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What's New in DFSMShsm

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IBM

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SHARE in Boston

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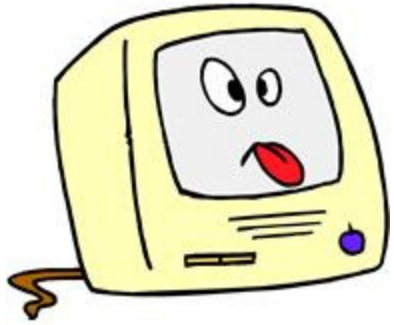
Agenda

- **General**
  - QUERY ACTIVE
  - RLS Server Error
  - UCB Storage Relief
  - Storage Group Priority
  - Recover w/ NEWNAME
- **Migration**
  - Throughput Improvements
- **Tape**
  - >40 Tapes
  - RECYCLE in place of TAPECOPY
  - Automatic restart of RECYCLE
- **Fast Replication**
  - Consistency Groups
  - Recover Data Set Enhancements
  - Performance
  - Usability
  - UCB Refresh
- **Storage Tiering**
- **Miscellaneous**

General
QUERY ACTIVE

- **Today:** You have a problem with a tape drive and need to cancel the associated HSM task, but how do you know which one to cancel?



- **V2R1:** QUERY ACTIVE(TCBADDRESS) includes tape volser, device address and task name.

```
ARC0161I MIGRATING VOLUME TPR18B FOR USER **AUTO**, REQUEST
NONE,TASK=MVOL1,TCB=x'00747690'; VOL=TPR18B, ADDR=0F12;
VOL=T00001, ADDR=0B30; VOL=NONE, ADDR=NONE
```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General
SMSVSAM Server (RLS) Error Handling

- **Today:** When DFSMShsm accesses the CDSes in RLS mode and an SMSVSAM server error occurs:
  - DFSMShsm takes a fatal abend and shuts down
  - After DFSMShsm is restarted, all DFSMShsm requests that were in progress at the time of the SMSVSAM server error are lost and must be reissued to complete.

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General
SMSVSAM Server (RLS) Error Handling

- **V2R1:** When an SMSVSAM server error occurs:
  - DFSMShsm will detect the error, and quiesce all CDS I/O activity
  - Once the SMSVSAM server initializes, DFSMShsm will automatically close and reopen the CDSes and continue processing
  - I/Os that failed will be retried
    - Some DFSMShsm requests that are in progress at the time of the server error may fail, depending on the timing of the error with respect to a series of I/O operations required to complete the request

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General
Virtual Storage Constraint Relief

- **Today:** DFSMShsm's large customers face periodic 878-Abends.
  - These abends have repetitively been shown to be caused by DFSMShsm capturing a high number **UCBs below-the-line**. Historically, DFSMShsm was required to capture UCBs below-the-line due to certain called services requiring UCBs to reside below-the-line.

- **V2R1:** DFSMShsm will no longer capture UCBs below-the-line. All services have been updated to be able to process UCBs in 31-bit addressing mode.

UCB: Unit Control Block that describes a device

General
Storage Group Priority

- The new Storage Group Processing Priority specifies the relative order in which storage groups should be processed during Automatic Space Management and Backup Processing
  - Storage Groups will be processed in the order of their priority
    - A higher value means a higher priority
    - Valid values are 1-100
    - Default value is 50

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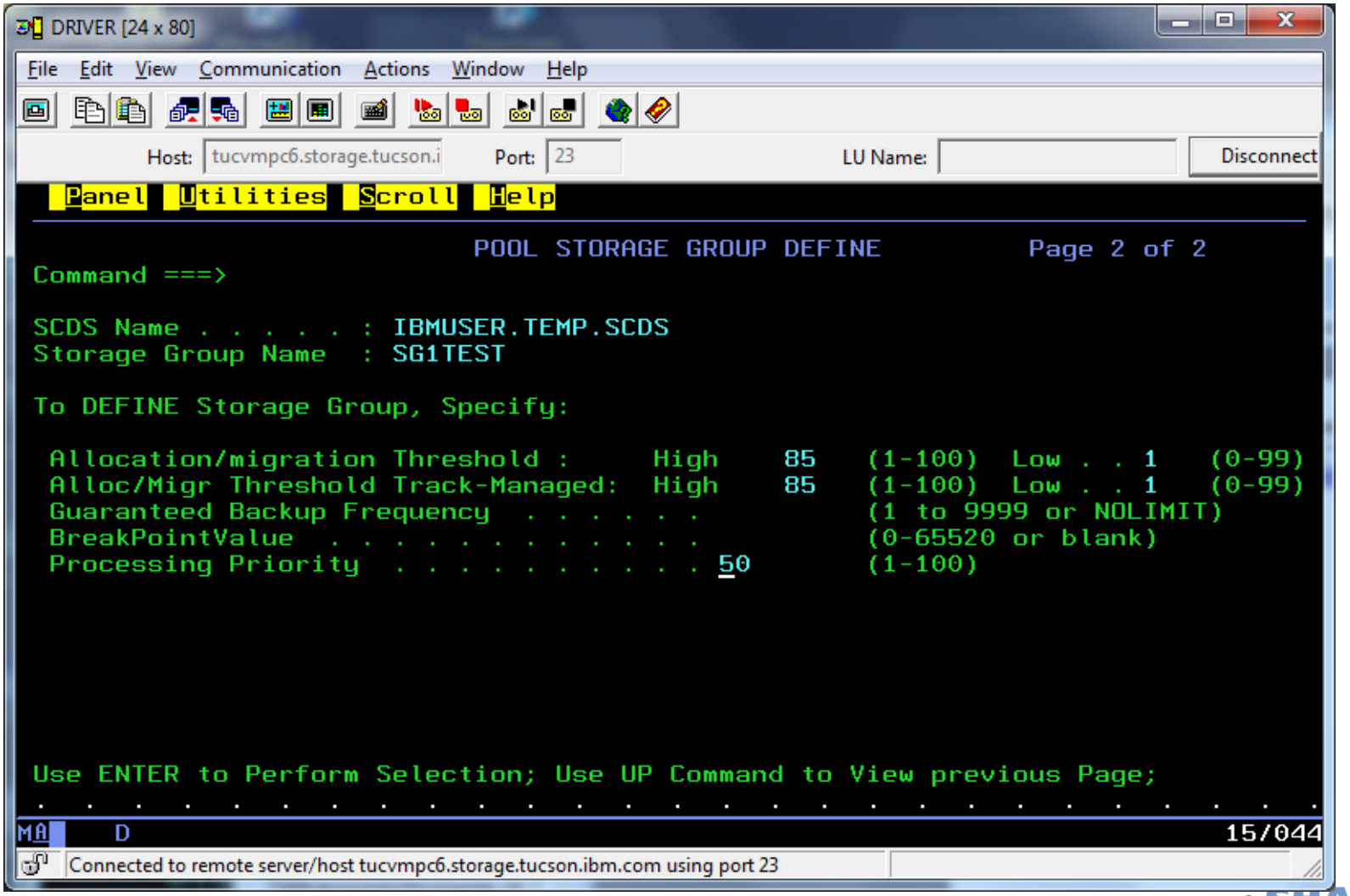
General
Storage Group Priority



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General
Recover VSAM data set with a NEWNAME

- **Today:** No support for renaming of a VSAM data set during recovery from dump.

- **V2R1:** Add Support
  - Existing optional parameter NEWNAME(newdsname) can now be specified for VSAM data sets when recovering with FROMDUMP

  - DFSMSdss RENAMEU and REPLACEU enhancements for this support
    - Physical data set COPY and RESTORE will be enhanced to support renaming of VSAM data sets when RENAMEUnconditional is specified. Renaming of AIX will remain unsupported.
    - Physical data set RESTORE will be enhanced to support REPLACEUnconditional.

  - Caveat – Data set can only be cataloged under certain conditions

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General
ARC0936I

- DFSMShsm can issue the ARC0936I message during processing of SMS-managed volumes. Today, when its return code is RC12, the SUBREAS 4-byte field is always zero.
- With this enhancement, when the FAST VVDS ACCESS interface returns RC12, REAS98, DFSMShsm will use the information in FVVPPROB field to put it into SUBREAS field of the ARC0936I message. This will help in diagnosing SMS VTOC/VVDS errors.

```
ARC0936I ERROR RETRIEVING SMS VTOC/VVDS DATA, FUNC = (ACCESS |
FREE), RC=retcode, REASON=reas1, SUBREAS=reas2
```

The explanation for RC = 12, REASON = 98 will be added to the message manual.

Code: RC = 12 REASON = 98-CATALOGENTRYMGR SUBREAS = Byte 1-Internal RC, Byte 2- Internal REASON, Bytes 3,4- catalog module identifier. Meaning: Error accessing CATENTRY.

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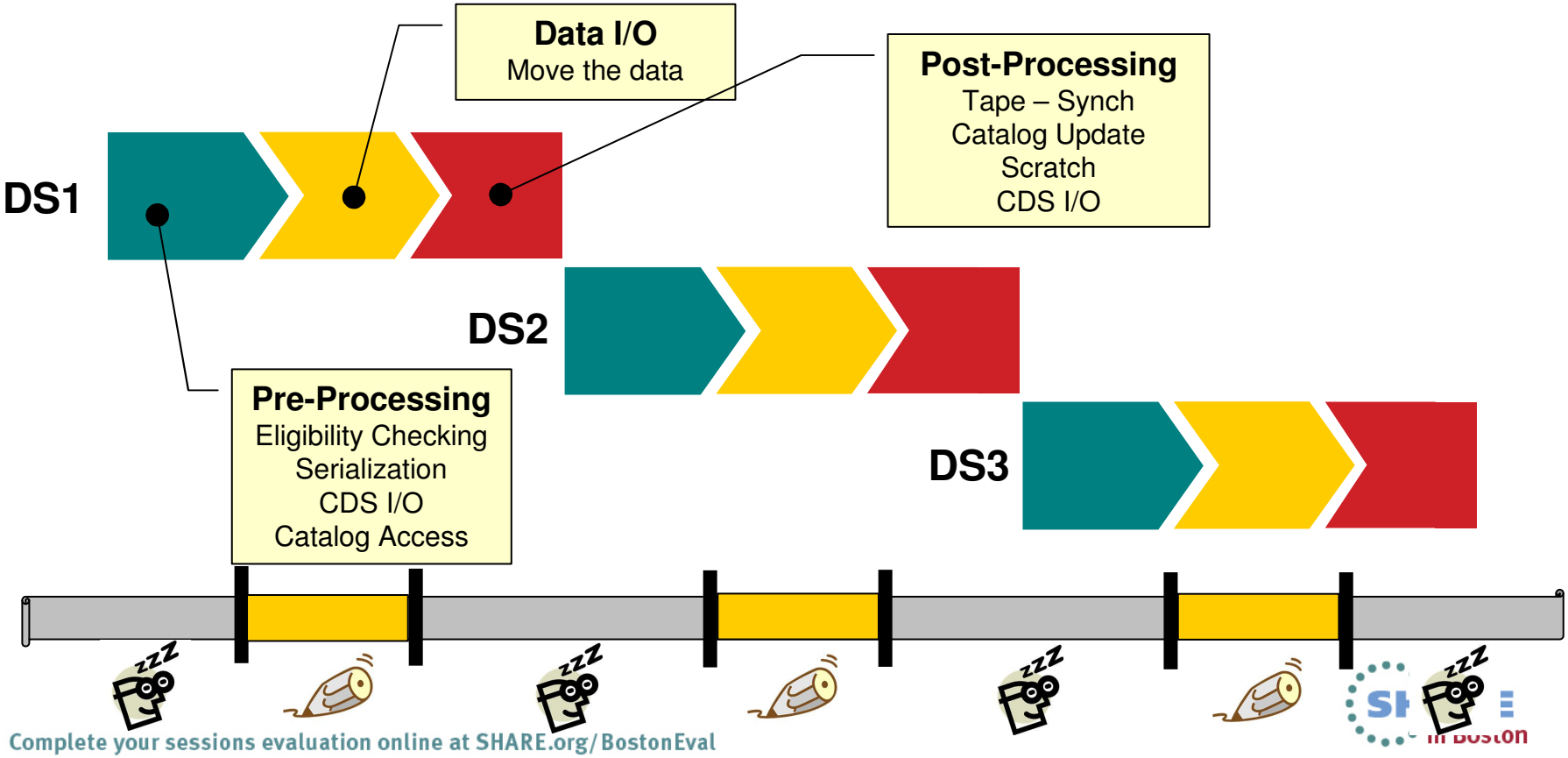
Migration
Throughput Improvement

- **Today:**
  - For small data sets, the overhead of pre- and post- migration processing accounts for as much as 2/3rds of the processing time.



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Migration
Throughput Improvement

- **V2R1:**
  - For each Data Movement Task, run multiple subtasks that overlap pre- and post-processing with data movement.

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Migration
Throughput Improvement

- Migration subtasking can be enabled for Primary Space Management, On Demand Migration and Interval Migration.

```
SETSYS:
            >__ ____________________________________ ___>
               |                               _YES_      |
               |_ _ MIGRATIONSUBTASKS_ _(__|_____|__)_|
                 |_ MIGRATIONSUBTASKS_ _(__|_____|__)_|
```

- MIGRATIONSUBTASKS(YES) enables the function and can only be specified on startup.

- The default number of subtasks is a *patchable* value which is initially set to 5.
  - Internal testing found this to be an ideal balance of throughput, CPU usage and memory consumption.

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Tape
Span datasets over 40 Tapes

- **Today:** Individual data sets can only span 40 tapes.
  - Not a problem for 'real' tape
  - Prevents DFSMShsm from managing larger data sets in a virtual tape environment.

  Example: $40_{tapes} * 4GB_{logical\ tape} * 2.5_{Compaction} = 400GB$

- **V2R1:** For migration and backup, individual data sets can span up to 254 tape volumes.

  Example: 254 * 4GB * 2.5 = 2.5TB

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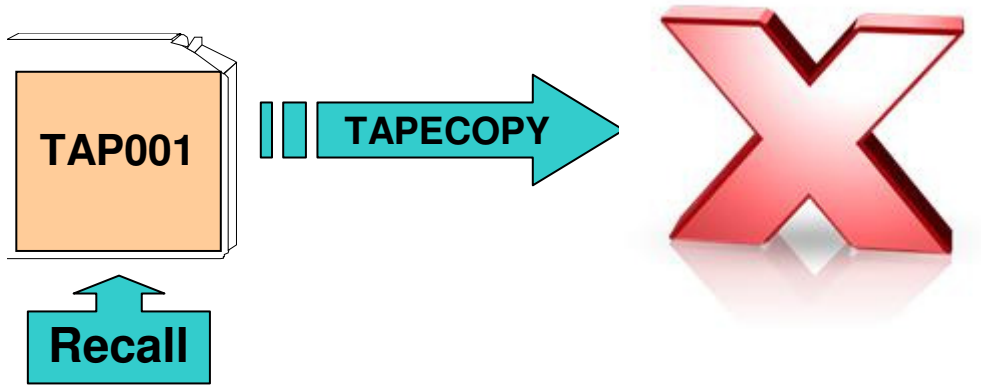
Tape
Span datasets over 40 Tapes

- FSR records have been extended from a maximum of 1260 bytes to 6396 bytes in order to contain up to 508 volume serials (254 input and 254 output).
- FSRs that list more than 144 tape volumes will be truncated when written to the DFSMShsm LOG data sets.
  - The existing fixed length 2048 LRECL prevents FSRs with more than 144 volumes from being written to the DFSMShsm log data sets in their entirety.
- Truncated FSRs will affect ARCPRLOG and ARCPEDIT output
  - ARCPRLOG output will display only the portion of each FSR that was written to the log.
  - When RECYCLE volumes are truncated, ARCPRLOG and ARCPEDIT output will display "TOVOL=******".

Tape
Use RECYCLE in place of TAPECOPY

- **Today:** When an alternate tape of a duplex copy pair fails to be created, DFSMShsm generates an automatic request to create a TAPECOPY of the original.
  - TAPECOPY is single tasked and does not have a resume capability.
  - A Recall request can take-away the tape from tape copy, causing tape copy to have to start from the beginning.

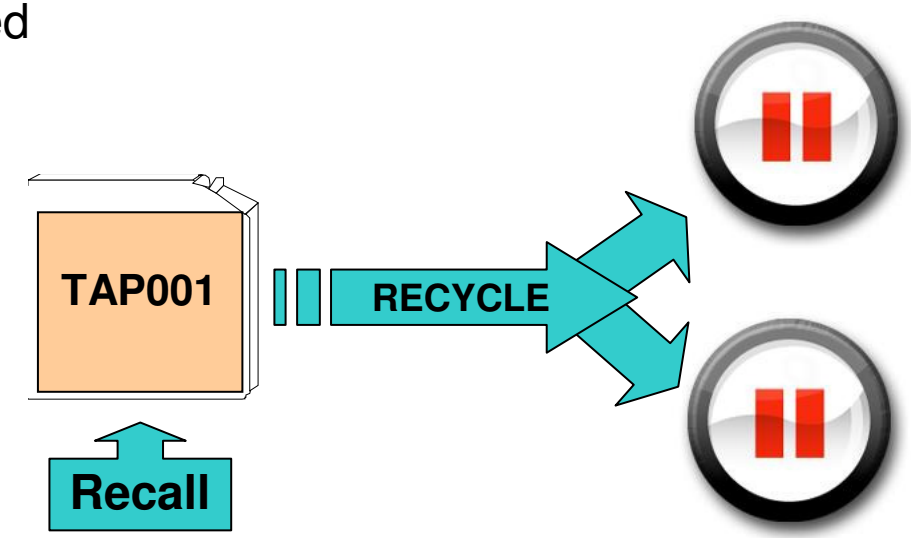


Tape
Use RECYCLE in place of TAPECOPY

- **V2R1**: A new option to create the alternate via RECYCLE

  SETSYS DUPLEX … ERRORALTERNATE (RECYCLE|TAPECOPY)

- Both Backup and Migration
- During Secondary Space Management, RECYCLE is used to replace the single original tape with a new original and alternate
  - RECYLE can be multi-tasked and doesn't have to start over from beginning if it is interrupted



Tape
Automatically restart RECYCLE

- **Today:** Tape take-away terminates Recycle processing
  - Recycle must be manually restarted, potentially multiple times

- **V2R1:** When a tape take-away occurs, a new Recycle command for the original tape will be automatically generated

SETSYS RECYCLETAKEAWAYRETRY(YES MAXRETRYATTEMPTS(*nn*) DELAY(*mmmm*) | NO)

  - The default is NO
  - nn: The value can be 1 – 99. The default value is 12.
  - mmmm: The value can be 1 – 9999. The default value is 300 (5min).
  - When max is reached: ARC0836I MAXIMUM NUMBER OF RECYCLE RETRY ATTEMPS FOR TAPE <VOLSER> HAS BEEN EXCEEDED

- To identify tapes that are in a Retry status or that have exceeded the maximum retries:

LIST TTOC SELECT (RECYCLETAKEAWAY)

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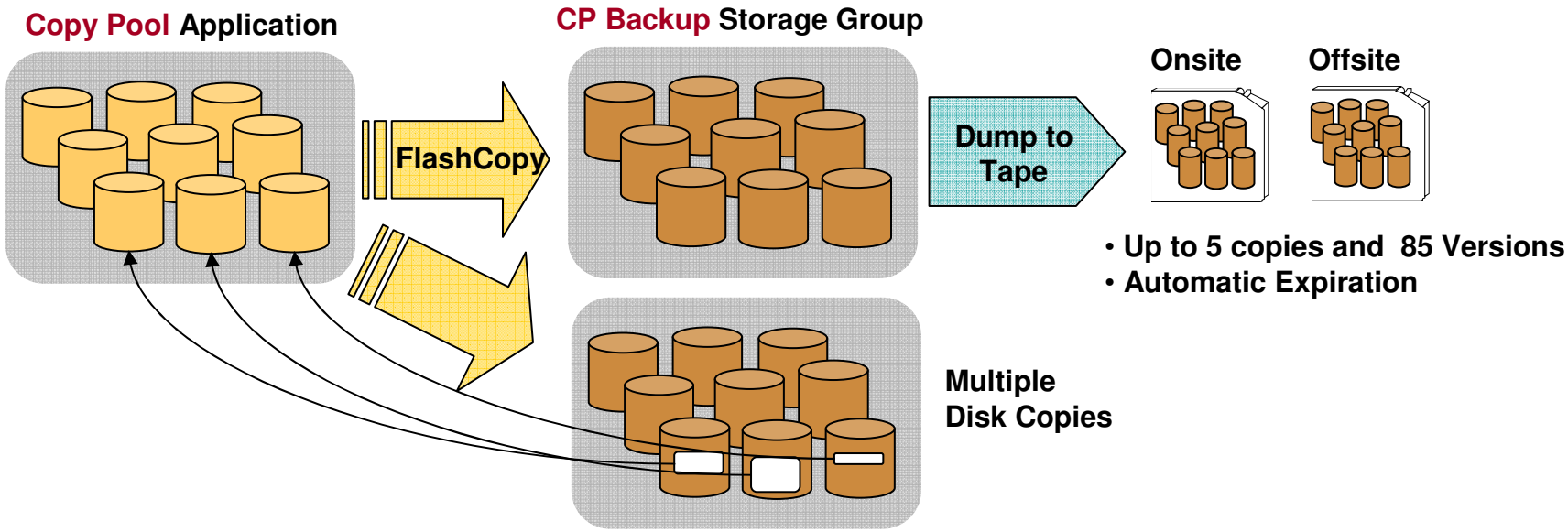
Fast Replication Overview

HSM function that manages Point-in-Time copies

- Combined with DB2 BACKUP SYSTEM, provides non-disruptive backup and recovery to any point in time for DB2 databases and subsystems (SAP)

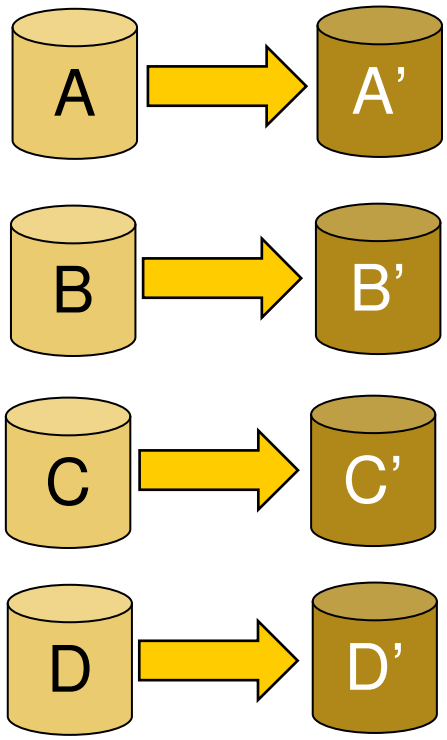


★**Recovery at all levels from either disk or tape!**

- Entire copy pool, individual volumes and …
- Individual data sets

Fast Replication
Consistency Groups

- **Standard FlashCopy – 'Fuzzy' Backup**
- **DB2 ensures data consistency during recovery**



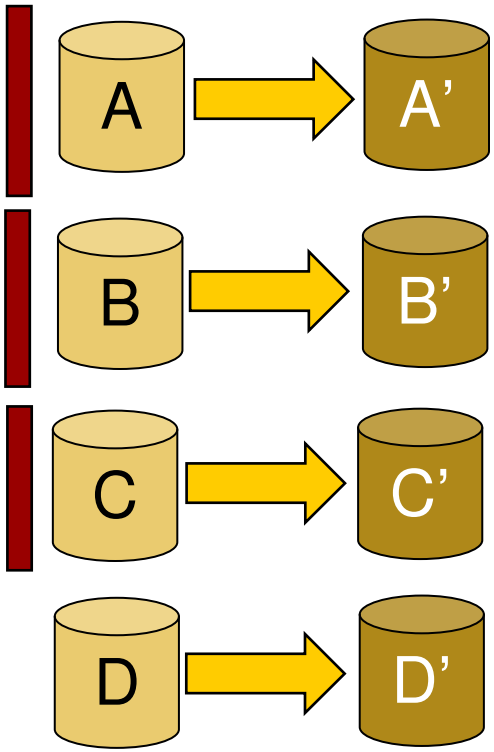
- **FC SrcA to TrgA'**
  - Writes held to SrcA during establish
  - Write activity on B, C, D
- **FC SrcB to TrgB'**
  - Writes held to SrcB during establish
  - Write activity on A, C, D
- **FC SrcC to TrgC'**
  - Writes held to SrcC during establish
  - Write activity on A, B, D
- **FC SrcD to TrgD'**
  - Writes held to SrcD during establish
  - Write activity on A, B, C

Fast Replication
Consistency Groups

- **Freeze FlashCopy Consistency Group**
  - I/O activity to a volume in a consistency group is held in an extended long busy (ELB)
  - A window can be created during which dependent write updates will not occur
  - I/O activity resumes when a FlashCopy Consistency Group is created
- **Consistency Group support is intended for DB2 Logs**
  - Default ELB is two minutes
  - Create a consistent copy of the Log copy pool such that a conditional restart *is not required*

Fast Replication
Consistency Groups

- **Consistency Group FlashCopy – Consistent copy**



- **FC SrcA to TrgA' / CGFREEZE**
  - Writes held to SrcA by ELB
  - Non Dependent write activity on B, C, D
- **FC SrcB to TrgB'**
  - Writes held to SrcA, B by ELB
  - Non Dependent write activity on C, D
- **FC SrcC to TrgC'**
  - Writes held to SrcA, B, C by ELB
  - Non Dependent write activity on D
- **FC SrcD to TrgD'**
  - TrgA – D contain a consistent copy
- **Consistency Group Created / CGTHAW**

Fast Replication
Consistency Groups

- Gotchas
  - The Consistency Group THAW is an LSS level operation
    - The control unit does not enable logical volume connected Freezes
    - If two copy pools with volumes in the same LSS are being backed up concurrently, the copy pool to first issue the THAW will invalidate the backup of the other copy pool
    - FRBACKUP requests are single threaded on an HSM host, so the exposure is when FRBACKUP requests are issued from multiple HSM hosts
    - HSM recognizes the issue and will fail the backup, which will have to be reissued
  - If the time to establish the FlashCopies for the volumes being processed as a part of the consistency group exceeds the CG timer (2 min default), then the control unit will release the ELBs on all of the volumes and the backup will fail

Fast Replication
Consistency Groups

```
Panel Utilities Scroll Help
------------------------------------------------------------------------------ DGTDCPP1 COPY POOL DEFINE/ALTER Page 1 of 5
Command ===>
SCDS Name . . . : USER6.MYSCDS
Copy Pool Name : COPYPL1
To DEFINE/ALTER Copy Pool, Specify:
Description ==> ____________________________________________________________________
            ==> ____________________________________________________________________
Auto Dump . . . N (Y or N) Dump Sys/Sys Group Name . . . _________
Dump Class . . _________ Dump Class . . _________
Dump Class . . _________ Dump Class . . _________
Dump Class . . _________
Number of DASD Fast Replication Backup
Versions with Background Copy . . . . . 2 (0 to 85 or blank)
FRBACKUP to PPRC Primary Volumes allowed . . . __ (NO, PN, PP, PR or blank)
FRRECOV to PPRC Primary Volumes allowed . . . __ (NO, PN, PP, PR or blank)
FlashCopy Consistency Group . . . . . N (Y or N)


Use ENTER to Perform Verification; Use DOWN Command to View next Panel;
Use HELP Command for Help; Use END Command to Save and Exit; CANCEL to Exit.
```

- **LIST COPYPOOL will have an indicator of the setting**

Fast Replication
Recover data set to any volume

- **Today**
  - FRRECOV DSNAME requires that a data set be recovered to the volume(s) that the data resided on at the time of the backup
    - If there is not enough space, then the recovery is failed and enough free space must be regained to perform the recovery
- **V2R1**
  - If there is not enough space on a volume to perform the recovery, HSM will select the volume in the same Storage Group that has the most free space

Fast Replication
NEWNAME

- **Today**
  - A data set must be recovered using the same name
- **V2R1**
  - A data set may be recovered to a new name
    - Recovery may from either Disk or Tape

    FRRECOV DSNAME(*ds.oldname*) NEWNAME(*ds.newname*)

    FRRECOV DSNAME(*ds.oldname*) NEWNAME(*ds.newname*) REPLACE

  - If there isn't enough space on the original volumes, then new volumes will be selected

Fast Replication
Data Set Recovery Performance

- **Today**
  - DSS Scans the entire VVDS to locate the VVR for the data set being processed
  - When many data sets are being processed, huge performance hit
    - A customer was recovering thousands of data sets.
    - Impact when the VVDS is large

- **V2R1**
  - HSM will capture the VVR RBA along with other catalog data at time of backup
    - Requires Catalog Capture option
  - HSM passes this to DSS during FRRECOV processing so that DSS can directly access the VVR

Fast Replication
D-Type APARS

OA39738

- For NOCOPY, volumes are always initialized after WITHDRAW, regardless of what the status of the volume it
- Some customers were reporting that target volumes were not getting initialized and being left with a broken VTOC

OA38533

- Increase Maximum Dump Tasks from 32 to 64

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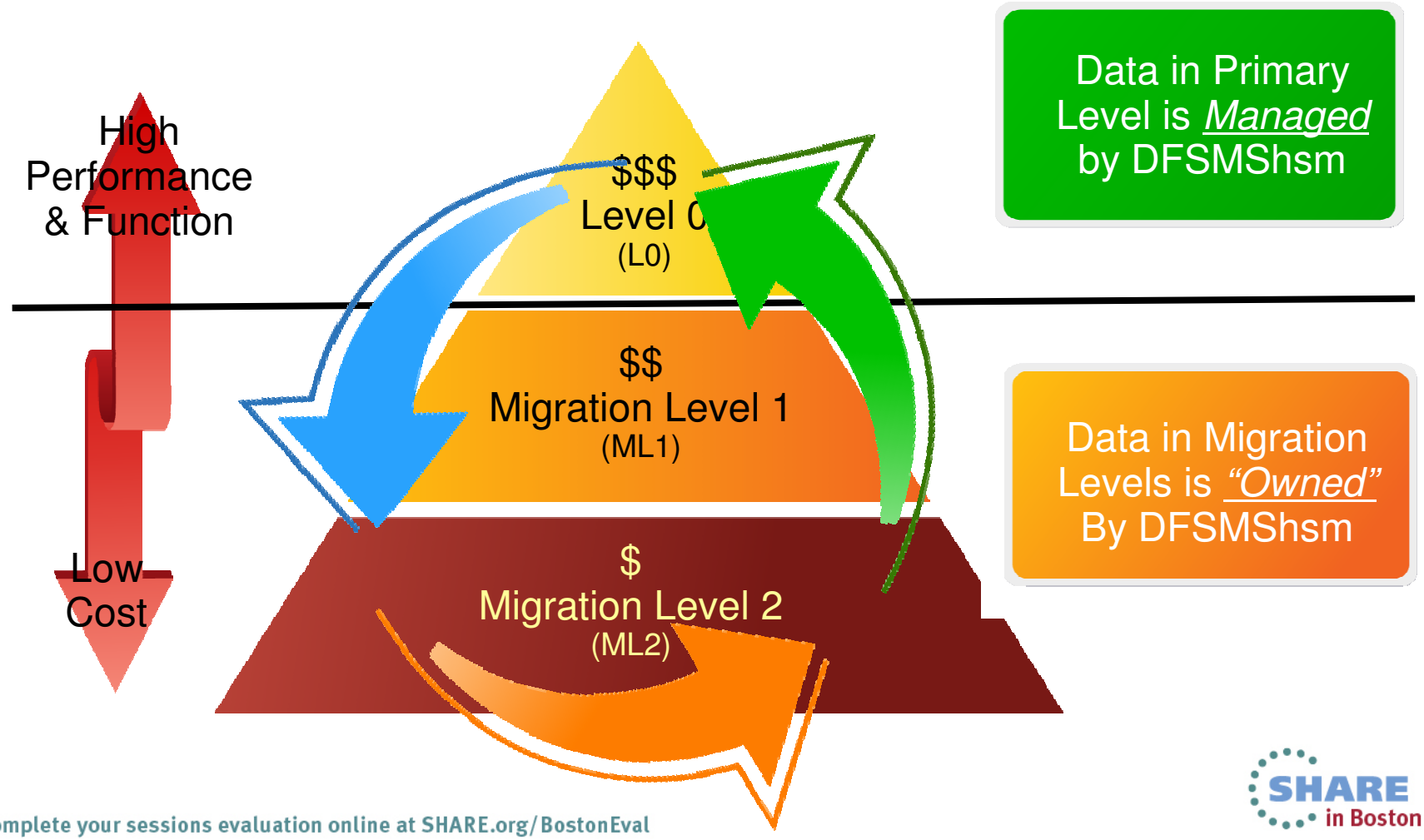
Storage Tiers: V2R1 Background

The *classic* DFSMS storage hierarchy (35 years old)



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Storage Tiers: V2R1 Background

- **The Space Management Environment is evolving**
  - Typical configurations have changed to leave data on Level 0 longer and then migrate directly to ML2
    - ★ When ML2 is a VTS, the VTS disk cache replaces the ML1 tier
      - ★ *Eliminates MIPS required for software compression to ML1*
      - ★ *Eliminates DFSMShsm ML1->ML2 processing*
    - ★ Tape storage controller functionality replacing DFSMShsm duplexing

- **Shortcomings of today's DFSMS functionality**
  - ✓No policy-based automation for moving data within the Primary Storage Hierarchy (Level 0)
  - ✓No policy-based management of Active (open) data

Storage Tiers: V2R1 Overview

z/OS V2R1 DFSMS provides the Storage Tiers Solution...

Automated, policy-based space management that moves data from tier to tier within the Primary (Level 0) Hierarchy

- ✓ Automated movement provided via the existing DFSMShsm Space Management function
  - Movement is referred to as a 'Class Transition'
  - Data remains in its original format and can be immediately accessed after the movement is complete
- ✓ Policies implemented via the existing Class Transition policies and updated Management Class policies
- ✓ Enhanced support for DB2, CICS and zFS data
  - *Open data temporarily closed to enable movement*

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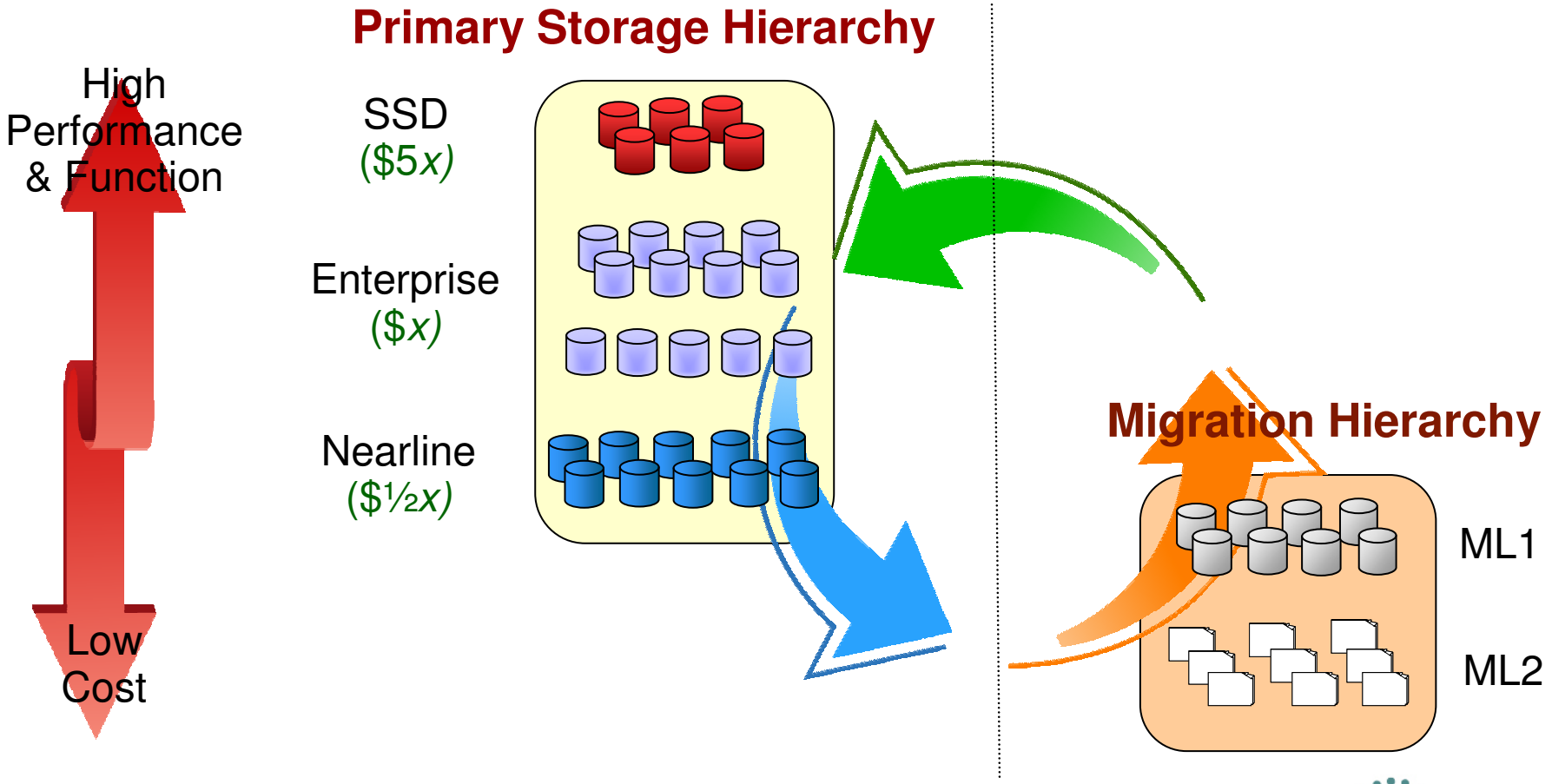
Storage Tiers: V2R1 Overview

The *classic* DFSMS storage hierarchy is modified to represent *distinct* Primary and Migration Hierarchies...



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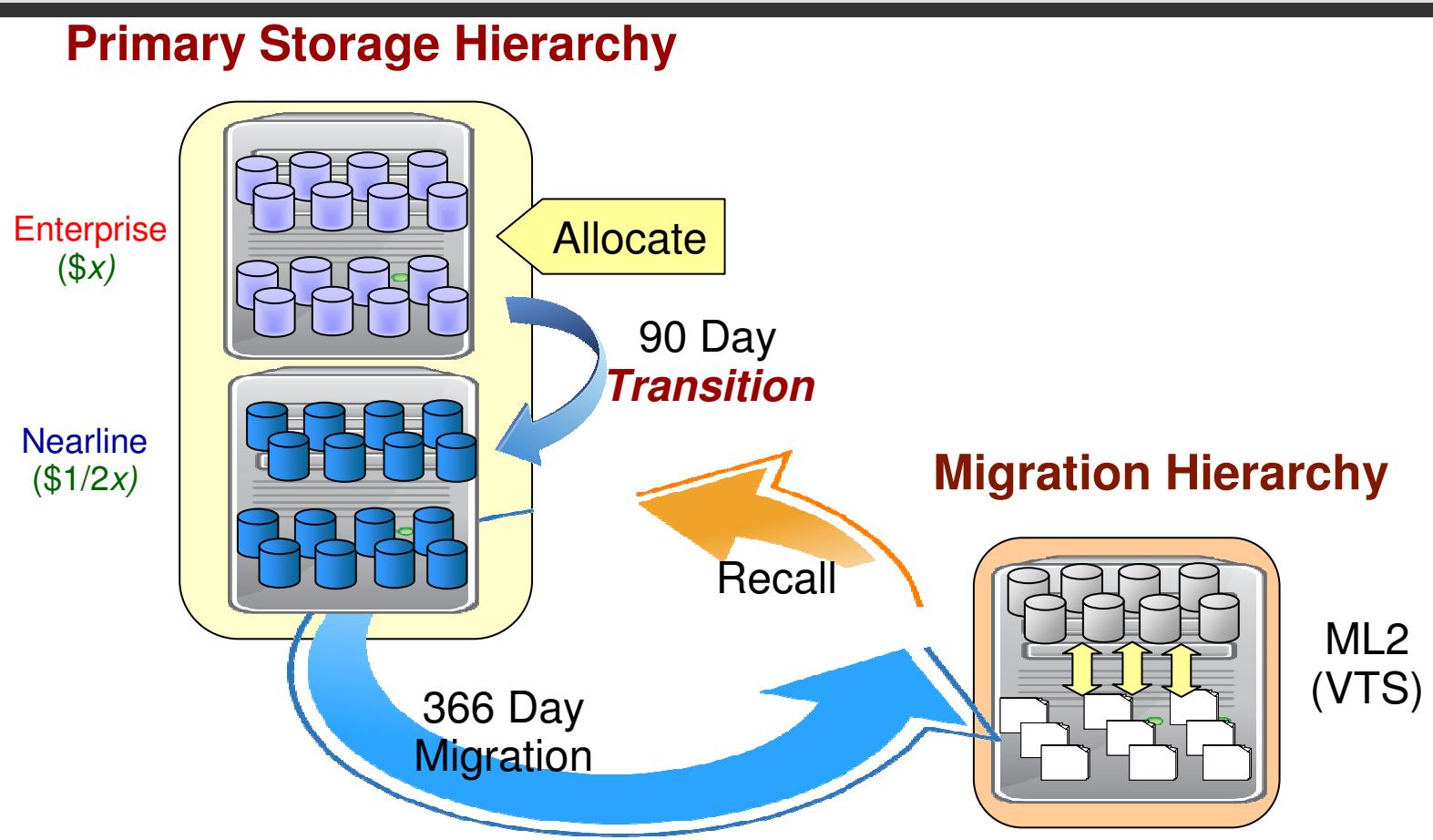
Storage Tiers: V2R1 Overview

This example environment shows data being “transitioned” from Enterprise Class storage to Nearline (SAS/SATA) Class storage after 90 days, and then becoming eligible for migration after 366 days of inactivity.



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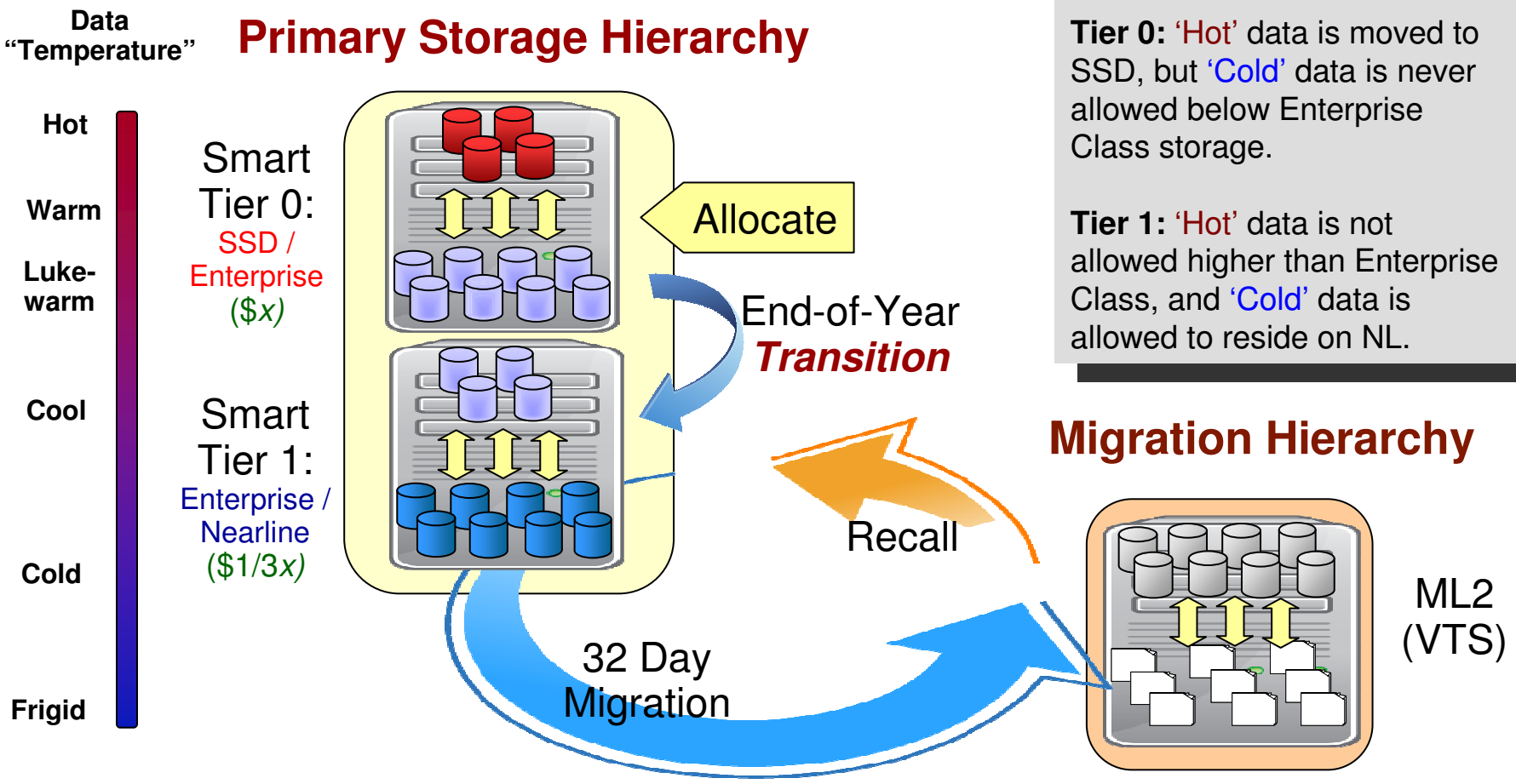
Storage Tiers: V2R1

This example environment shows data being "transitioned" from 'Smart Tier 0' to 'Smart Tier 1' at the end-of-year, and then becoming eligible for migration after 32 days of inactivity.

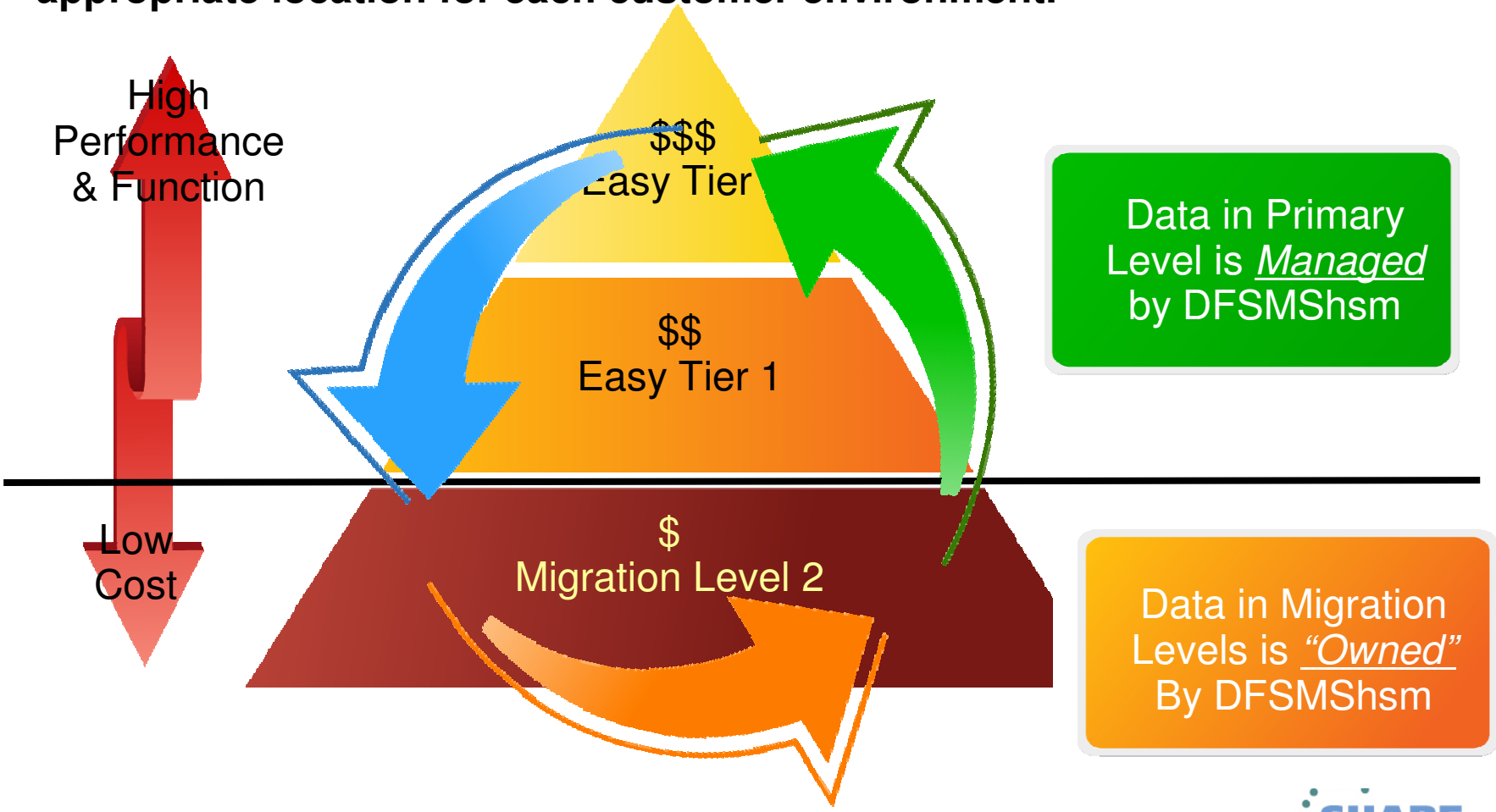


Tier 0: 'Hot' data is moved to SSD, but 'Cold' data is never allowed below Enterprise Class storage.

Tier 1: 'Hot' data is not allowed higher than Enterprise Class, and 'Cold' data is allowed to reside on NL.

Storage Tiers: V2R1 Overview

The *enhanced* DFSMS storage hierarchy enables "the bar" to be in the most appropriate location for each customer environment.



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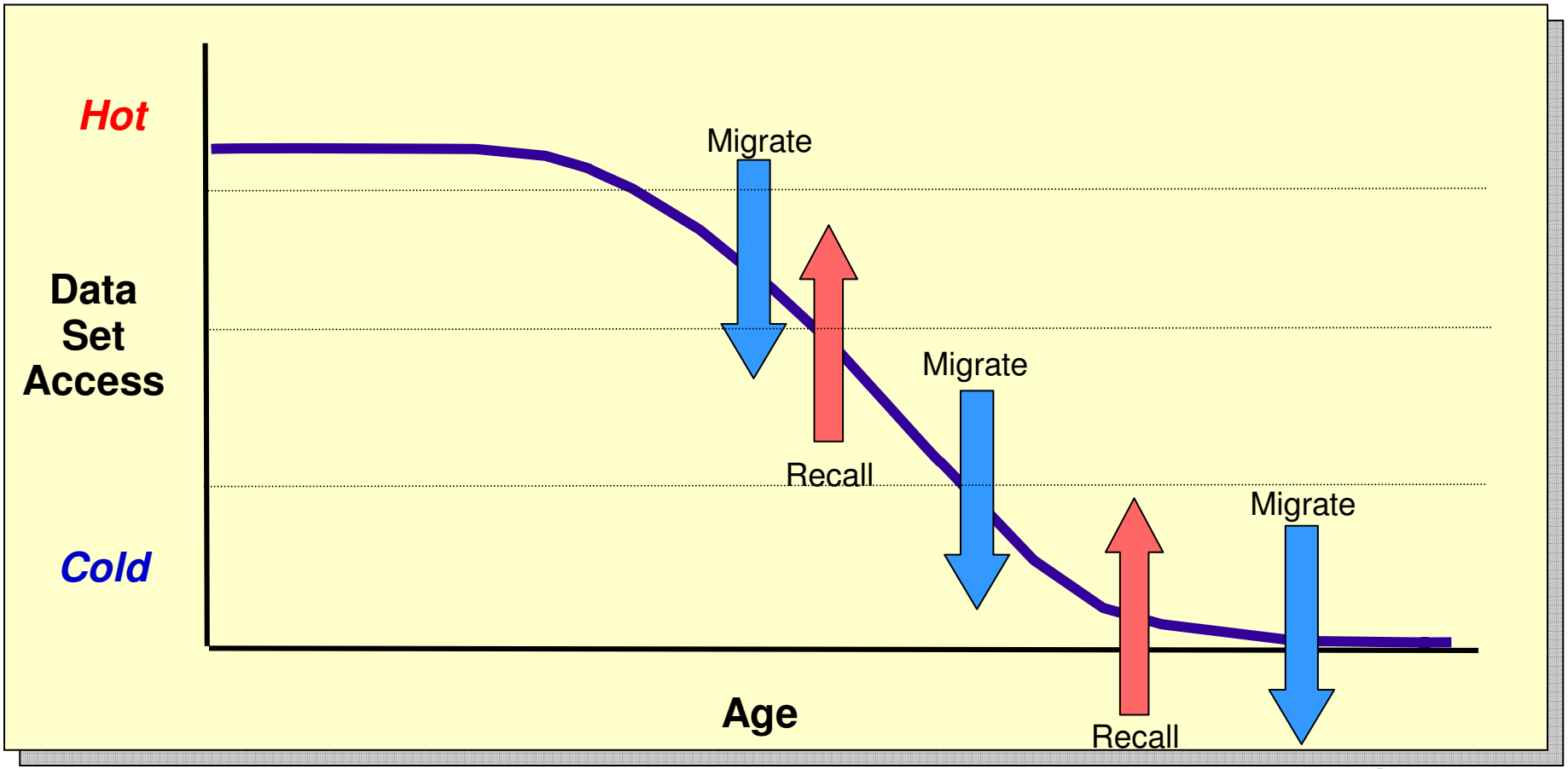
DFSMS Storage Tiers z/OS V2R1

As a data set ages and goes through cycles of activity and inactivity, it can go through many migration and recall iterations.



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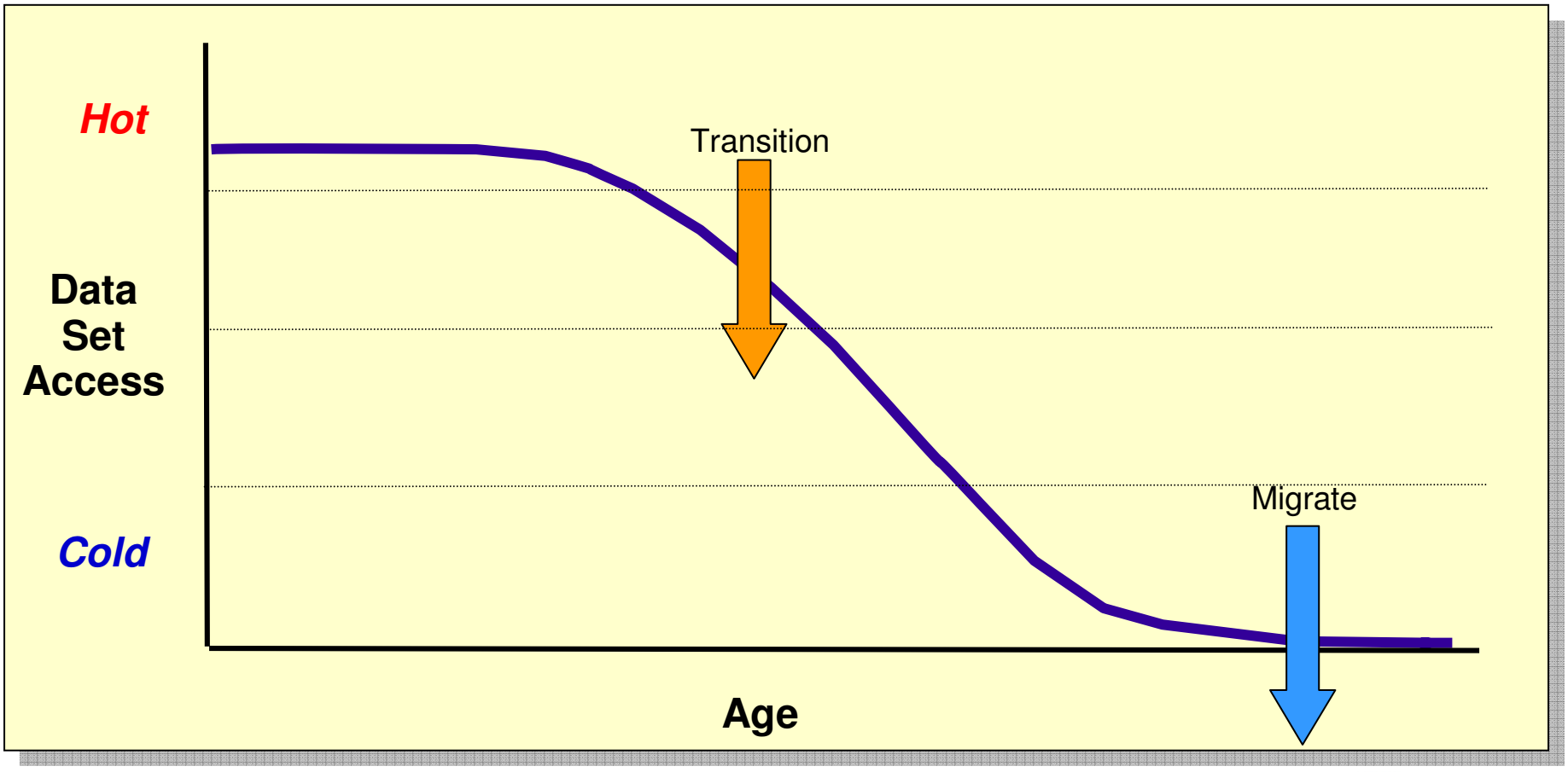
Storage Tiers: V2R1
Usage

The migration / recall iterations can be replaced with a single class transition and potentially single migration.



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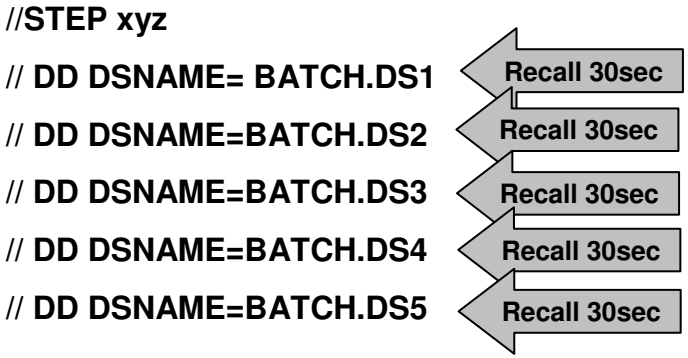
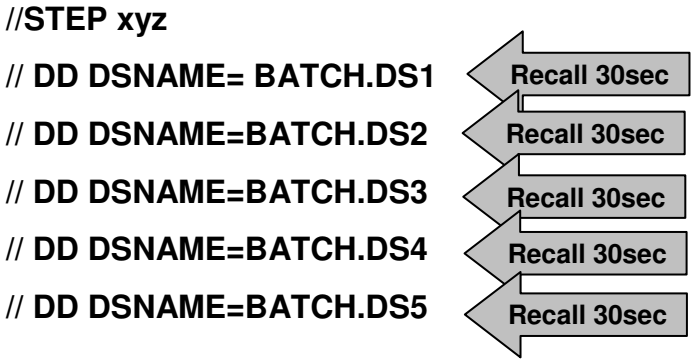
Miscellaneous

Allocation updated to enable you to specify that migrated data sets be allocated by a batch job be recalled in ***parallel***, before each job step starts

ALLOCxx Parmlib: BATCH_RCLMIGDS(PARALLEL)
SETALLOC: SETALLOC SYSTEM,BATCH_RCLMIGDS=PARALLEL



Elapsed Recall Time = 150 seconds



Elapsed Recall Time = 30 seconds

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What's New in DFSMShsm

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