



Managing HSM so that HSM doesn't manage you!

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1

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2

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3

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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

4



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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.

5

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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

6

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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 work

7

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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
 - *Need to reside on the same disk volume*
- HSMLOGY data set can be analyzed using ARCPRLG/ARCPEDIT programs

8

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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

```

FUNC=MIGRATE LO->L2          TOVOL=500361  FAVOL=SMS004  JOBNM=HSM      AC=00019  REAS=00000
TIMES: REQUEST RECEIVED=130159, STARTED=130159, ALLOCATED=130200, ENDED=130200.
DSN=ITM622.ADCD.RKOSTHRE          DSORG=VS      RECFM=
DLU=10245  DLM=00000  BYTR=000000000  TRKR=000000    BYTU=000000000  TRKU=000000
04EC0000 02F10000 00000000 0000E2E0 E2F1C0E2 04404040 40400000 00000000
00005C5C 08E2D45C 5C5C0300 09E3D4F6 F2F24BC1 04C3C440 0902C4E2 E3C0D9C5
40404040 40404040 40404040 40404040 40404040 40404040 40404040 40404040
8083E2D4 E2F0F0F4 00000000 00000013 00000000 00000000 00000000 00000000
00000000 00000000 0111039F 13015992 13015992 13020006 13020002 0110245F
0000000F 00000000 00000000 00000000 00000000 00000003 00000000 00000000
00000005 E2C3C4C5 C6404040 00000000 00000000 0005D4C3 D7D9C440 40400000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
00000000 00000000 00000000 00000000 00000000 00000000 00000000 00000000
F1400000 00000000 00000000
LEN=0150  TOD=130200  DATE=11/02/08  ID=03  NAME=OUTPUT MSG TO OPER/USER
MSGID=0734  TD=**OPER**  NI=9  ARC0734I ACTION=MIGRATE FAVOL=SMS004 TOVOL=500361 TRACKS= 16 AC= 19, REASON= 0, AGE=
159, DSN=ITM622.ADCD.RKOSTHRE
  
```

ARCPRINT EDITLOG



- EDITLOG shows request but does not show outcome

```
***** TOD=130200 DATE=08111839 NAME=MIGRATION ENDED *****  
FUNC=MIGRATE L0->L2          TOVOL=500361  FRVOL=SMS004  DEVT=43048003  START=130159  END=130200  
DSN=ITM622.ADCD.RKDSTHRE          DSORG=VS    RECFM=  
BATCH REQUEST    NOWAIT SPECIFIED  
SYSTEM REQUEST  
***** TOD=130200 DATE=08111839 NAME=MIGRATION ENDED *****
```

11

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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 LOGY
- 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

12

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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)

15

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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.....

16

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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 records.
 - Requires other OEM software license
 - SAS
 - What is the plan for support and knowledge transfer?

17

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

18

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      DFSMSshm ABARS Report      HSM
- ARCGAR01 ABARS ARECOVER Statistics      DFSMSshm ABARS Report      HSM
- ARCGDB01 DCOLLECT BACKUP DATA          DFSMSshm DCOLLECT BACKUP   P390
- ARCGDD01 DCOLLECT DASD CAPACITY PLANNIN DFSMSshm DCOLLECT DASD CAP P390
- ARCGDM01 DCOLLECT MIGRATION DATA       DFSMSshm DCOLLECT MIGRATION P390
- ARCGDT01 DCOLLECT TAPE CAPACITY PLANNIN DFSMSshm DCOLLECT TAPE CAP P390
- ARCGS001 Statistics for DFSMSshm        DFSMSshm FSR-SMF Records    HSM
- ARCGS002 Statistics for Backup           DFSMSshm FSR-SMF Records    P390
- ARCGS003 Statistics for Migration        DFSMSshm FSR-SMF Records    P390
- ARCGS004 Statistics for Recall           DFSMSshm FSR-SMF Records    P390
- ARCGS005 Statistics for Recovery         DFSMSshm FSR-SMF Records    HSM
- ARCGS006 Statistics for Volume Dump     DFSMSshm FSR-SMF Records    HSM
- ARCGS007 Statistics for Restore from Du DFSMSshm FSR-SMF Records    HSM
- ARCGS008 Statistics for FRBACKUP        DFSMSshm FSR-SMF Records    HSM
- ARCGS009 Statistics for FRRecover       DFSMSshm FSR-SMF Records    HSM
- ARCGS010 DFSMSshm Thrashing Report       DFSMSshm 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	SVS2.RMM.CONTROL.FILE	SMS001	68	412	0
2011040	12003937	DSN810.DSNDBC.BJTBASE.BJTARCSP.I0001.A001	SMS0M1	68	412	0
2011040	12004166	ITM622.ADCD.ARNSGRP1	SMS001	19	0	0
2011040	12004220	DSN810.DSNDBC.BJTBASE.BJTATTSP.I0001.A001	SMS0M1	68	412	0
2011040	12004950	DSN810.DSNDBC.BJTBASE.BJTARCSP.I0001.A001	SMS0M1	0	0	16612
2011040	12004959	ITM622.ADCD.ARNSGRP1	SMS001	0	0	8323
2011040	12004962	SVS2.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	SMS0M1	68	412	0
2011040	12005057	AKD.MEDIACCTL.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.OCCDS.TTCVAUDT	SMS001	0	0	23
2011040	12005271	IXGLDGR.ATR.ADCDPL.DELAYED.UR.ADCDPL	SMS001	68	412	0
2011040	12005331	ITM622.ADCD.ARNSGRP1	SMS001	19	0	0
2011040	12005739	DSN810.DSNDBC.BJTBASE.BJTATTSP.I0001.A001	SMS0M1	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	10836
2011041	13001273	SYS2.RMM.HSKP.MESSAGE.SHAVE.G2712V00	0001	SMS002	0	0	6
2011041	13001399	ITM622.ADCD.RKDSSTSA	0000	SMS002	19	8	8
2011041	13001565	ITM622.ADCD.RKDSCKPT	0000	SMS002	19	8	8
2011041	13001612	ITM622.ADCD.RKDSQURY	0000	SMS002	19	8	8
2011041	13001633	ITM622.ADCD.RKDSYST	0000	SMS002	19	8	8
2011041	13001649	ITM622.ADCD.RKDSSEPM	0000	SMS002	19	8	8
2011041	13001666	ITM622.ADCD.RKDSSEVP	0000	SMS002	19	8	8
2011041	13001680	ITM622.ADCD.RKDSGRPC	0000	SMS002	19	8	8
2011041	13001696	SYS2.BJTBASE.BJTBUCCSP.D2011039.T101622	0002	SMS002	0	0	24
2011041	13002005	SYS2.BJTBASE.BJTUWNSP.D2011040.T001701	0002	SMS002	0	0	12
2011041	13002090	SYS2.BJTBASE.BJTDOSSP.D2011039.T101622	0002	SMS002	0	0	1983
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.BJTANSP.D2011040.T001701	0002	SMS002	0	0	96
2011041	13002595	SYS2.BJTBASE.BJTUISP.D2011040.T001701	0002	SMS002	0	0	8
2011041	13002671	SYS2.BJTBASE.BJTAVRSP.D2011040.T001701	0002	SMS002	0	0	8

21



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

22



ISPF view of Migration errors

```

FILTERED VIEW OF MIGRATE/BACKUP
Enter 0 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 Rsn  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.SMCRLD                    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

```

23

Drill-down from migration errors

```

Rc/Rsn  ----- Advanced Reporting for DFSMSshm V2R3 ----- 13:58
Command ==> █

Refer to DFHSM message ARC1299I for more information
MIGRATE Return Code 99 - UNSUPPORTED DS
Reasons=> 00014 DSN IS APF AUTHORIZED LIBRARY

```

24

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
CM	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	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 (migration/backup) –
 - 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
 - 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 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) / DFSS errors (rc68) / vtoc discrepancy (rc87)*
 - *Waste of DFSMSHsm resources*

27

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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).
 - Everyday 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

28

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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.ABARSHGR.JCLPROF	0	293	SMS002	MCDEF	1
2011045	15315281	P390.ABR.DENO.INSTJCL	0	441	SMS006	MCDEF	1
2011045	15315297	P390.ABR.DENO.XFRBIN	0	293	SMS008	MCDEF	1
2011045	15315314	P390.ABR.DENO.XFRBINR	0	475	SMS006	MCDEF	1
2011045	15320662	P390.ABARSHGR.JCLPROF	2	0			1
2011045	15320679	P390.ABR.DENO.INSTJCL	2	0			1
2011045	15320694	P390.ABR.DENO.XFRBIN	2	0			1
2011045	15320711	P390.ABR.DENO.XFRBINR	2	0			1
2011045	15320727	P390.ABRACD1.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

33

Thrashing

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

```
DFSMShm Thrashing Report - 1 - 02/14/2011 15:54:02
```

DSN	AGE	SIZE KB	DATE	TIME REQ	JOB NAME REQUEST IN SERVICE	TARGET	MC NAME
ARH238.GLOBAL.CSI	0	1444	2811039	14283238	CONS INV	SHS088	MCPRD
ARH238.GLOBAL.CSI	0	1444	2811039	14283871	CONS INV	SHS089	MCPRD
ARH238.GLOBAL.CSI	0	1444	2811039	14284894	CONS INV	SHS089	MCPRD
ARH238.GLOBAL.CSI	0	1444	2811039	14284701	CONS INV	SHS087	MCPRD
ATH319.GLOBAL.CSI	0	722	2811039	14285148	CONS INV	SHS086	MCPRD
B3T238.GLOBAL.CSI	0	1444	2811039	14285417	CONS INV	SHS086	MCPRD
GL0319.GLOBAL.CSI	0	722	2811039	14218189	CONS INV	SHS088	MCPRD
HDSM612.GLOBAL.CSI	0	3125	2811039	14218468	CONS INV	SHS086	MCPRD
HSMFCT.H1.ABACKUP.OM.D11834.T893138	1	37	2811041	15468296	P398	SHS087	MCINACT
P398.SMPE.CHTL	0	689	2811039	14195843	P398	SHS087	MCSPEC
SYS2.ARH238.SMPE.CHTL	0	156	2811039	14421312	P398	SHS087	MCDEF
SYS2.MXH8982.SMKHCPDS	1	188	2811039	08823825	MXKHJOB	SHS088	MCDEF
SYS2.MXH8982.SMKHMSG	1	229	2811040	08823832	MXKHJOB	SHS088	MCDEF
SYS2.SMF DUMP.G2412V88	0	97842	2811040	19128984	JES2	SHS083	MC SHF 21
SYS2.SMF DUMP.G2413V88	0	108959	2811041	14898852	JES2	SHS087	MC SHF 21

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

- These are not really thrashing
- Review SETSYS MAXEXTENTS

34

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)

37

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Automation for early completion



- 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

38

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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

- Should you reorganize a Control Data Set (cont) ?
- 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

Reorganizing Control Data Sets

- Should you reorganize a Control Data Set (cont) ?
 - Look for alternative solutions
 - Correct sizing of CDSs
 - Reorg While Active products
 - CA Reclaim (Session 9007, 11am, Room 201C)
 - Review why and if needed, use tested procedure
 - Is there a performance increase 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 I-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 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

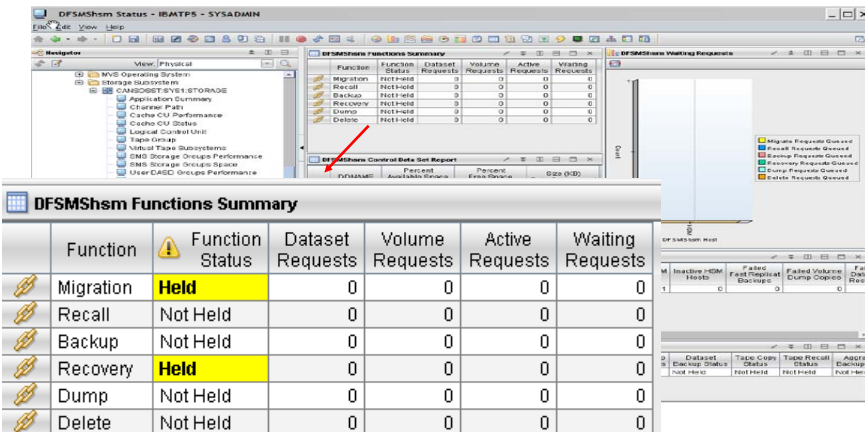
Items to be monitored

- 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

45

Monitoring

- HSM Function Status



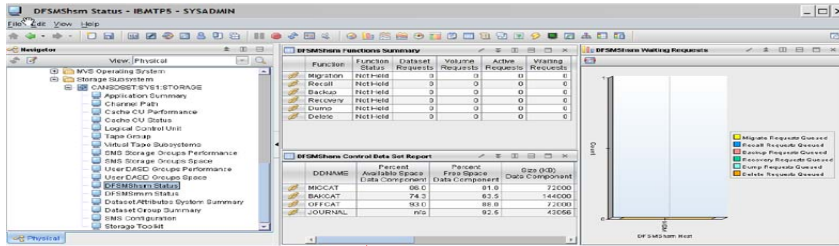
The screenshot shows the DFSMSHsm Functions Summary report. A red arrow points to the 'Control Data Set Report' link in the navigation pane. The summary table is as follows:

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

46

Monitoring

- HSM CDS Utilization



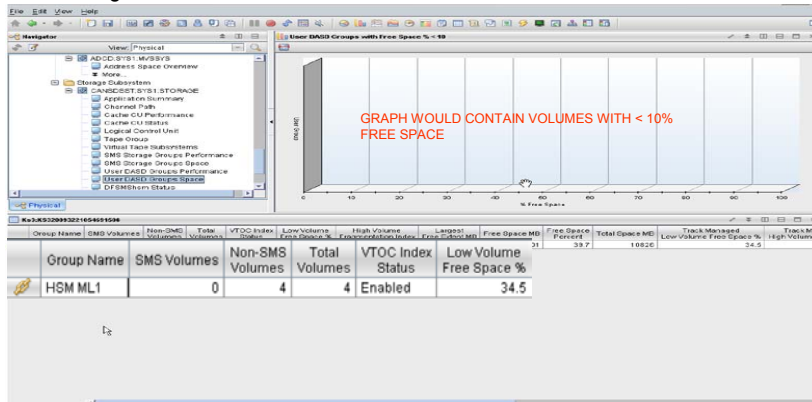
DFSMSHsm Control Data Set Report

	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

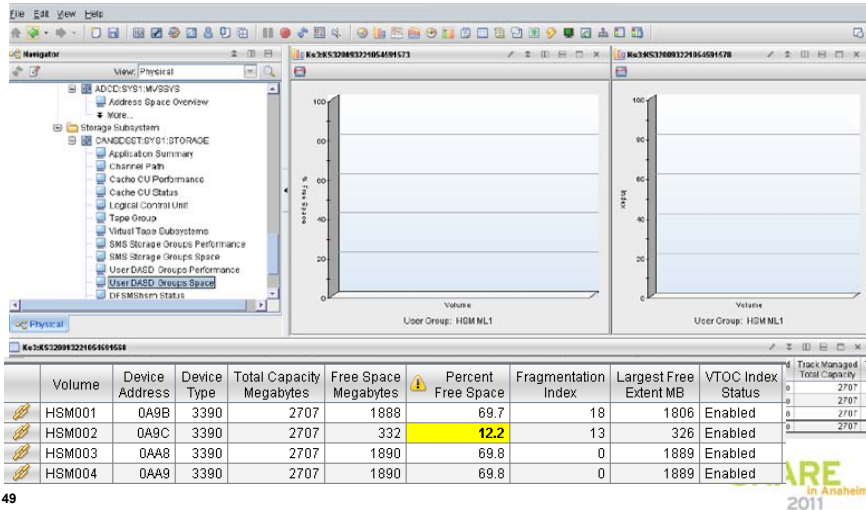
HSM ML1 Volume Utilization

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



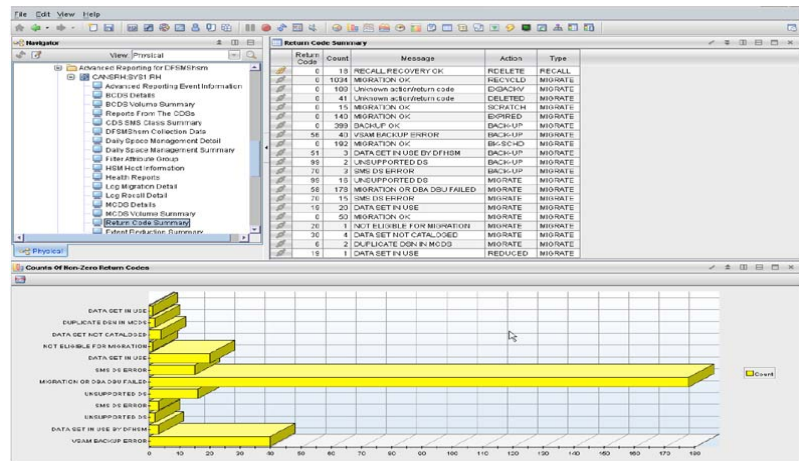
Monitoring

HSM ML1 Volume Utilization DETAILS



Monitoring

Return Codes

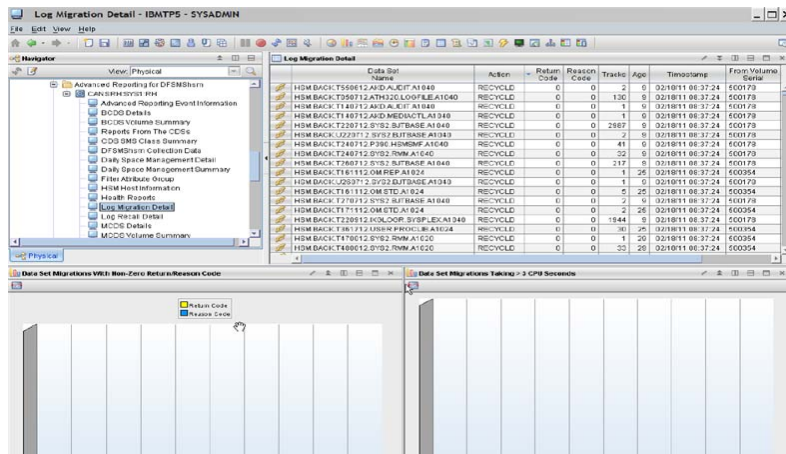


Monitoring Return Codes

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	

51

Monitoring Migration Return Codes



Cds/Dir Name	Action	Return Code	Reason Code	Tracks	Age	Timestamp	From Volume Serial
HSM BACK: T558612.AHD.ALCIT A1040	RECYCLD	0	0	2	0	02/18/11 06:37:24	E00079
HSM BACK: T289712.AHD.LOOP.LEX A1040	RECYCLD	0	0	130	0	02/18/11 06:37:24	E00079
HSM BACK: T148712.AHD.ALCIT A1040	RECYCLD	0	0	1	0	02/18/11 06:37:24	E00079
HSM BACK: T148712.AHD.MEDUCL A1040	RECYCLD	0	0	1	0	02/18/11 06:37:24	E00079
HSM BACK: T220712.S7B2.BUTBASE A1040	RECYCLD	0	0	2887	0	02/18/11 06:37:24	E00079
HSM BACK: U223712.S7B2.BUTBASE A1040	RECYCLD	0	0	2	0	02/18/11 06:37:24	E00079
HSM BACK: T248712.S7B2.RMM A1040	RECYCLD	0	0	41	0	02/18/11 06:37:24	E00079
HSM BACK: T248712.S7B2.RMM A1040	RECYCLD	0	0	32	0	02/18/11 06:37:24	E00079
HSM BACK: T280712.S7B2.BUTBASE A1040	RECYCLD	0	0	217	0	02/18/11 06:37:24	E00079
HSM BACK: T16112.OM.REP A1024	RECYCLD	0	0	1	26	02/18/11 06:37:24	E00354
HSM BACK: U253712.S7B2.BUTBASE A1040	RECYCLD	0	0	1	0	02/18/11 06:37:24	E00079
HSM BACK: T16112.OM.ETD A1024	RECYCLD	0	0	5	25	02/18/11 06:37:24	E00354
HSM BACK: T270712.S7B2.BUTBASE A1040	RECYCLD	0	0	2	0	02/18/11 06:37:24	E00079
HSM BACK: T1115.OM.ETD A1024	RECYCLD	0	0	2	26	02/18/11 06:37:24	E00354
HSM BACK: T220912.KOLLOOR.S7B2.LEX A1040	RECYCLD	0	1844	0	0	02/18/11 06:37:24	E00079
HSM BACK: T16112.OM.REP A1024	RECYCLD	0	0	30	25	02/18/11 06:37:24	E00354
HSM BACK: T170612.S7B2.RMM A1020	RECYCLD	0	0	1	20	02/18/11 06:37:24	E00354
HSM BACK: T480612.S7B2.RMM A1020	RECYCLD	0	0	35	26	02/18/11 06:37:24	E00354

52

Audit Example



The screenshot shows the 'Migration Control Data Set Error Summary' window. The main pane displays a table of errors with columns for Error ID, Error Count, Recard Count, and Error Message. The error messages include issues like 'MCD ENTRY IS NOT CATALOGED', 'MCD VSIAM COMPONENT IS NOT CATALOGED', and 'MCD LEVEL 1 ENTRY HAS NO VTIOC ENTRY ON LI VOLUME'. A 3D bar chart titled 'MCD Error Summary' is visible in the bottom right, showing error counts for various error IDs, with the highest count for 1117C.

Error ID	Error Count	Recard Count	Error Message
1101C	0	0	MCD ENTRY IS NOT CATALOGED
1101C	0	0	MCD VSIAM COMPONENT IS NOT CATALOGED
1102C	3	3	MCD ENTRY IS CATALOGED ON DIFFERENT VOLUME
1102C	0	0	MCD VSIAM COMPONENT ON DIFFERENT VOLUME
1103W	0	0	MCD ENTRY IS MISSING THE MCA ENTRY
1104C	3	3	MCD LEVEL 1 ENTRY HAS NO VTIOC ENTRY ON LI VOLUME
1104C	0	0	MCD VSIAM BASE NAME IS MISSING IN MCD
1105W	0	0	MCD IS ON VOLUME WHICH HAS NO MCV ENTRY
1106W	0	0	SUMMARY OF VOLUMES HAVING NO MCV ENTRY
1107W	0	0	MCD LEVEL 2 IS ON VOLUME WHICH HAS NO TTIOC ENTRY
1107W	0	0	SUMMARY OF VOLUMES MISSING IN TTIOC
1108W	0	0	MCA ENTRY IS MISSING MCD VSIAM COMPONENT ENTRY
1109W	0	0	MCD ALIAS IS NOT ON TTIOC
1110W	0	0	MCD HAS DUPLICATE MCA ENTRY
1111W	0	0	MCA ENTRY IS MISSING MCD ENTRY
1112W	0	0	MCD VSIAM BASE NAME IS MISSING IN MCD
1113W	0	0	MCD VSIAM COMPONENT NAME IS MISSING IN MCA
1114W	0	0	ALIAS NAME EXISTS ON VTIOC, MCA IS MISSING
1115W	0	0	VTIOC ALIAS NAME HAS VTIOC ERROR

53



Monitoring

HSM user catalog Space and Backup Status



The screenshot shows the 'Catalog Summary' window. The main pane displays a table of catalog entries with columns for Catalog Name, Volume Based, Capacity, Primary/Secondary, Capacity Type, Backup Code, Last Backup, and Timestamp. Below the table are two 3D bar charts: 'Most Volume' and 'Primary Secondary, Alarms', showing the distribution of catalog entries across different categories.

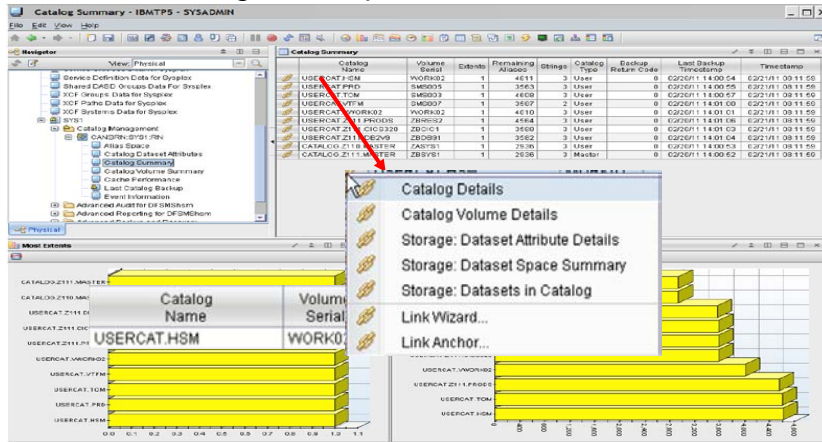
Catalog Name	Volume Based	Capacity	Primary/Secondary	Capacity Type	Backup Code	Last Backup	Timestamp
USERCAT 10M	107952	1	4511	3 User	0	02/01/11 08:04	02/01/11 08:05
USERCAT 10M	107952	1	2963	3 User	0	02/01/11 08:05	02/01/11 08:05
USERCAT 10M	107952	1	4008	3 User	0	02/01/11 08:05	02/01/11 08:05
USERCAT 10M	107952	1	2657	2 User	0	02/01/11 08:05	02/01/11 08:05
USERCAT 10M	107952	1	4193	3 User	0	02/01/11 08:05	02/01/11 08:05
USERCAT 2111 PROCS	209352	1	4984	3 User	0	02/01/11 08:05	02/01/11 08:05
USERCAT 2111 PROCS	209352	1	3900	3 User	0	02/01/11 08:05	02/01/11 08:05
USERCAT 2111 DR219	209352	1	3552	3 User	0	02/01/11 08:04	02/01/11 08:05
USERCAT 2111 DR219	209352	1	2636	3 User	0	02/01/11 08:04	02/01/11 08:05
CATALOG 2111 MASTER	209352	1	2036	3 Master	0	02/01/11 08:02	02/01/11 08:05

54



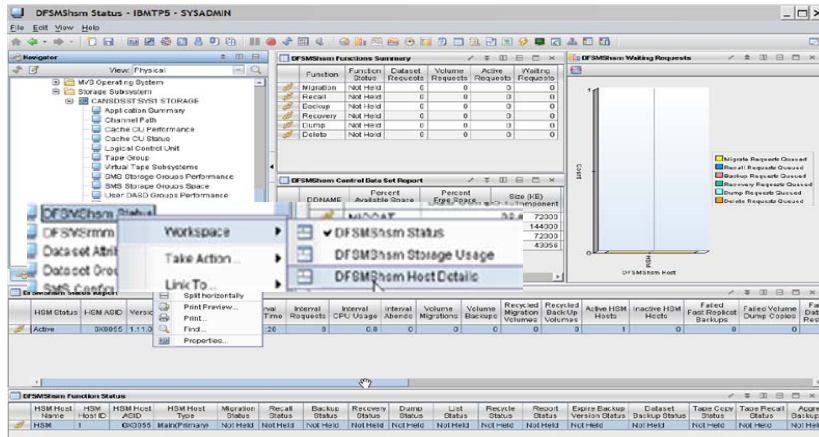
Monitoring

HSM user catalog backup status. Extents

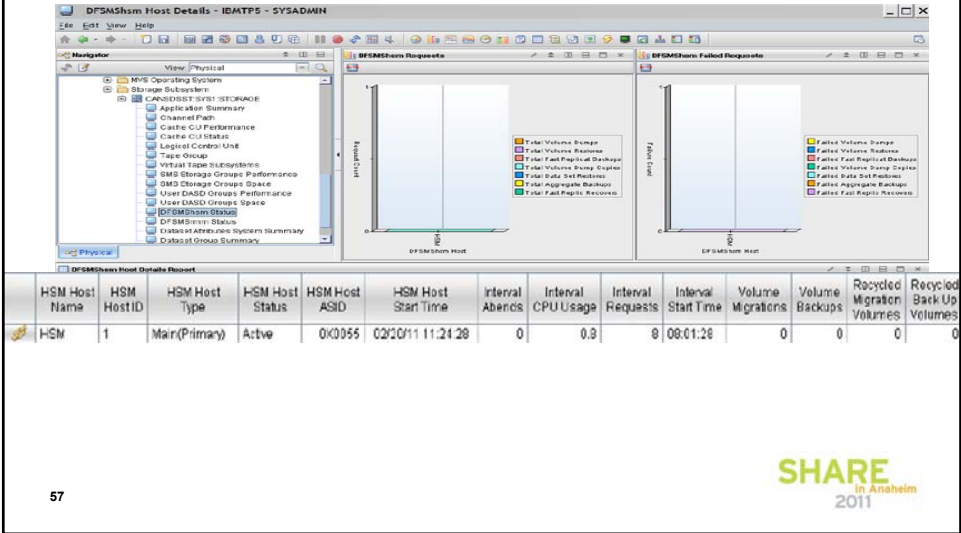


Monitoring

HSMplex and Common Recall Queue

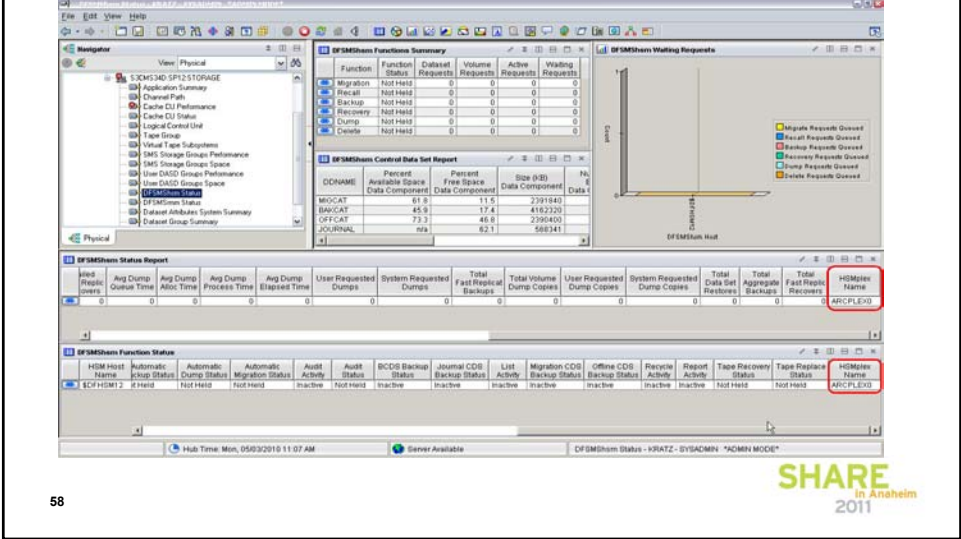


Monitoring Hosts in your HSMplex



HSM Host Name	HSM HostID	HSM Host Type	HSM Host Status	HSM Host ASID	HSM Host Start Time	Internal Aborts	Internal CPU Usage	Internal Requests	Internal Start Time	Volume Migrations	Volume Backups	Recycled Migration Volumes	Recycled Back-Up Volumes
HSM	1	Main(Primary)	Active	0K0055	02/20/11 11:24:28	0	0.0	8	08:01:28	0	0	0	0

Monitoring HSMplex information



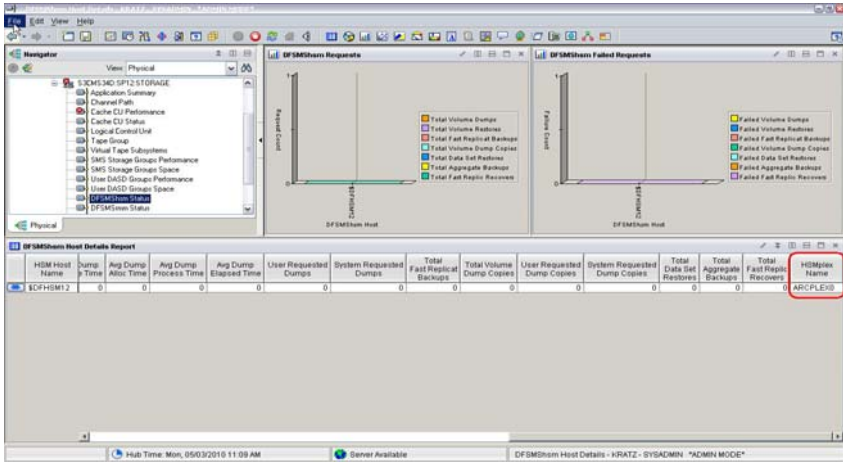
Function	Function Status	Dataset	Volume Requests	Active Requests	Waiting Requests
Migration	Not Held	0	0	0	0
Recall	Not Held	0	0	0	0
Backup	Not Held	0	0	0	0
Recovery	Not Held	0	0	0	0
Dump	Not Held	0	0	0	0
Delete	Not Held	0	0	0	0

DFSMShm Status Report	Active Requests	Avg Dump Queue Time	Avg Dump Alloc Time	Avg Dump Process Time	User Requested Dumps	System Requested Dumps	Total Failed Backups	Total Volume Dump Copies	User Requested Dump Copies	System Requested Dump Copies	Total Data Set Restores	Total Aggregate Backups	Total Fast Reps Recovered	HSMplex Name
	0	0	0	0	0	0	0	0	0	0	0	0	0	ARCPL50

HSM Host Name	Automatic Backup Status	Automatic Migration Status	Auto Activity	Auto Status	CCDS Backup Status	Journal CDS Activity	List Activity	Migration CDS Backup Status	Offline CDS Backup Status	Recycle Activity	Report Activity	Tape Recovery Status	Tape Restore Status	HSMplex Name
DFHSM12	Not Held	Not Held	Not Held	Inactive	Not Held	Inactive	Inactive	Inactive	Inactive	Inactive	Inactive	Not Held	Not Held	ARCPL50

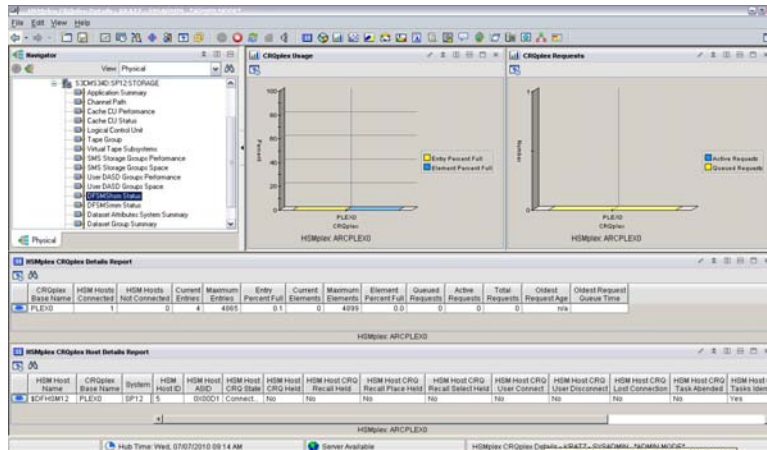
Monitoring

HSM Host Details



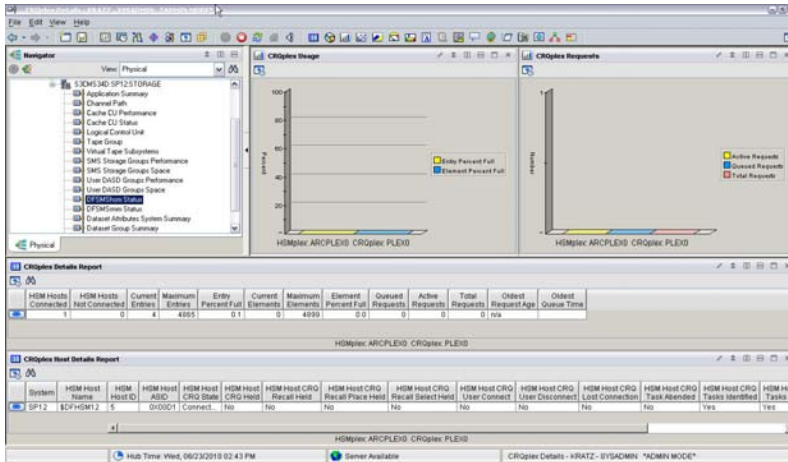
Monitoring

HSM Common Recall Queue Details



Monitoring

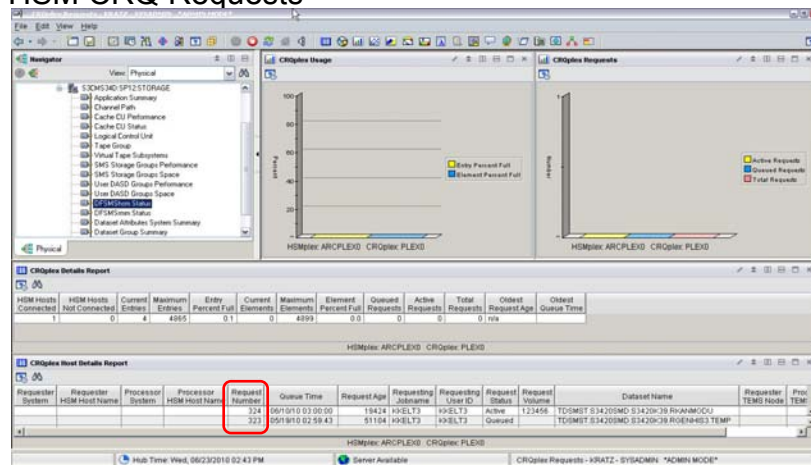
HSM CRQ Plex Details



61

Monitoring

HSM CRQ Requests



62

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