and notify you right away before problems occur. At the end of this session, the attendee will have a better understanding of the typical daily activities of a storage administrator.

Check status of HSMs

- Make sure that the HSM started tasks are running as expected
  - No held functions
  - All functions held could indicate CDS backup failure!

DFSMShsm Functions Summary

Function	Function Status	Dataset Requests	Volume Requests	Active Requests	Waiting Requests
Migration	**Held**	0	0	0	0
Recall	Not Held	0	0	0	0
Backup	Not Held	0	0	0	0
Recovery	**Held**	0	0	0	0
Dump	Not Held	0	0	0	0
Delete	Not Held	0	0	0	0

Control Data Set Occupancy

- Automate action for Control data set backup failures
  - ARC0744E message
    - Highlighted message
- Monitor for ARC0026E (Journaling disabled)
  - Most functions will be held
- Monitor for ARC0909E message (CDS/Journal percent full)
  - Thresholds set by SETSYS MONITOR
  - Different thresholds can be set for different control entities
- If Journal fills up, processing will stop until journal is cleared
  - BACKVOL CDS
  - Recalls should still continue to process

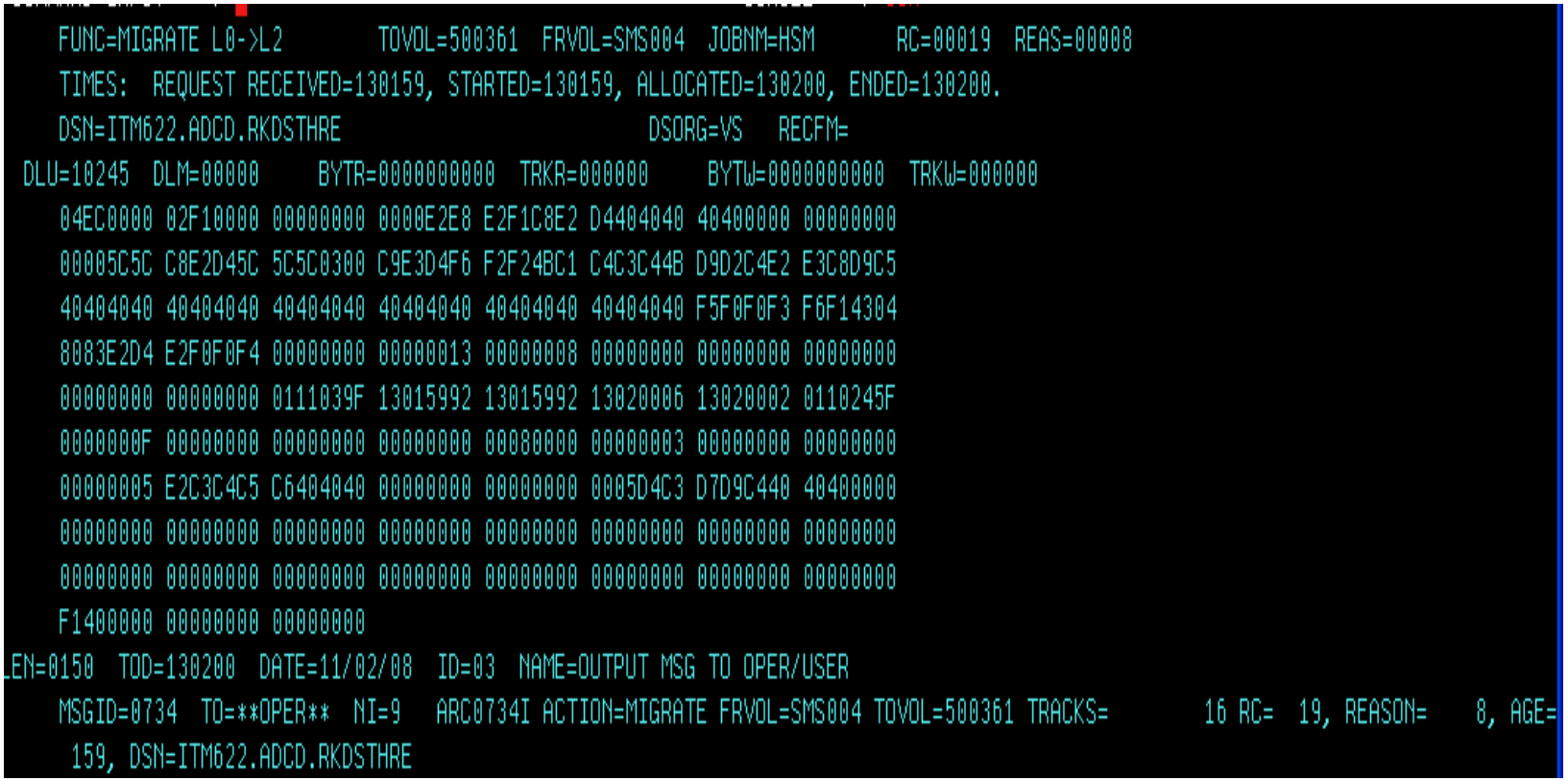
Information Source - HSM Log files

- HSM Logfiles are used to track HSM activity
- Required if using an ISV solution that reads the logs
- Disable if not needed
  - Additional overhead when using logging
- One set of log files per HSM started task
- Active logfile is always the HSMLOGX dataset
  - Exclusive enqueue issued by HSM started task
  - HSM swaps the log files by renaming them
    - *Must reside on the same volume*
- HSMLOGY data set can be analyzed using ARCPRLOG/ARCPEDIT programs

Using ARCPRLOG

- Members provided by HSM starter set
  - Member ARCSTRST in SYS1.SAMPLIB
- ARCSTRST creates xxx.SAMPLE.CNTL
- HSMLOG prints the contents of the HSMLOGY data set
  - As delivered, the 2nd step zeros out the HSMLOGY data set
- HSMEDIT formats the output from the previous job
- Both are still somewhat cryptic

ARCPRINT PRINTLOG



ARCPRINT EDITLOG

- EDITLOG shows request but does not show outcome

```
    FUNC=MIGRATE L0->L2          TOVOL=500361  FRVOL=SMS004  DEVT=43048083  START=130159  END=130200
    DSN=ITM622.ADCD.RKDSTHRE                              DSORG=VS   RECFM=
    BATCH REQUEST    NOWAIT SPECIFIED
    SYSTEM REQUEST

**********  TOD=130200  DATE=00111039  NAME=MIGRATION ENDED              **********
```

Information Source – HSM Activity Logs

- Activity Logs contain information from the automated functions
  - Space Management (Primary & Secondary)
  - Automatic Backup
  - Autodump
- Not to be confused with HSMLOGX and HSMLOGY
- Can be written to SYSOUT or DASD
  - SETSYS ACTLOGTYPE
  - SYSOUT can be accessed while automatic function is active
- SETSYS ACTLOGMSGLVL controls messages issued
  - Recommend FULL rather than EXCEPTIONONLY
  - This parm also controls which messages are written to LOGX/Y

Activity Log Error Summary

```
ERROR SUMMARY OF ERRORS IN DFSMShsm Space Management   2011/02/10
RC RC  TEXT
 6   0   DUPLICATE DATA SET NAME IN DFSMSHSM DATA BASE      2  DATASETS
19   1   DATASET IN USE (NON-VSAM)                          4  DATASETS
19   8   DATASET IN USE (VSAM)                             24  DATASETS
20   4   NON-SMS DATASET CATALOGED TO WRONG VOLUME          1  DATASETS
30   0   DATASET NOT CATALOGED                              3  DATASETS
58   4   VTOC SAYS MULTI VOL, CAT SAYS NOT                  2  DATASETS
58   8   NO CATALOG ENTRY FOUND                           176  DATASETS
70  13   CATALOGED TO A DIFFERENT VOLUME                   16  DATASETS
99   6   INVALID BLOCKSIZE                                  1  DATASETS
99  14   APF AUTHORIZED DATASET                            15  DATASETS
```

Activity Log Error Details

```
ERROR CATEGORIZATION OF DFSMShsm Space Management      2011/02/10
RETURN CODE REASON CODE  DSN
          >>>>>>>>>>>>>>>> DUPLICATE DATA SET NAME IN DFSMSHSM DATA BASE
           6            0  RMM.TOOLKIT.PENU
                           RMM.TOOLKIT.TENU
                            2 DATASETS
           >>>>>>>>>>>>>>>> DATASET IN USE (NON-VSAM)
          19            1  NETVIEW.USER.CNM01.DSIASRC
                           NETVIEW.USER.CNM01.DSIARPT
                           NETVIEW.USER.CNM01.DSILIST
                           ARH230.SARHMSGS
                            4 DATASETS
           >>>>>>>>>>>>>>>> DATASET IN USE (VSAM)
          19            8  ITM622.ADCD.RKDSBUNG
                           ITM622.ADCD.RKDSPYMR
                           ITM622.ADCD.RKDSTHRE
                           ITM622.ADCD.RKMSLOG
                           ITM622.ADCD.RKDSLINK
                           ITM622.ADCD.RKDSCPRM
                           ITM622.ADCD.RKDSSDMS
                           ITM622.ADCD.RKDSSDDD
```

Information Source – SMF Records

- HSM can write SMF records
  - Default is SETSYS NOSMF
- To activate, SETSYS SMF(xxx)
  - SETSYS SMF(240) commonly used
- If activated, HSM writes 2 SMF records
  - In above example, 240 and 241
- 1st record contains
  - Daily Statistics (DSR)
  - Volume Statistics (VSR)
- 2nd record contains
  - Function Statistics (FSR)
  - ABARS function Statistics (WWFSR)

SMF Records

- Monitoring products can gather SMF records
  - Hooks into IEFU83, IEFU84, etc.
- Warning! Not all records are written to SMF
  - Example:
    - RC=99
    - RC=58
    - There may be others…….

Homegrown Reporting Tools

- Purpose –
  - Report on DFSMShsm activity.
    - Migration, backup, recall, recover, extent reduction, PSM, SSM, etc.
      - *What and Why?*
      - *Age, times, etc.*
  - Successful/unsuccessful
    - What, Why and How long?
- Things to know –
  - Requires in-depth knowledge of HSM and internal records.
  - Often requires other OEM software license
    - SAS
    - What is the plan for support and knowledge transfer?

DFSMSrmm Report Generator

- DFSMShsm reporting added in z/OS V1R10 DFSMS
- Available in ISMF Option G
  - Create Storage Management Reports
- Reports created from FSR and WWFSR SMF records
- Additional reports from data obtained using DCOLLECT
- SMF records need to be dumped from SYS1.MANx or logstream first
- More info in Sessions 9232 and 9233 on Friday morning

Storage Management Reports

- Various reports available

```
                        DFSMSrmm Report Definitions          Row 1 to 17 of 41
Command ===> _____________________________________________ Scroll ===> CSR

The following line commands are valid: A,D,G,H,J,L,M,N,S, and T

S Name     Report title                  Report type                 User id
- -------- ----------------------------- --------------------------- -------
_ ARCGAB01 ABARS ABACKUP Statistics       DFSMShsm ABARS Report       HSM
_ ARCGAR01 ABARS ARECOVER Statistics      DFSMShsm ABARS Report       HSM
_ ARCGDB01 DCOLLECT BACKUP DATA           DFSMShsm DCOLLECT BACKUP    P390
_ ARCGDD01 DCOLLECT DASD CAPACITY PLANNIN DFSMShsm DCOLLECT DASD CAP  P390
_ ARCGDM01 DCOLLECT MIGRATION DATA        DFSMShsm DCOLLECT MIGRATION P390
_ ARCGDT01 DCOLLECT TAPE CAPACITY PLANNIN DFSMShsm DCOLLECT TAPE CAP  P390
_ ARCGS001 Statistics for DFSMShsm        DFSMShsm FSR-SMF Records    HSM
_ ARCGS002 Statistics for Backup          DFSMShsm FSR-SMF Records    P390
_ ARCGS003 Statistics for Migration       DFSMShsm FSR-SMF Records    P390
_ ARCGS004 Statistics for Recall          DFSMShsm FSR-SMF Records    P390
_ ARCGS005 Statistics for Recovery        DFSMShsm FSR-SMF Records    HSM
_ ARCGS006 Statistics for Volume Dump     DFSMShsm FSR-SMF Records    HSM
_ ARCGS007 Statistics for Restore from Du DFSMShsm FSR-SMF Records    HSM
_ ARCGS008 Statistics for FRBACKUP        DFSMShsm FSR-SMF Records    HSM
_ ARCGS009 Statistics for FRRecover       DFSMShsm FSR-SMF Records    HSM
_ ARCGS010 DFSMShsm Thrashing Report      DFSMShsm FSR-SMF Records    P390
```

Backup Error Report using DFSMSrmm Report Generator

Statistics for Backup - 1 - 02/14/2011 14:59:30

DATE	TIME REQ	DSN	SOURCE	RC	REASON CODE	KB READ
2011040	12003814	SYS2.RMM.CONTROL.FILE	SMS001	68	412	0
2011040	12003937	DSN810.DSNDBC.BJTBASE.BJTARCSP.I0001.A001	SMSOM1	68	412	0
2011040	12004166	ITM622.ADCD.RRNSGRP1	SMS001	19	0	0
2011040	12004220	DSN810.DSNDBC.BJTBASE.BJTATTSP.I0001.A001	SMSOM1	68	412	0
2011040	12004950	DSN810.DSNDBC.BJTBASE.BJTARCSP.I0001.A001	SMSOM1	0	0	16612
2011040	12004959	ITM622.ADCD.RRNSGRP1	SMS001	0	0	8323
2011040	12004962	SYS2.RMM.CONTROL.FILE	SMS001	0	0	2344
2011040	12004994	AKD.AUDIT.CATLIST	SMS001	0	0	1
2011040	12005002	AKD.AUDIT.RMMCNTL	SMS001	0	0	1
2011040	12005039	DSN810.DSNDBC.BJTBASE.BJTACTSP.I0001.A001	SMSOM1	68	412	0
2011040	12005057	AKD.MEDIACTL.V900018.ERRORS	SMS001	0	0	1
2011040	12005129	P390.SPFTEMP0.CNTL	SMS001	19	0	0
2011040	12005157	P390.SPFTEMP0.CNTL	SMS001	0	0	8
2011040	12005264	AKD.AUDIT.OCDS.TTCVAUDT	SMS001	0	0	23
2011040	12005271	IXGLOGR.ATR.ADCDPL.DELAYED.UR.ADCDPL	SMS001	68	412	0
2011040	12005331	ITM622.ADCD.RRVSGRP1	SMS001	19	0	0
2011040	12005739	DSN810.DSNDBC.BJTBASE.BJTATTSP.I0001.A001	SMSOM1	0	0	16612

Migration Error Report using DFSMSrmm Report Generator

Statistics for Migration - 1 - 02/11/2011 11:04:31

DATE	TIME REQ	DSN	AGE	SOURCE	RC	REASON CODE	KB READ
2011041	13000719	SYS2.TDS.DCOLLECT.G0353V00	0002	SMS002	0	0	18836
2011041	13001273	SYS2.RMM.HSKP.MESSAGE.SAVE.G2712V00	0001	SMS002	0	0	6
2011041	13001399	ITM622.ADCD.RKDSSTSA	0000	SMS002	19	8	0
2011041	13001565	ITM622.ADCD.RKDSCKPT	0000	SMS002	19	8	0
2011041	13001612	ITM622.ADCD.RKDSQURY	0000	SMS002	19	8	0
2011041	13001633	ITM622.ADCD.RKDSDYST	0000	SMS002	19	8	0
2011041	13001649	ITM622.ADCD.RKDSEPRM	0000	SMS002	19	8	0
2011041	13001666	ITM622.ADCD.RKDSEVMP	0000	SMS002	19	8	0
2011041	13001680	ITM622.ADCD.RKDSGRPC	0000	SMS002	19	8	0
2011041	13001696	SYS2.BJTBASE.BJTBUCSP.D2011039.T181622	0002	SMS002	0	0	24
2011041	13002005	SYS2.BJTBASE.BJTUAMSP.D2011040.T001701	0002	SMS002	0	0	12
2011041	13002090	SYS2.BJTBASE.BJTDDSSP.D2011039.T181622	0002	SMS002	0	0	1903
2011041	13002249	SYS2.BJTBASE.BJTLAYSP.D2011040.T001701	0002	SMS002	0	0	3377
2011041	13002397	SYS2.BJTBASE.BJTATTSP.D2011040.T001701	0002	SMS002	0	0	12
2011041	13002469	SYS2.BJTBASE.BJTBANSP.D2011040.T001701	0002	SMS002	0	0	96
2011041	13002595	SYS2.BJTBASE.BJTBUISP.D2011040.T001701	0002	SMS002	0	0	8
2011041	13002671	SYS2.BJTBASE.BJTAVRSP.D2011040.T001701	0002	SMS002	0	0	8

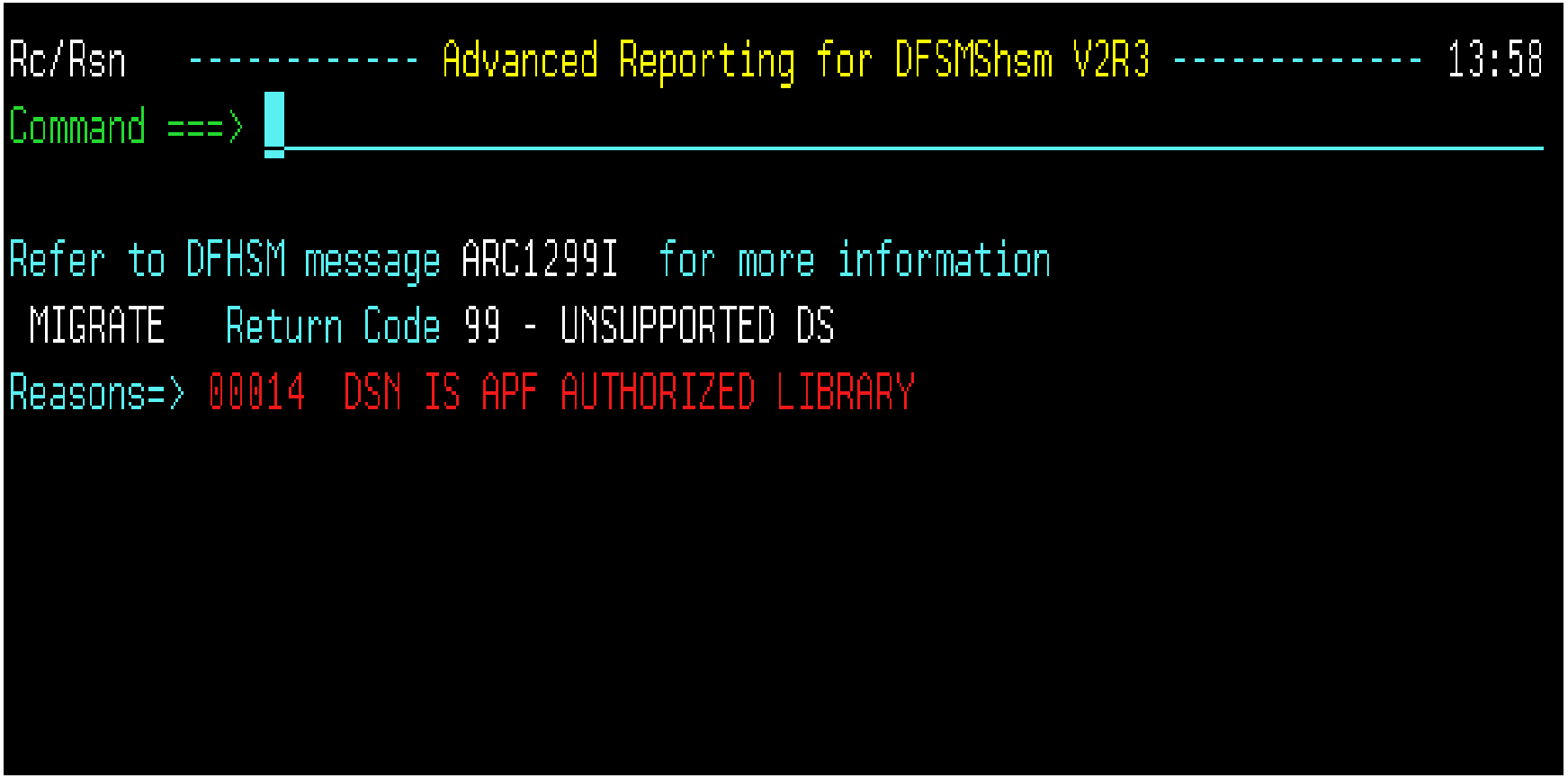
Using an ISPF-based product

- Ability to filter on particular conditions
  - Functions
  - Return Codes
  - Date/Time
- Ability to store queries
- Able to take corrective actions
- Also provides means to execute in batch

ISPF view of Migration errors

```
          FILTERED VIEW OF MIGRATE/BACKUP
 Enter O at Command for list of options.
 Panel 1 of 3. Scroll right for more information.
 Key S beside entry for return/reason codes.
S   Dsn                                              Action    Rc Rsnc    Trks  Age
    DSN810.DSNDBD.BJTBASE.BJTACTX2.I0001.A001        MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTACTX5.I0001.A001        MIGRATE   58 00008      0  286
    MAINSTAR.MCR0703.SMCRLOAD                        MIGRATE   99 00014      0   20
    DSN810.DSNDBD.BJTBASE.BJTARCX3.I0001.A001        MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTARCX7.I0001.A001        MIGRATE   58 00008      0  286
s   SYS2.MXH0902.SMXHLOAD                            MIGRATE   99 00014      0    0
    DSN810.DSNDBD.BJTBASE.BJTARCX8.I0001.A001        MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTARCXC.I0001.A001        MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTARCXD.I0001.A001        MIGRATE   58 00008      0  286
    DSN810.DSNDBD.DRLDB.EXCEPTRI.I0001.A001          MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTARCXE.I0001.A001        MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTATTX1.I0001.A001        MIGRATE   58 00008      0  286
    IXGLOGR.ATR.ADCDPL.RM.DATA.A0000000.DATA         MIGRATE   70 00013      0  278
    DSN810.DSNDBD.DRLDB.DRLEXPRI.I0001.A001          MIGRATE   58 00008      0  286
    DSN810.DSNDBD.BJTBASE.BJTATTX2.I0001.A001        MIGRATE   58 00008      0  290
    DSN810.DSNDBD.DRLDB.DFSMSACT.I0001.A001          MIGRATE   58 00008      0  286
```

Drill-down from migration errors



Monitor ABARS events

- If using ABARS, ensure that these jobs are successful

Application Backup Events (Base Events)

	ABARS Event Name	Base Version	Incremental Version	Type of Backup	Status of Backup	Utility RC	ITABR RC	Event Timestamp	Elapsed Time	Datasets Backed Up	Total Space Backed Up
	OM	0	0	BI	COMPLETE	0	0	02/11/11 09:30:06	00:24:53	6591	1,512,136
	P390	0	0	I	COMPLETE	34	999	02/10/11 15:30:16	**:**:**	0	
	P390	0	-1	I	COMPLETE	0	4	02/09/11 15:30:41	00:01:35	24	82,954
	P390	0	-2	I	COMPLETE	0	4	02/08/11 15:31:00	00:01:24	15	21,011
	P390	0	-3	BI	COMPLETE	0	4	02/07/11 15:30:36	00:14:53	917	3,413,906
	SYS2	0	0	I	COMPLETE	0	0	02/10/11 17:16:02	00:08:40	130	2,480,861
	SYS2	0	-1	I	COMPLETE	0	0	02/09/11 17:15:24	00:08:23	132	2,398,480
	SYS2	0	-2	I	COMPLETE	0	0	02/08/11 17:15:42	00:09:00	134	2,482,871
	SYS2	0	-3	BI	COMPLETE	0	4	02/07/11 17:15:21	00:17:12	771	6,212,594

Common Causes of Migration & Backup Failures

- Everyday in most shops DFSMShsm primary, secondary and backup are run at specific times daily. In most cases business's have grown, storage farms have grown and managed data has grown, but when was the last time your scheduled tasks were reviewed or verified?
- Here are some common failures that we have seen
  - Data Set in Use (RC=19) –
    - A common encountered error, everyday DFSMShsm will try to migrate and backup these data sets and fail.
      - *Waste of DFSMShsm resources*

Common Causes of Migration & Backup Failures

- Common causes of migration/backup failures (continued) –
  - No space on ML1 Volume (RC=37)
    - This is usually seen with large data sets. Some simple solutions include adding additional volumes to ML1 pool, modifying management rules to expire more data on primary pools, using an ARCMDEXT to migrate large data sets straight to tape or consider using ML1 Overflow volumes
  - HSM Backup Critical Errors (condition code ne 0) –
    - HSM backup is critical to shops using this as their first level data recovery.
      - *Backup window overlaps batch processing*
      - *Ctlg errors (rc30) / DFDSS errors (rc68) / vtoc discrepancy (rc87)*
        - *Waste of DFSMShsm resources*

Common Causes of Migration & Backup Failures

- Common causes of migration/backup failures (continued) –
  - Unsupported Datasets (rc99, rsn04) are a very common migration and backup error.
    - Cause of the problem is incorrectly defined data sets (no DSORG).
    - Every day HSM will try to migrate/backup these data sets and fail. We have seen situations where the same data sets have been failing for nine years and more. The quickest and easiest correction is to update the SMS routines to automatically assign a data class.
      - *Waste of DFSMShsm resources.*
- Running Interval Migration means that errors may occur multiple times a day
  - Reports show repeated errors against same data set name

Patches – Problem Determination

- Examples
  - PATCH .MGCB.+26 X'FF'
    - Used to determine why an SMS-managed data set is not selected during volume migration
  - PATCH .BGCB.+24 X'FF'
    - Used to determine why SMS-managed data sets are not being selected during volume backup
- These patches produce a lot of messages
  - ARC1245I with Reason Codes GT 90 for migrations
  - ARC1334I with Reason Codes GT 90 for backups
- Use diagnostic patches only when needed or directed by Level 2 support
  - Excessive non-zero return codes
  - Extra processing overhead

Recall Failures

- You will probably hear about recall issues long before running a report!
  - RC=2 often means that the user tried the recall multiple times
- If you see a lot of failures, check to see if a process is issuing HRECALLs, regardless of whether the data is migrated or not

Statistics for Recall - 1 - 02/14/2011 15:36:04

DATE	TIME REQ	DSN	RC	AGE	TARGET	MC NAME	HOST
2011045	15315242	P390.ABA.LOG	0	175	SMS003	MCDEF	1
2011045	15315262	P390.ABARSMGR.JCLPROF	0	293	SMS002	MCDEF	1
2011045	15315281	P390.ABR.DEMO.INSTJCL	0	441	SMS006	MCDEF	1
2011045	15315297	P390.ABR.DEMO.XFRBIN	0	293	SMS008	MCDEF	1
2011045	15315314	P390.ABR.DEMO.XFRBINR	0	475	SMS006	MCDEF	1
2011045	15320662	P390.ABARSMGR.JCLPROF	2	0			1
2011045	15320679	P390.ABR.DEMO.INSTJCL	2	0			1
2011045	15320694	P390.ABR.DEMO.XFRBIN	2	0			1
2011045	15320711	P390.ABR.DEMO.XFRBINR	2	0			1
2011045	15320727	P390.ABRACDI.PROD.INJCL	0	390	SMS008	MCDEF	1

Common Recall Queue - CRQ

- Consolidates recall requests and spreads them across HSM instances
  - Balances workloads around the complete HSMplex
  - Can help reduce recall delays
- Allows important recalls to be prioritized ahead of lesser ones
  - Use ARCRPEXT (Return Priority exit)
- Optimizes Tape mounts
  - Single tape mount satisfies requests from multiple LPARS
- Requests can be carried out by all or some of the systems
  - Allows systems without attached tape to issue recall requests

Expire Errors

- Expire processing is performed as part of Space Management
  - Primary, Secondary Space Management & Interval Migration
- Check for RC=53
  - Means that data set needs a backup first
  - Can also be seen when trying to migrate to ML2
- Data sets with explicit expiration dates can be expired by HSM
  - Review SETSYS EXPIREDDATASETS
    - SCRATCH will delete, NOSCRATCH will ignore
  - Explicit expiration dates override management class rules

Thrashing

- Thrashing can be described in 2 ways
  - A data set which is migrated and recalled within a few days
  - Data sets which are migrated and recalled multiple times
- Often generation data sets involved
  - Management Class says to allows GDS early migration
    - MC Class field # GDG Elements on Primary
  - Some jobs recall entire GDG rather than relative generation
    - Data is recalled even when not needed
- Consider not migrating small datasets
  - Migration may not be worth the processing overhead
  - Use ARCMDEXT exit to exclude from migration
    - Can also allow migration to ML1 but exclude from ML2

Thrashing

- HSM SMF records (FSR) can be used to look for thrashing

DFSMShsm Thrashing Report - 1 - 02/14/2011 15:54:02

DSN	AGE	SIZE KB	DATE	TIME REQ	JOB NAME REQUESTIN SERVICE	TARGET	MC NAME
AAH230.GLOBAL.CSI	0	1444	2011039	14203238	CONSINV	SMS009	MCPRD
ABR220.GLOBAL.CSI	0	1444	2011039	14203671	CONSINV	SMS009	MCPRD
ACM230.GLOBAL.CSI	0	1444	2011039	14204094	CONSINV	SMS009	MCPRD
ARH230.GLOBAL.CSI	0	1444	2011039	14204781	CONSINV	SMS007	MCPRD
ATH310.GLOBAL.CSI	0	722	2011039	14205140	CONSINV	SMS006	MCPRD
BJT230.GLOBAL.CSI	0	1444	2011039	14205417	CONSINV	SMS006	MCPRD
GLO310.GLOBAL.CSI	0	722	2011039	14210189	CONSINV	SMS008	MCPRD
HOSM612.GLOBAL.CSI	0	3125	2011039	14210468	CONSINV	SMS006	MCPRD
HSMACT.H1.ABACKUP.OM.D11034.T093138	1	37	2011041	15460296	P390	SMS007	MCHSMACT
P390.SMPE.CNTL	0	609	2011039	14195043	P390	SMS007	MCSPEC
SYS2.ARH230.SMPE.CNTL	0	156	2011039	14421312	P390	SMS007	MCDEF
SYS2.MXH0902.SMXHCMDS	1	180	2011039	08023825	XMXHJOB	SMS008	MCDEF
SYS2.MXH0902.SMXHMSGS	1	229	2011040	08023032	XMXHJOB	SMS008	MCDEF
SYS2.SMFDUMP.G2412V00	0	97842	2011040	15120984	JES2	SMS003	MCSMF21
SYS2.SMFDUMP.G2413V00	0	100569	2011041	14090052	JES2	SMS007	MCSMF21

Note: FSR records can also include data sets processed for extent reduction

- These are not really thrashing
- Review SETSYS MAXEXTENTS

Thrashing – IEFBR14

- Production jobs often use IEFBR14 with DISP=(x,DELETE) as first step
- HSM will recall the data set in order to delete
- z/OS V1R11 allows data sets to be deleted without Recall
- Changes in ALLOCxx member in SYS1.PARMLIB
  - SYSTEM IEFBR14_DELMIGDS(NORECALL)
  - Default value is LEGACY
- Recommend NORECALL unless another product already being used
  - e.g. zOSEM

Migration and SMS Storage Group Thresholds

- We have seen sites using unrealistic storage group thresholds
  - E.g. High threshold 80%, low threshold 1%
- Primary Space Management will attempt to process down to low threshold
- Interval Migration starts after halfway between high- & low-threshold is exceeded
  - Ends at low-threshold
- Leads to excessive cycles and missed space management windows
- Set values that are realistic for the storage group

Automation for SMS Allocation failures

- Monitor syslog for allocation failures and space issues
  - IGD17380I when high threshold has been exceeded
  - IGD17223I when an overflow storage group is used
  - IGD17272I when allocation failed due to insufficient space
- Initiate action
  - E-mail
  - Volume migration
  - On-demand migration (new V1V13 function)

Automation for early completion

- Definition: HSM automatic function finishes before all volumes processed
- Check for following messages
  - ARC0717I Automatic Backup
  - ARC0625I Automatic Dump
  - ARC0521I Primary Space Management
- Solution
  - Increase windows
    - Earlier start time, later end-time
  - Increase number of tasks
    - This can be automated and performed dynamically if needed
- Device availability may be restricting factor
  - Physical tape drives

Reorganizing Control Data Sets

- Should you reorganize a Control Data Set?
  - Some Say Yes, Some Say No

- Why are you Reorganizing a Control Data Set?
  - Receiving warning messages from DFSMShsm
    - Incorrect sizing
    - Single cluster at 4Gb limit
    - “That is what we have been doing for years”

Reorganizing Control Data Sets

- Think of DFSMShsm as a crucial part of the OS
  - Every minute it is down –
    - Migrated data cannot be recalled
      - *Production delays*
    - Backed up data cannot be recovered
- Most common reason for having to perform CDS forward recovery is after a reorg

Reorganizing Control Data Sets

- Should you reorganize a Control Data Set (cont) ?
  - Look for alternative solutions
    - Correct sizing of CDSs
    - Reorg While Open products
    - CA Reclaim (Session 9007 from Share in Anaheim)
    - Review why and if needed, use tried and tested procedure
  - Is there a performance degradation after a reorg?
    - Yes, the reorg removes all splits, but when HSM is restarted the first thing it will do inside a CDS is a split.
    - Performance impact for a number of weeks

HSM Audits

- Recommend running audits regularly
- Always run an audit after the CDSs have been reorganized
- HSM audits run l-o-n-g……
  - VSAM Record Level Sharing can help improve CDS audits
- If you are not able to regularly run audits, you might need an external audit product
  - Allows a more targeted approach
  - Example: IBM Tivoli Advanced Audit for DFSMShsm

Using a monitoring product

- Allows drilling down to additional information
- Ability to group similar errors together
- Allows setting up of automation
  - Situations
  - Policies
- Visual indicators
  - User thresholds
- Problem determination is built in
  - Dynamic workspace links for faster diagnosis

Monitoring

Monitoring Products:

- IBM Tivoli Omegamon XE for Storage
- IBM Tivoli Advanced Audit for DFSMShsm
- IBM Tivoli Advanced Reporting for DFSMShsm
- IBM Tivoli Advanced Backup and Recovery Manager
- IBM Tivoli Advanced Catalog Management

- Other vendors products can monitor as well

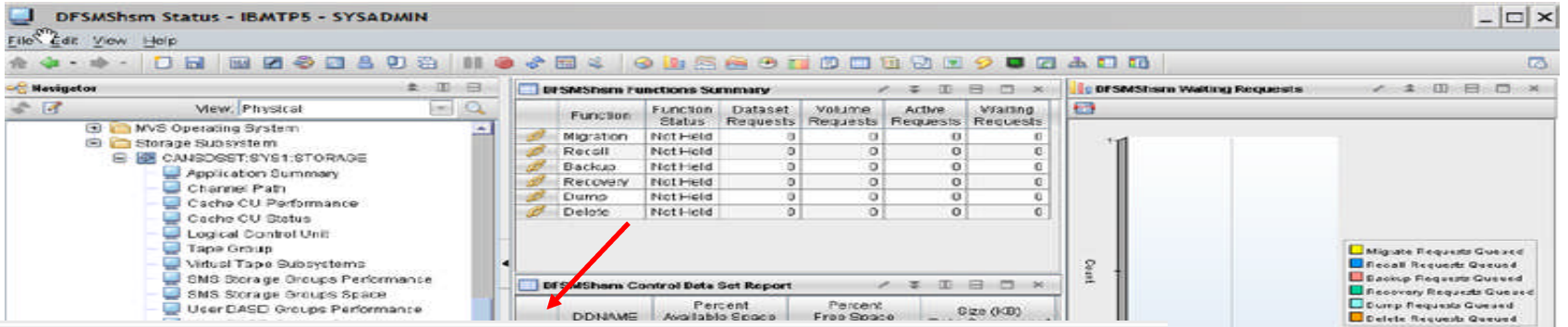
Monitoring

Items to be monitored

- HSM Function Status
- HSM CDS utilization
- HSM ML1 Volumes
- Migrate/Recall Success/Failure
- Return Codes LOGX
- HSM user catalog
  - Space
  - Backup
- Aggregate Backups
- Common Recall Queue HSMPLEX

Monitoring

- HSM Function Status

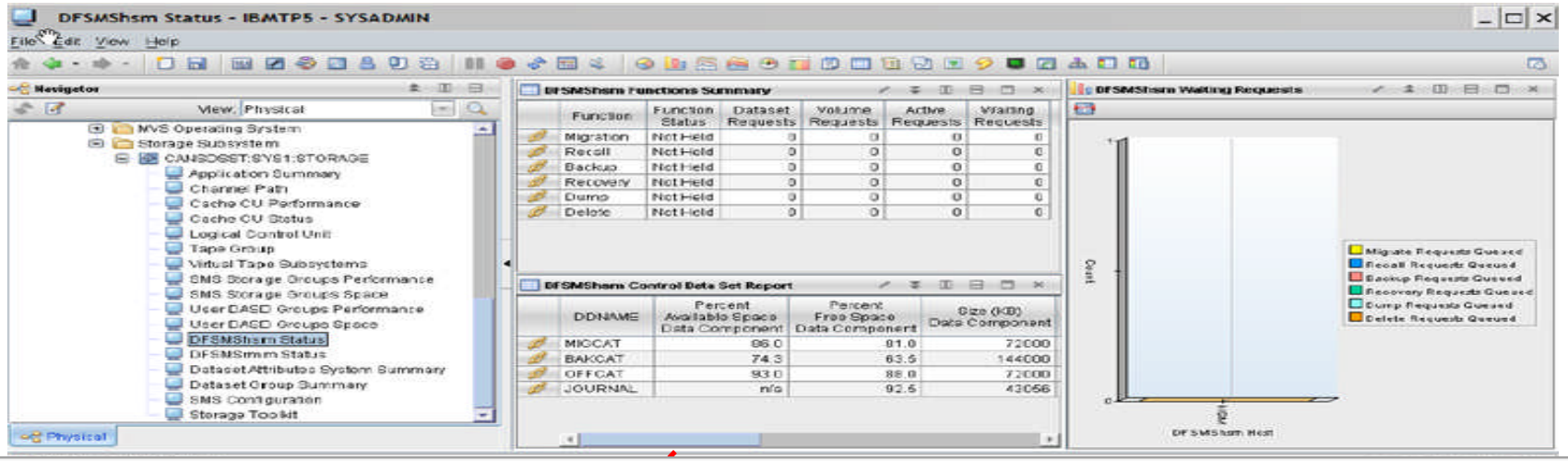


DFSMShsm Functions Summary

	Function	Function Status	Dataset Requests	Volume Requests	Active Requests	Waiting Requests
	Migration	**Held**	0	0	0	0
	Recall	Not Held	0	0	0	0
	Backup	Not Held	0	0	0	0
	Recovery	**Held**	0	0	0	0
	Dump	Not Held	0	0	0	0
	Delete	Not Held	0	0	0	0

Monitoring

- HSM CDS Utilization



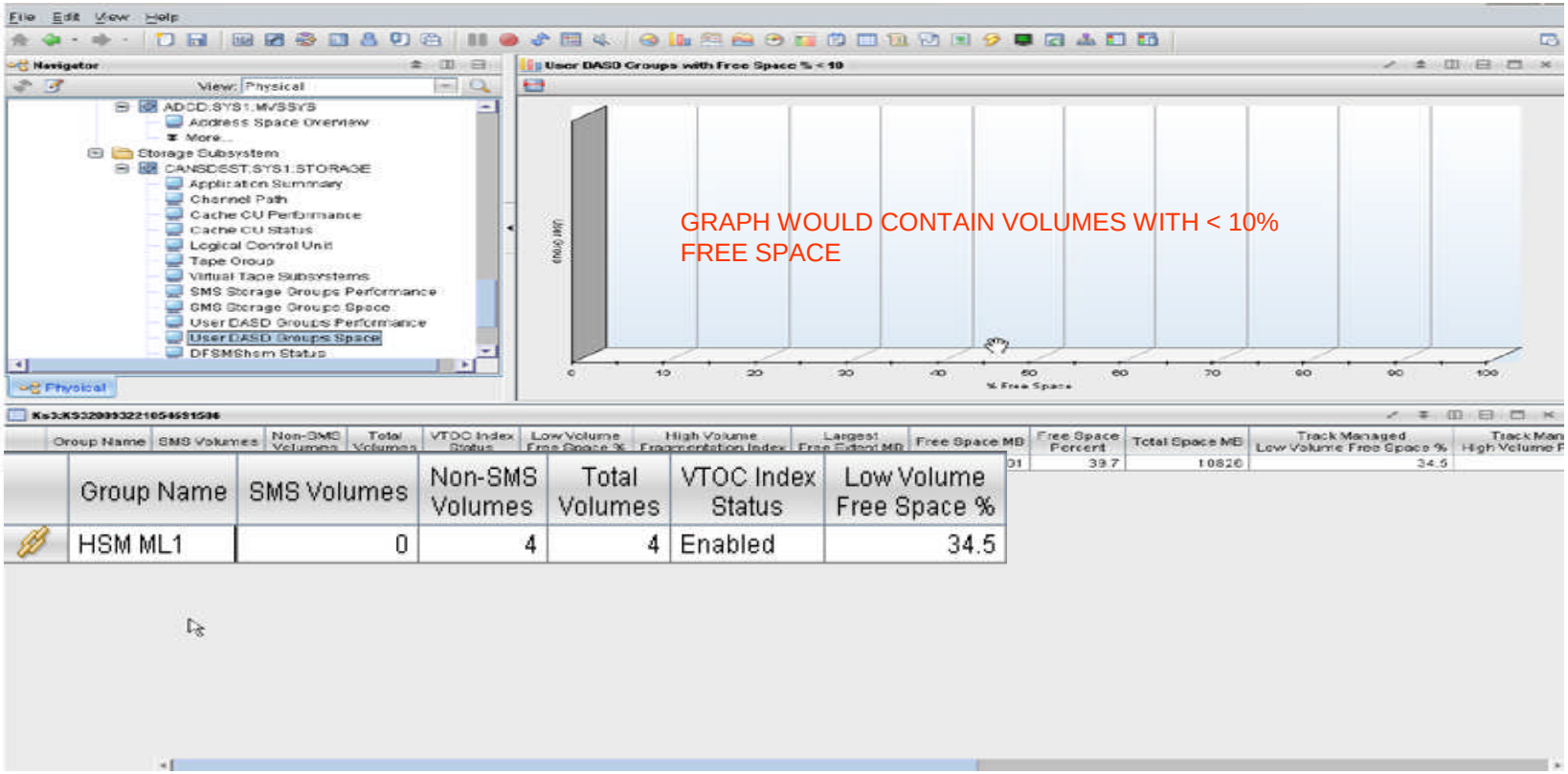
DFSMShsm Control Data Set Report

	DDNAME	Percent Available Space Data Component	Percent Free Space Data Component	Size (KB) Data Component	Number of Extents Data Component	Percent Available Space Index Component	Percent Free Space Index Component	Size (KB) Index Component	Number of Extents Index Component	Display Order
	MIGCAT	85.6	80.0	72000	1	83.3	83.4	252	1	16
	BAKCAT	73.5	63.5	144000	1	70.6	70.7	504	1	48
	OFFCAT	92.8	88.0	72000	1	89.6	89.7	252	1	80
	JOURNAL	n/a	79.7	43056	1	n/a	n/a	n/a	n/a	112

Monitoring

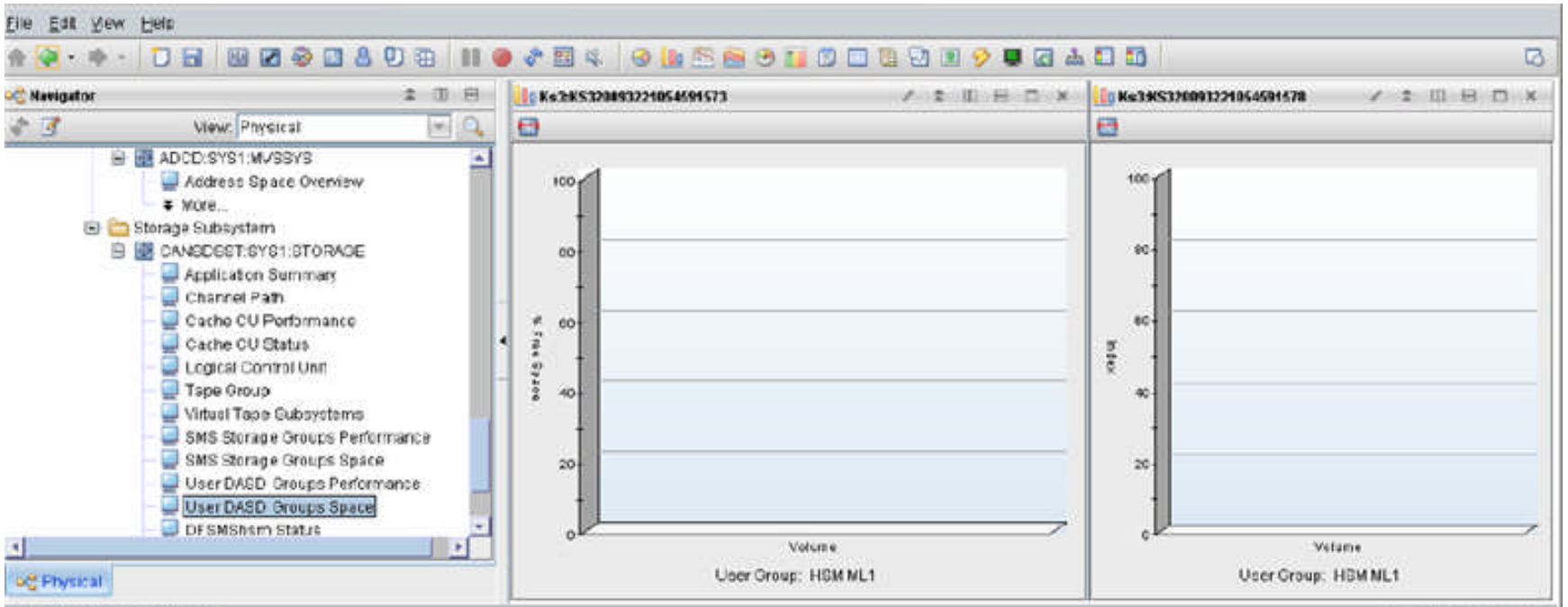
HSM ML1 Volume Utilization

A Group of the HSM ML1 volumes is defined to track the free space and fragmentation index.



Monitoring

HSM ML1 Volume Utilization DETAILS

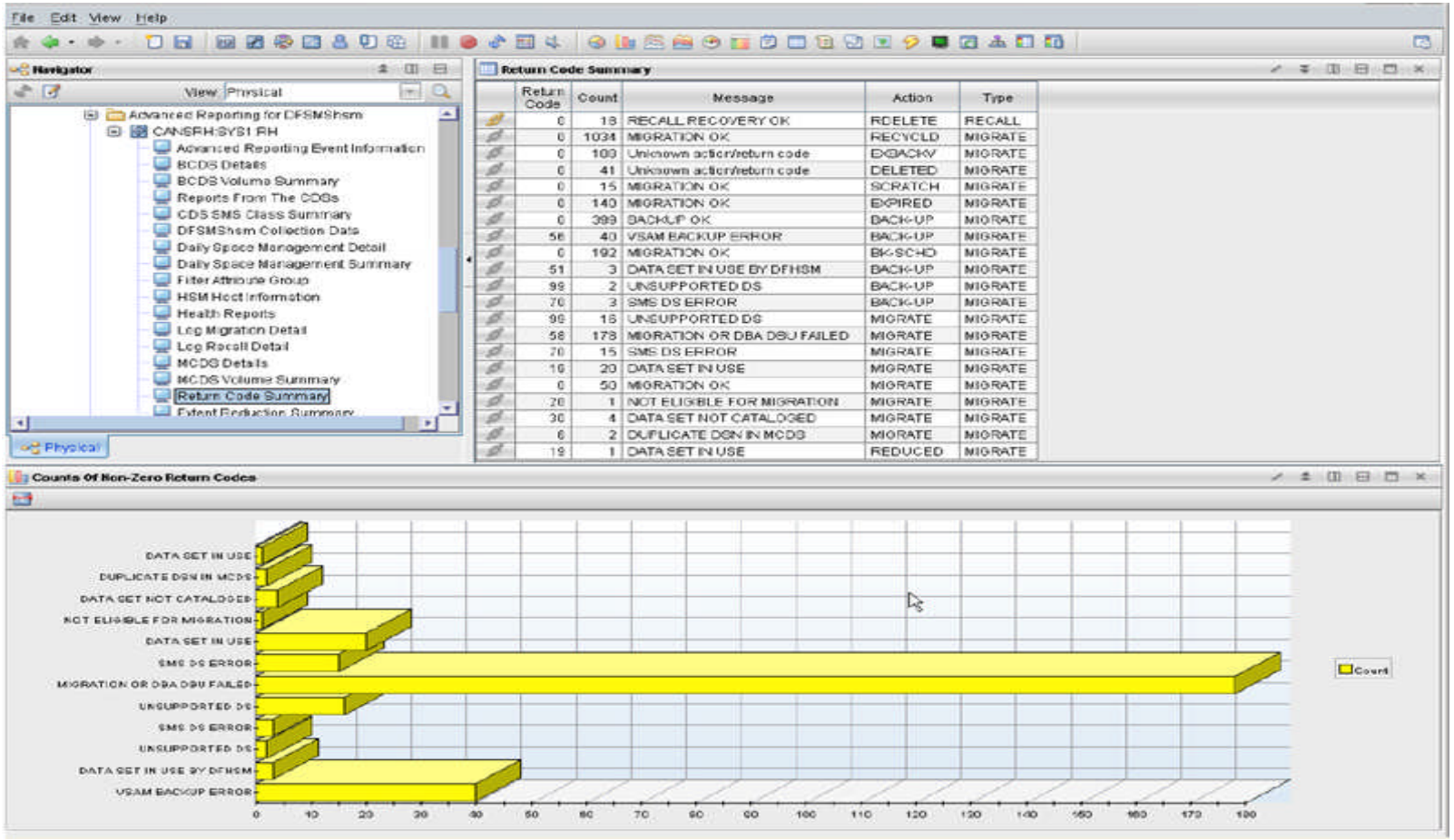


	Volume	Device Address	Device Type	Total Capacity Megabytes	Free Space Megabytes	Percent Free Space	Fragmentation Index	Largest Free Extent MB	VTOC Index Status
	HSM001	0A9B	3390	2707	1888	69.7	18	1806	Enabled
	HSM002	0A9C	3390	2707	332	12.2	13	326	Enabled
	HSM003	0AA8	3390	2707	1890	69.8	0	1889	Enabled
	HSM004	0AA9	3390	2707	1890	69.8	0	1889	Enabled

Track Managed Total Capacity
2707
2707
2707
2707

Monitoring

Return Codes



Monitoring

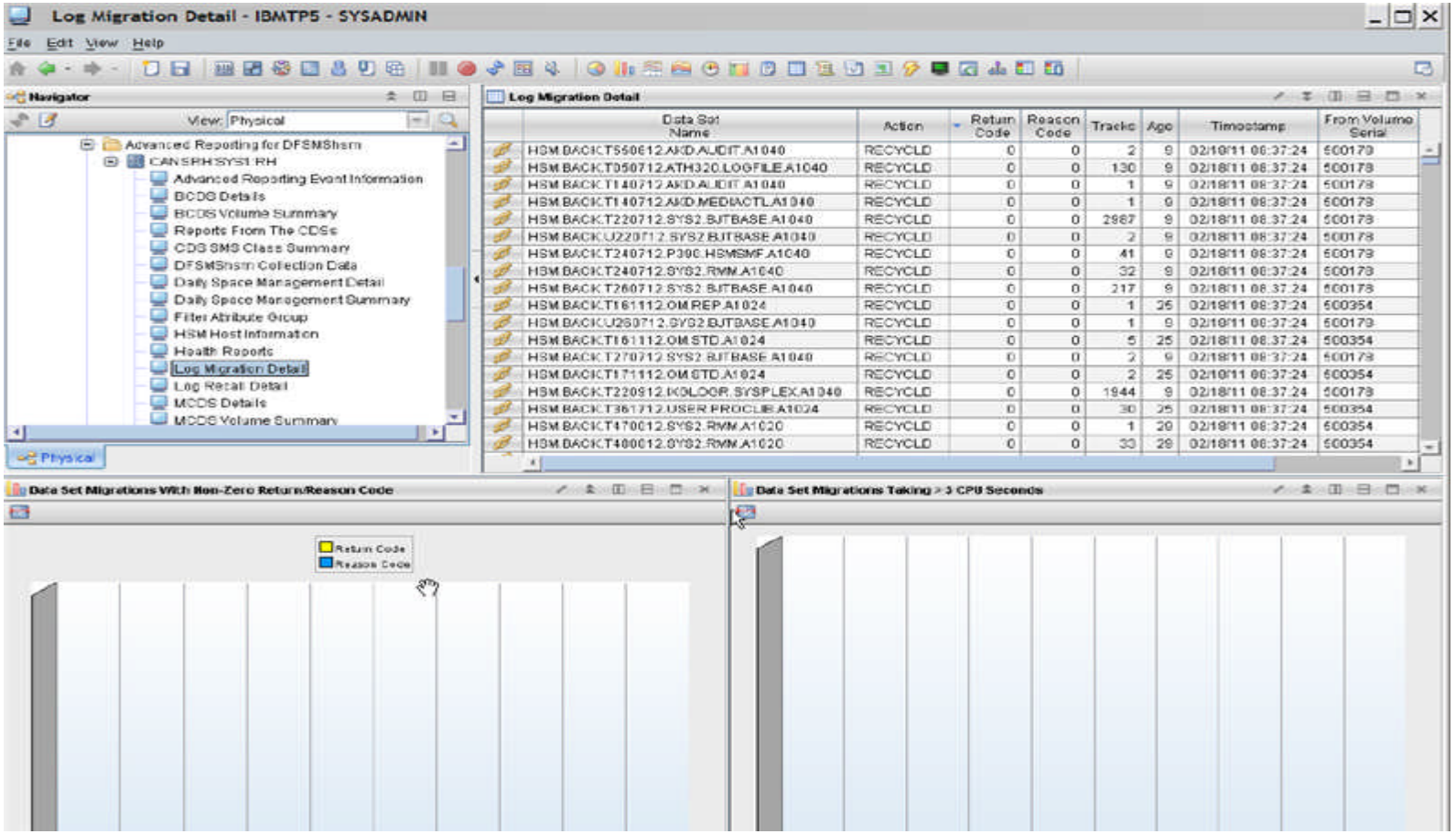
Return Codes

Return Code Summary

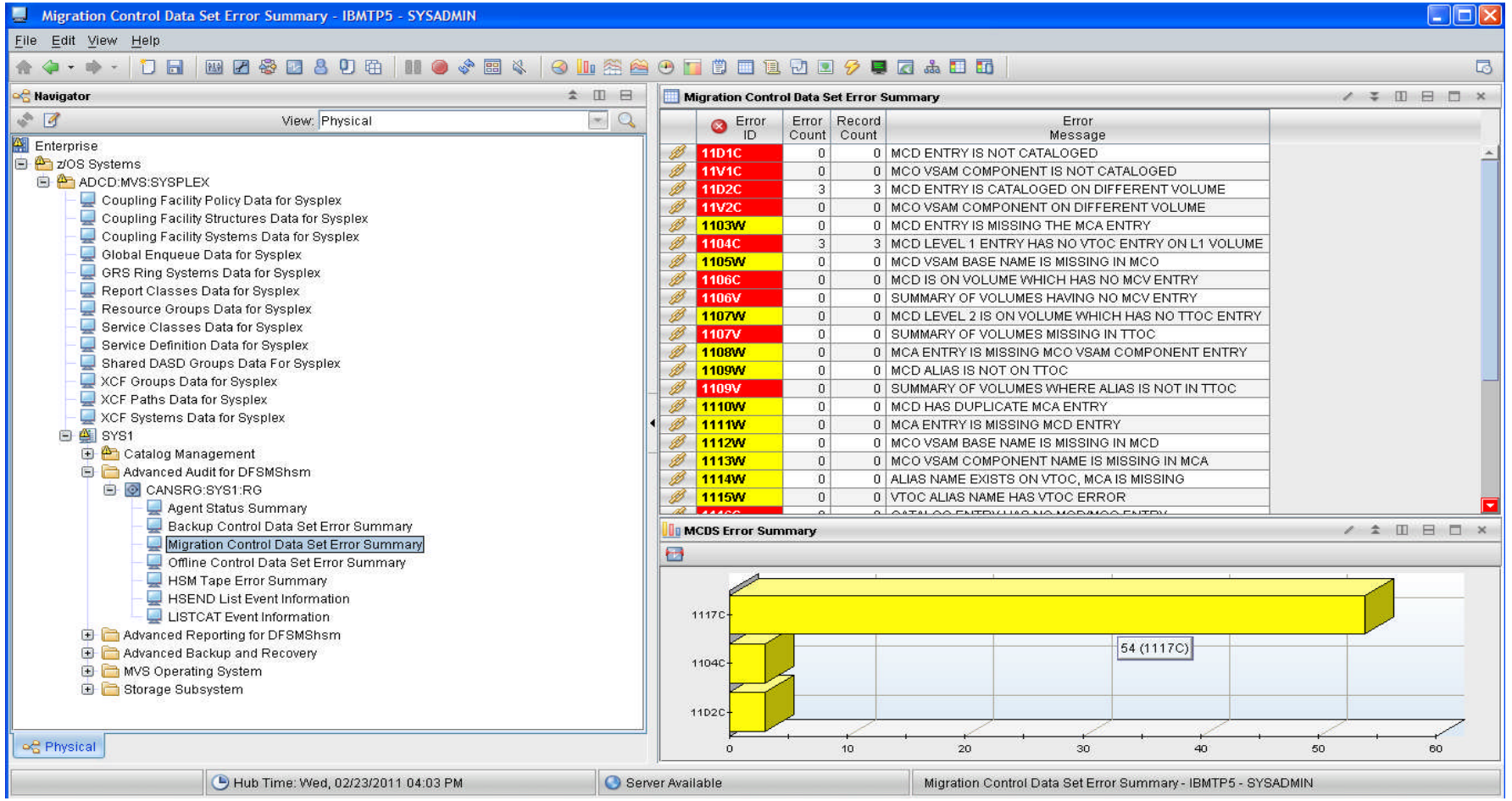
Return Code	Count	Message	Action	Type
0	487	BACKUP OK	BACK-UP	MIGRATE
68	56	BKUP FAILED BECAUSE OF DFDSS ERR	BACK-UP	MIGRATE
19	1	DATA SET IN USE	REDUCED	MIGRATE
19	19	DATA SET IN USE	MIGRATE	MIGRATE
51	4	DATA SET IN USE BY DFHSM	BACK-UP	MIGRATE
30	3	DATA SET NOT CATALOGED	MIGRATE	MIGRATE
6	2	DUPLICATE DSN IN MCDS	MIGRATE	MIGRATE
0	148	MIGRATION OK	MOVE VT	MIGRATE
0	1591	MIGRATION OK	MIG1TO2	MIGRATE
0	1192	MIGRATION OK	RECYCLD	MIGRATE
0	7	MIGRATION OK	SCRATCH	MIGRATE
0	58	MIGRATION OK	EXPIRED	MIGRATE
0	194	MIGRATION OK	BK-SCHD	MIGRATE
0	45	MIGRATION OK	MIGRATE	MIGRATE
58	178	MIGRATION OR DBA DBU FAILED	MIGRATE	MIGRATE
20	4	NOT ELIGIBLE FOR MIGRATION	MIGRATE	MIGRATE
0	7	RECALL:RECOVERY OK	RECALL	RECALL
0	20	RECALL:RECOVERY OK	RDELETE	RECALL
70	16	SMS DS ERROR	MIGRATE	MIGRATE
70	4	SMS DS ERROR	BACK-UP	MIGRATE

Monitoring

Migration Return Codes

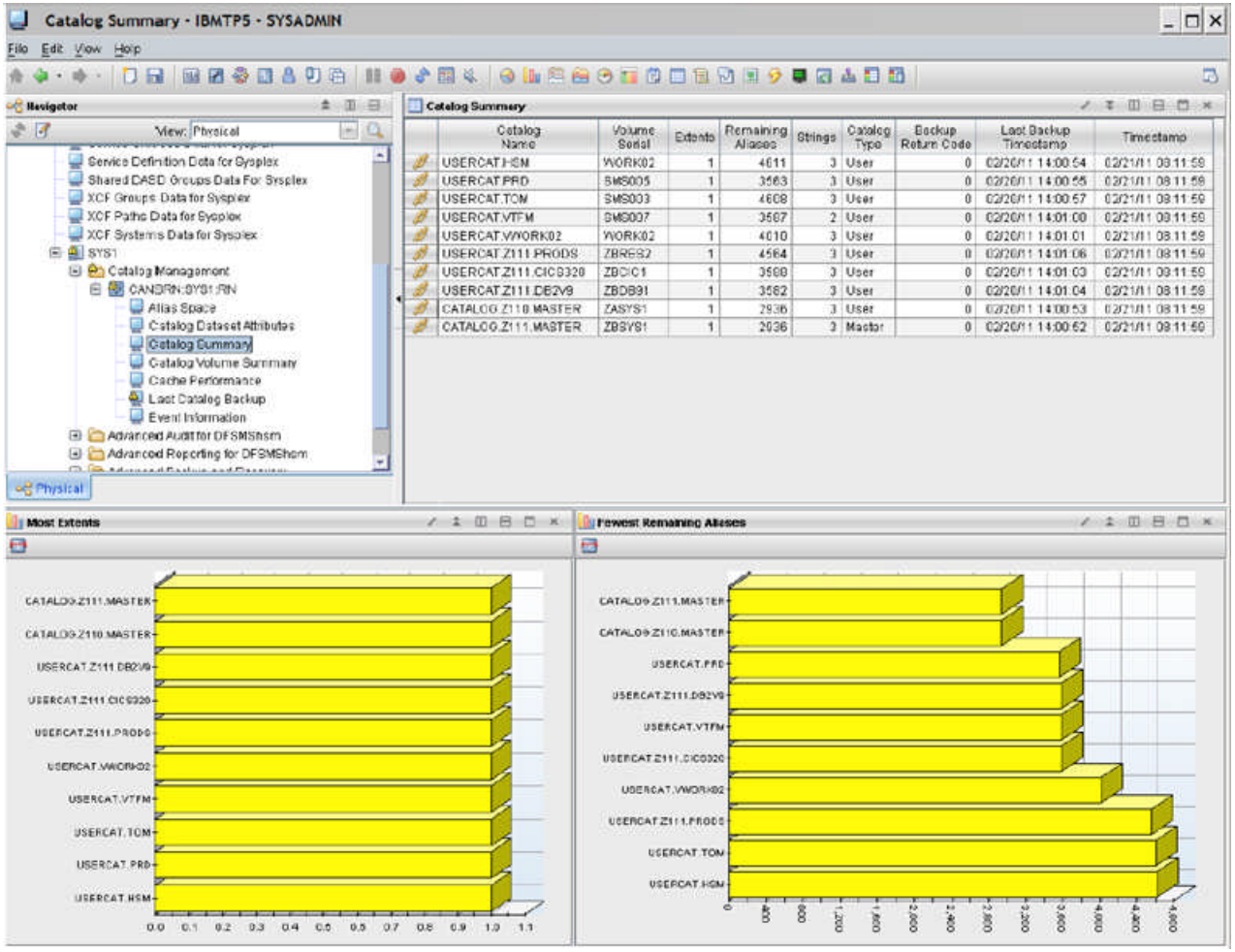


Audit Example



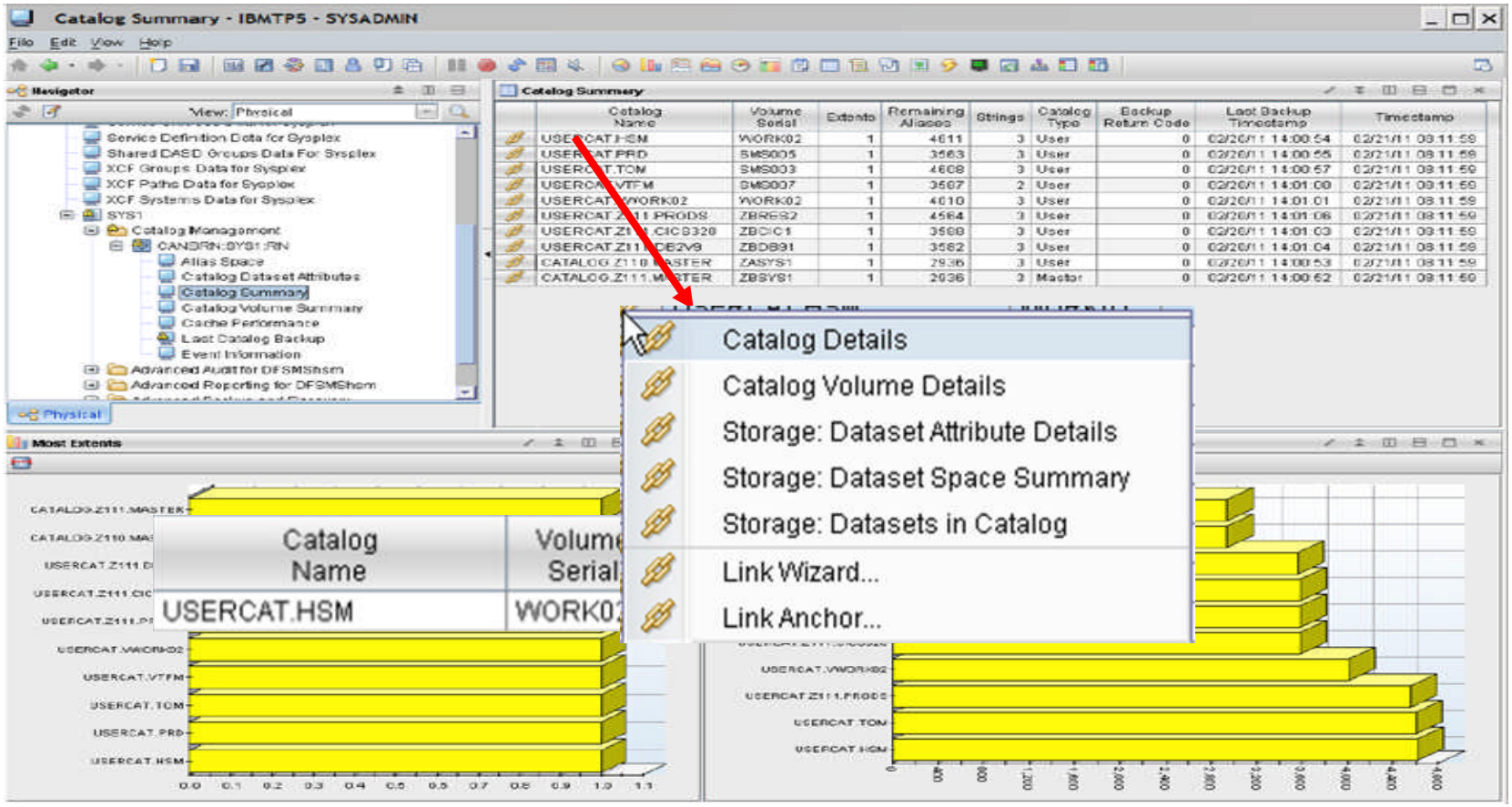
Monitoring

HSM user catalog Space and Backup Status



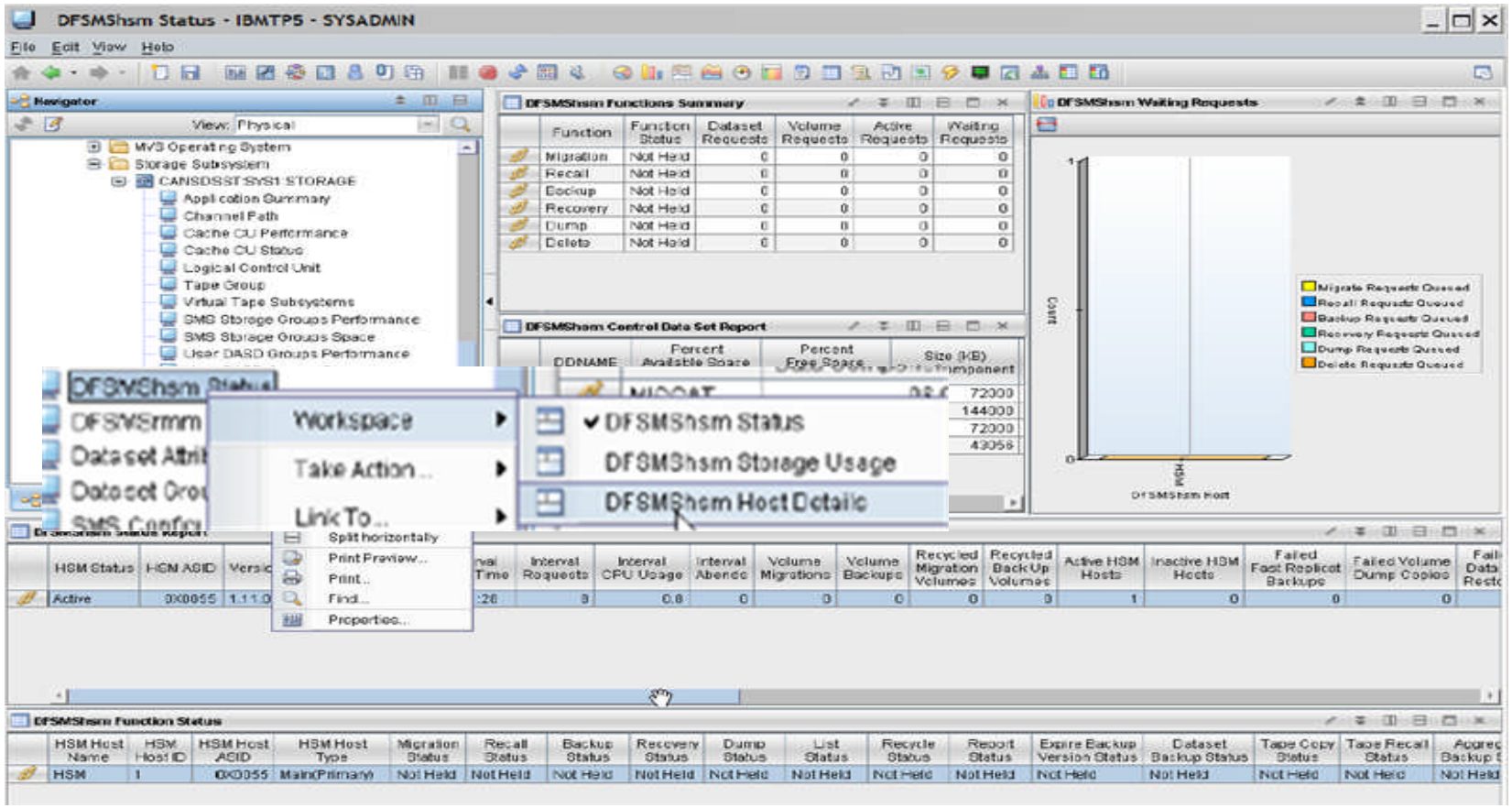
Monitoring

HSM user catalog backup status. Extents



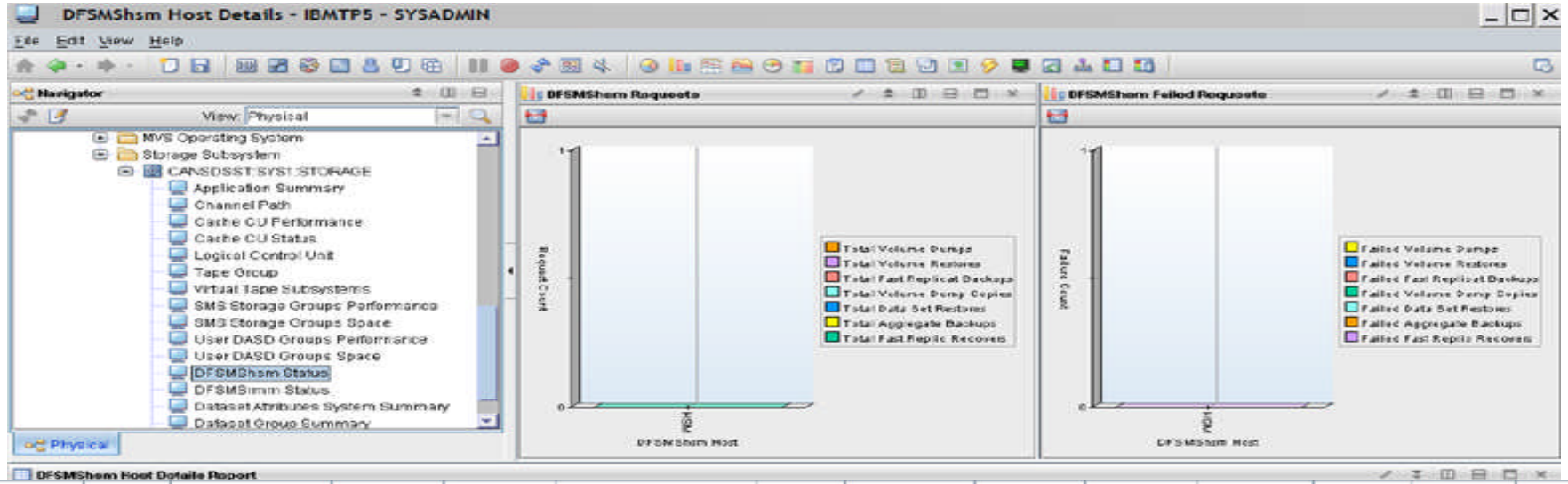
Monitoring

HSMplex and Common Recall Queue



Monitoring

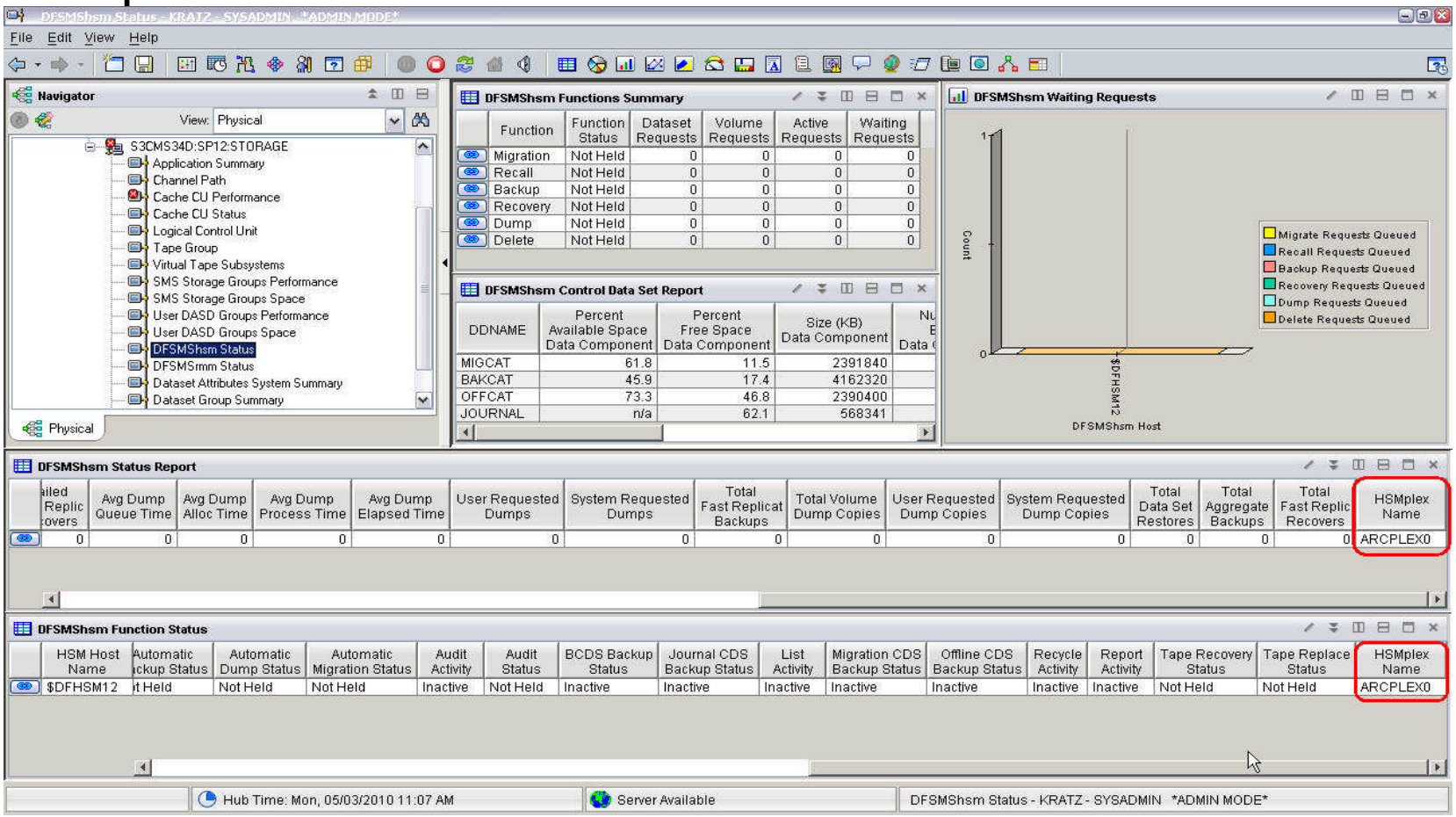
Hosts in your HSMplex



	HSM Host Name	HSM Host ID	HSM Host Type	HSM Host Status	HSM Host ASID	HSM Host Start Time	Interval Abends	Interval CPU Usage	Interval Requests	Interval Start Time	Volume Migrations	Volume Backups	Recycled Migration Volumes	Recycled Back Up Volumes
	HSM	1	Main(Primary)	Active	0X0055	02/20/11 11:24:28	0	0.8	8	08:01:28	0	0	0	0

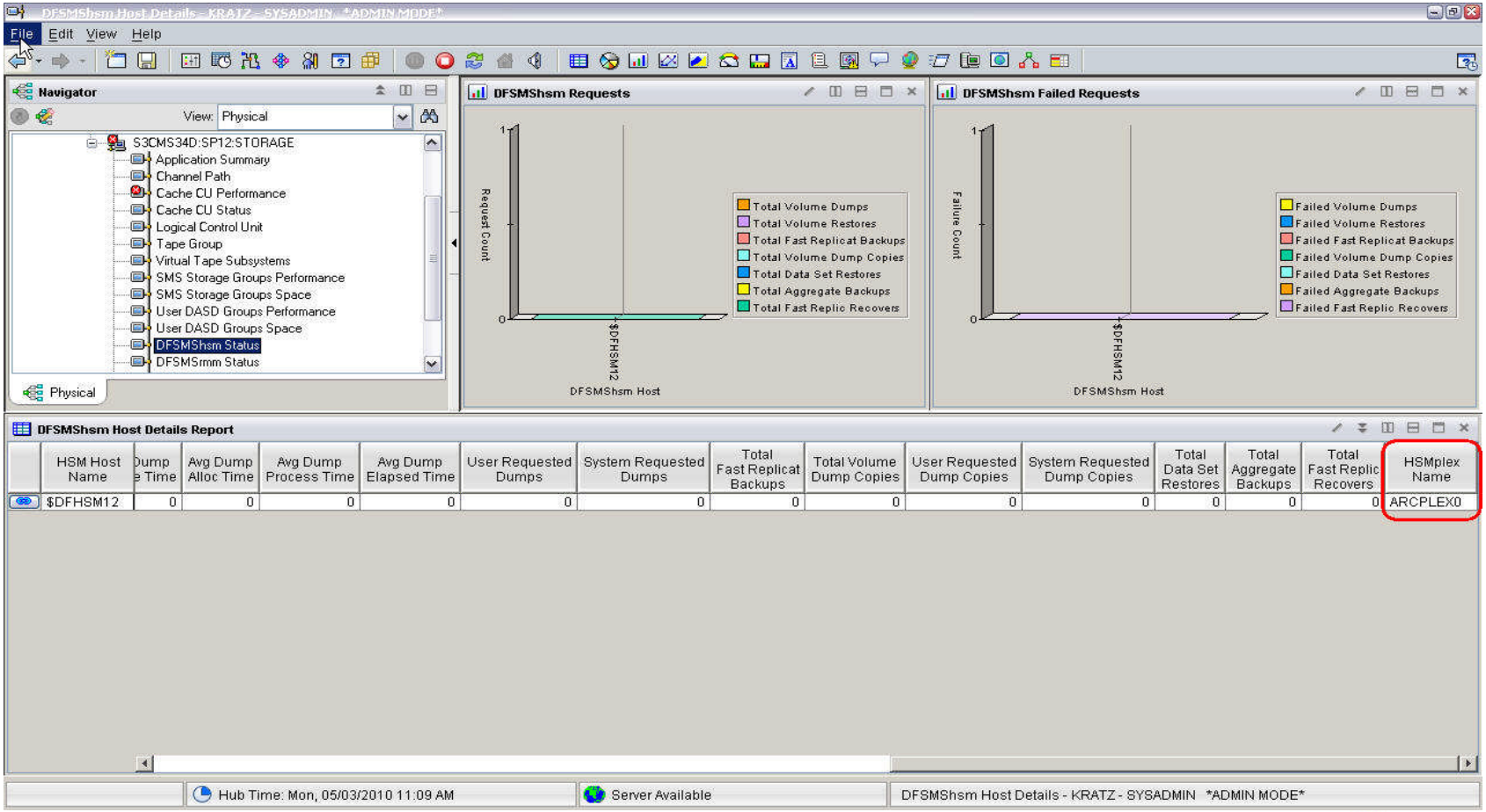
Monitoring

HSMplex information



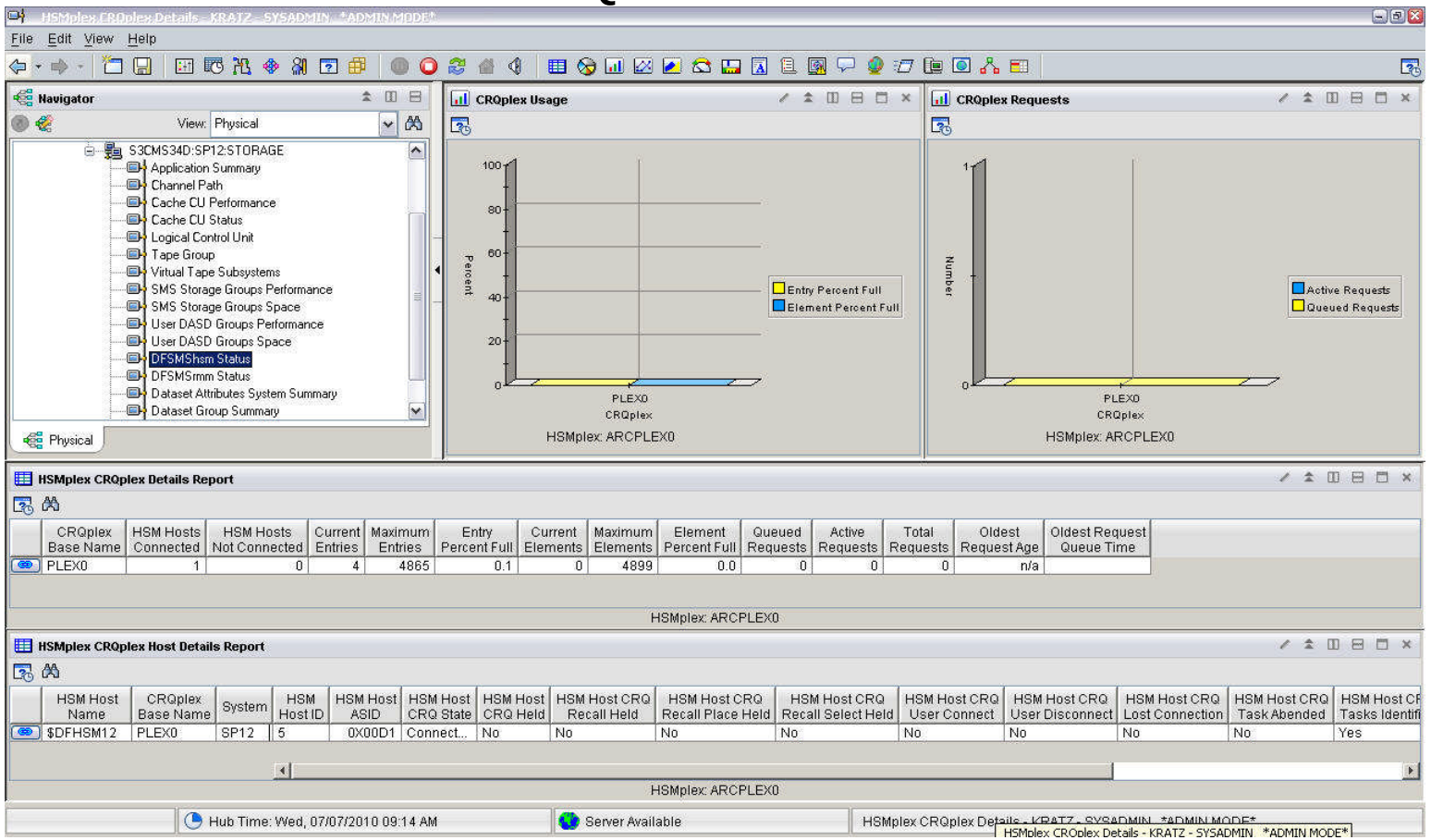
Monitoring

HSM Host Details



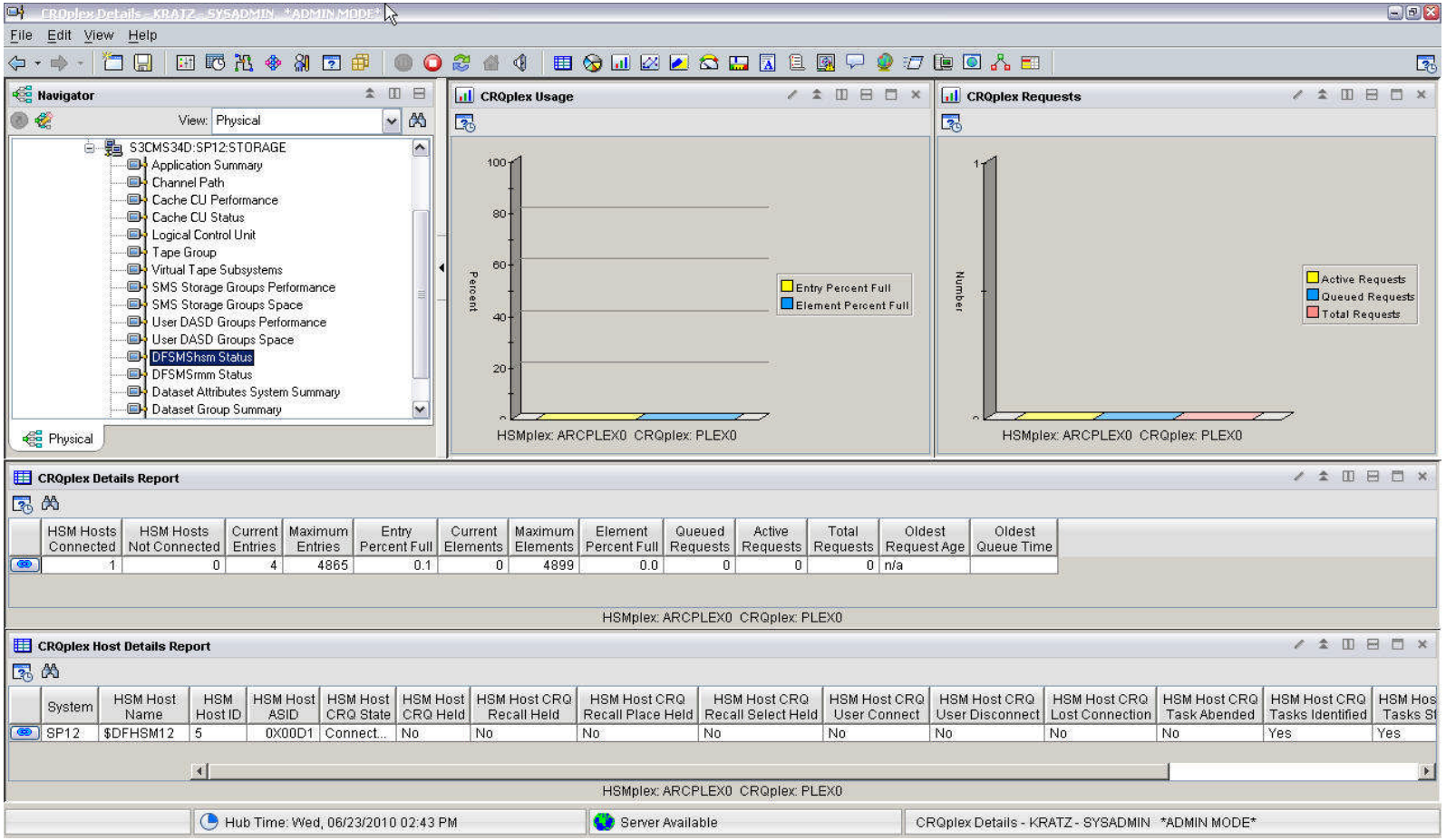
Monitoring

HSM Common Recall Queue Details



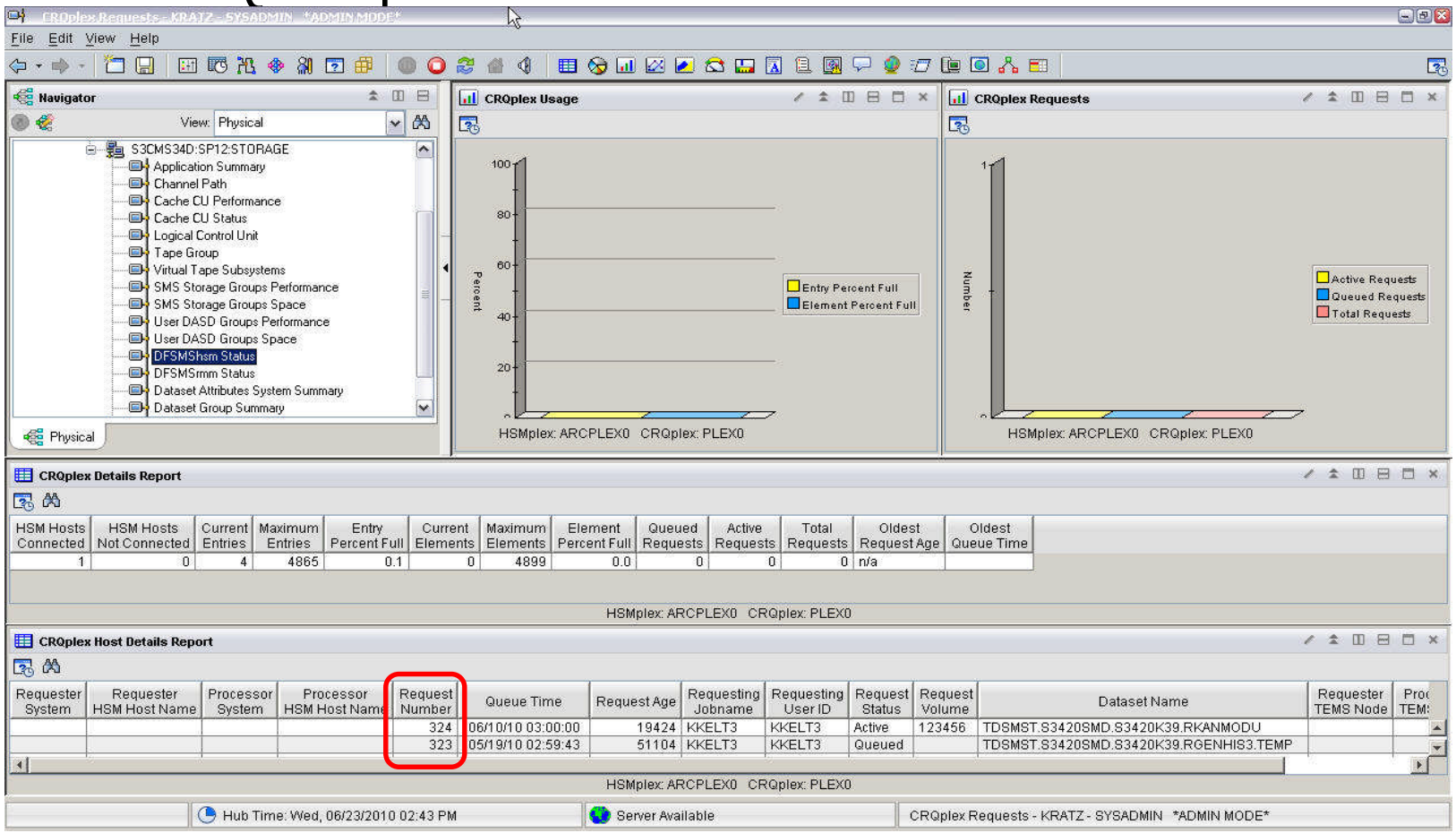
Monitoring

HSM CRQPlex Details



Monitoring

HSM CRQ Requests



Monitoring

The monitoring tools aren't just used to look at the information from another product!

Let the TOOLs work for you….

Automate the monitor to look at value and WARN you

Send out a Page, text or email

Issue a command

Rest easy (or get your other work done) knowing your HSM's health is clean

Recap

- Introduction
- HSM Status
- Control data sets and journal
- Information sources
- Return Codes and reporting
- Common causes for migration and backup failures
- Thrashing
- Storage Group thresholds
- Message automation
- Reorganizing Control Data Sets
- HSM Audits
- Monitoring

Managing HSM so that HSM doesn't manage you!

Session Number 09351