What's New in DFSMShsm

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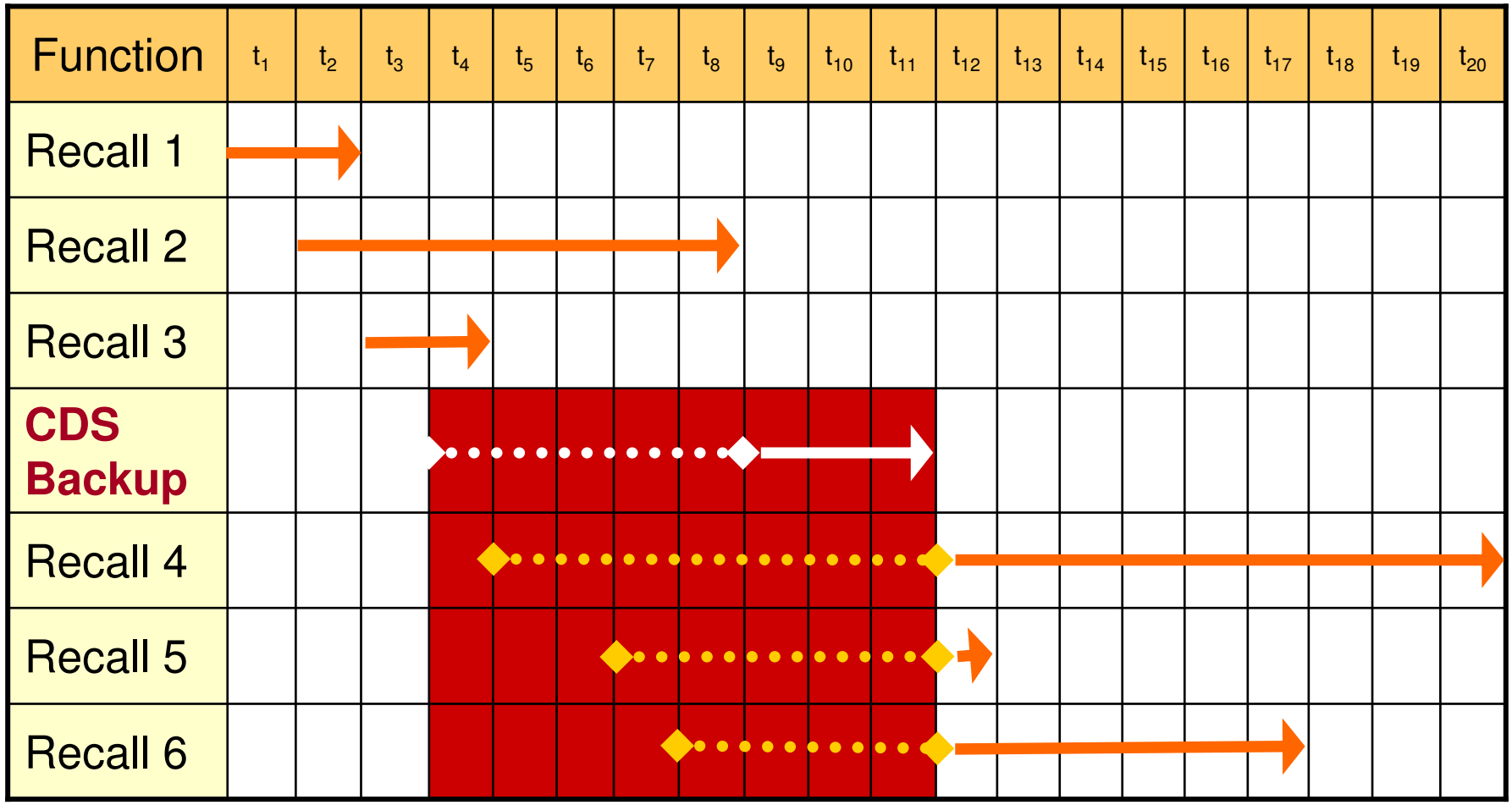
Agenda

- **General**
  - NonDisruptive CDS Backup
  - ONLYIF
  - Usability
  - CA Reclaim
  - Deduplication
  - EAV Support
  - Cross Memory
- **Migration**
  - On Demand Migration
  - Performance Improvements
- **Backup**
  - Dump Block Size
  - Dump Stacking Limit
  - Multitask Recovery from Dump Tapes
- **Fast Replication**
  - Copy Pool Recovery from Dump Tape
  - Fast Reverse Restore
  - Space Efficient
  - Preserve Mirror
  - UCB Refresh
- **Miscellaneous**

General: V1R13
Nondisruptive CDS Backup

- Today, CDS Backup can be very disruptive to other HSM activity
  - All other HSM activity must be quiesced before CDS Backup can start
    - Some customers HOLD all HSM activity prior to the start of CDS Backup to ensure that it can begin at its scheduled time
  - Functions that start while CDS Backup is waiting to start have to wait until the completion of CDS Backup
  - Higher impact in an RLS environment than nonRLS
- Journal is backed up using Standard I/O, even when Concurrent Copy is specified
  - Since there is a chance for Concurrent Copy to fail the physical copy after logical completion, Standard I/O is always used for the journal to ensure it is not nulled without being copied in its entirety
  - Outage for CDS backup is at least as long as the time it takes to backup the journal

General: V1R13
Nondisruptive CDS Backup



New HSM Activity Quiesced

Pre-V1R3

General: V1R13
Nondisruptive CDS Backup

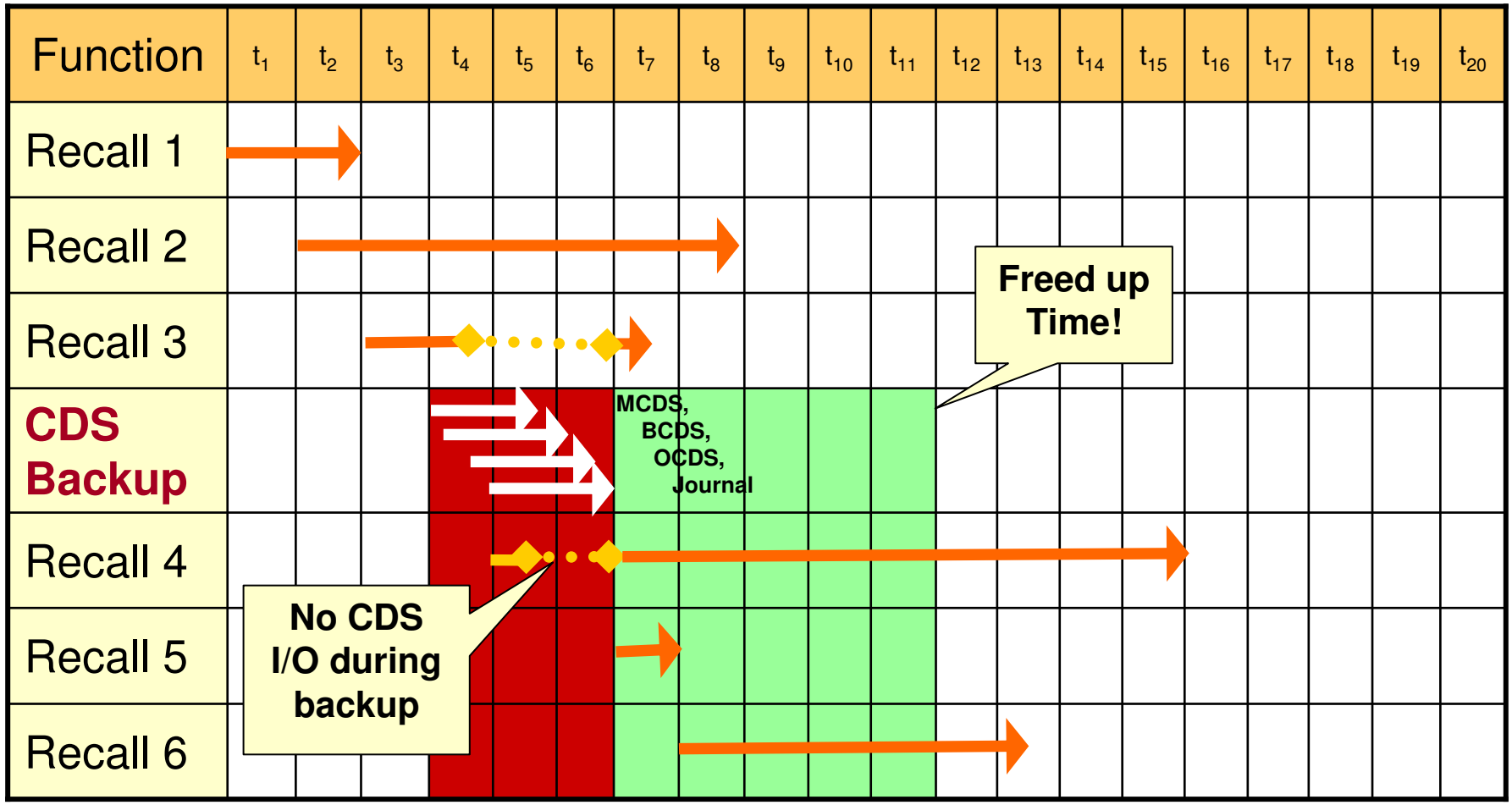
- nonRLS Environment
  - Only HSM activity on the *same LPAR* impacts/is impacted by CDS Backup
    - Serialization scheme uses enqueue scope of SYSTEM and a Reserve to cover other systems

- RLS Environment
  - HSM activity on *any host* in the HSMplex impacts/is impacted by CDS Backup
    - Serialization scheme uses enqueue scope of SYSTEMS

General: V1R13
Nondisruptive CDS Backup

- V1R13 Enhancements
  - CDS Backup serialization scheme has been enhanced such that all active HSM activity *does not* have to complete before CDS Backup can begin
    - CDS and Journal I/O is quiesced before and during copy of control data sets and journal to ensure a data consistent backup
    - When concurrent copy is used, this is a brief disruption
  - The backup of the Journal will begin before the CDSes are quiesced
    - HSM activity can continue while the 'static' portion of the journal is backed up
    - Activity is quiesced during brief time required to backup the remainder of the journal
    - Requirements:
      - All CDS clusters are SMS-managed
      - Concurrent Copy specified
      - SETSYS CDSVERSIONBACKUP(DATAMOVER(DSS))
      - SETSYS JOURNAL(RECOVERY)

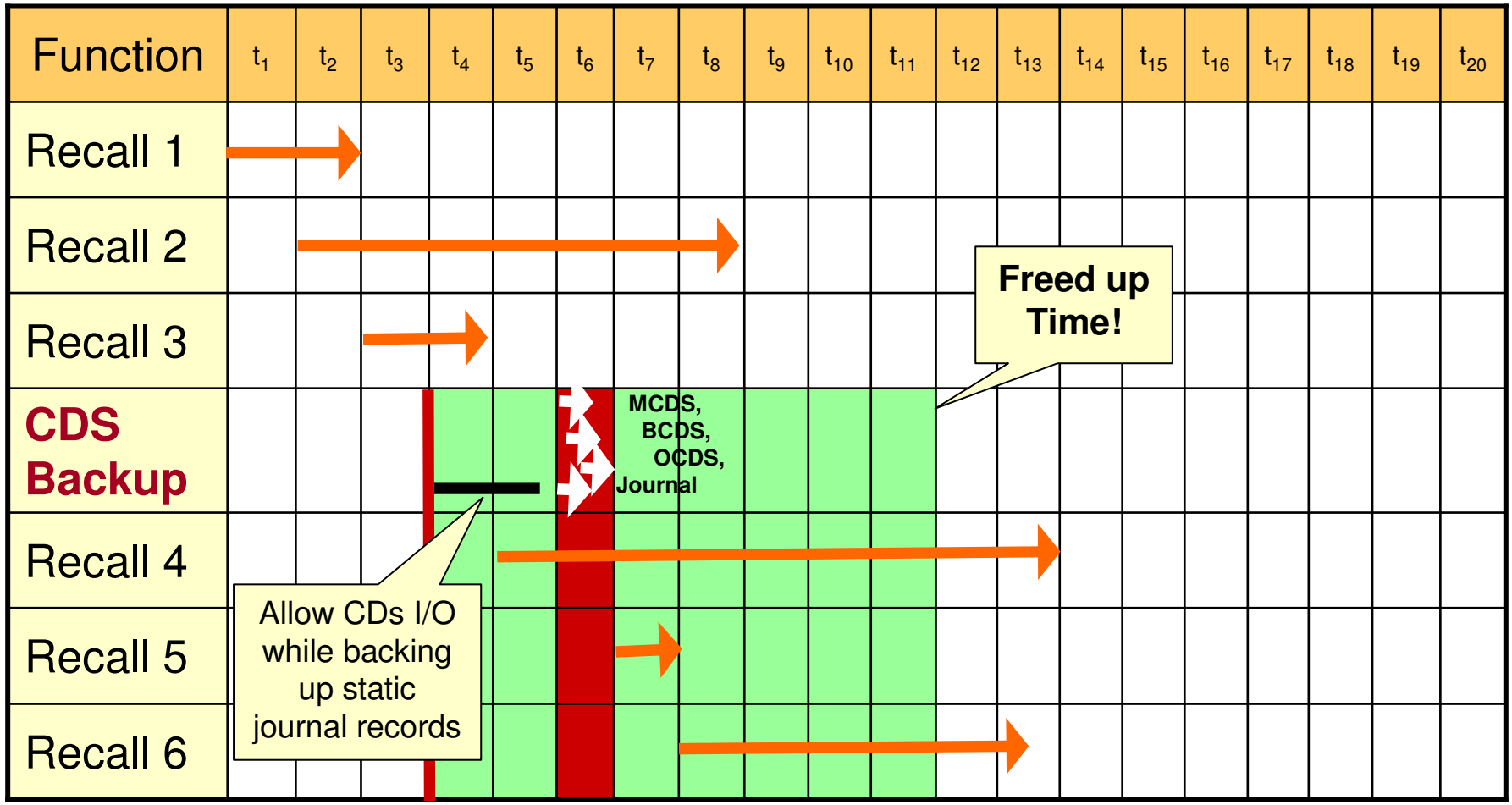
General: V1R13
Nondisruptive CDS Backup



HSM Activity Quiesced

V1R3: Not CC

General: V1R13
Nondisruptive CDS Backup

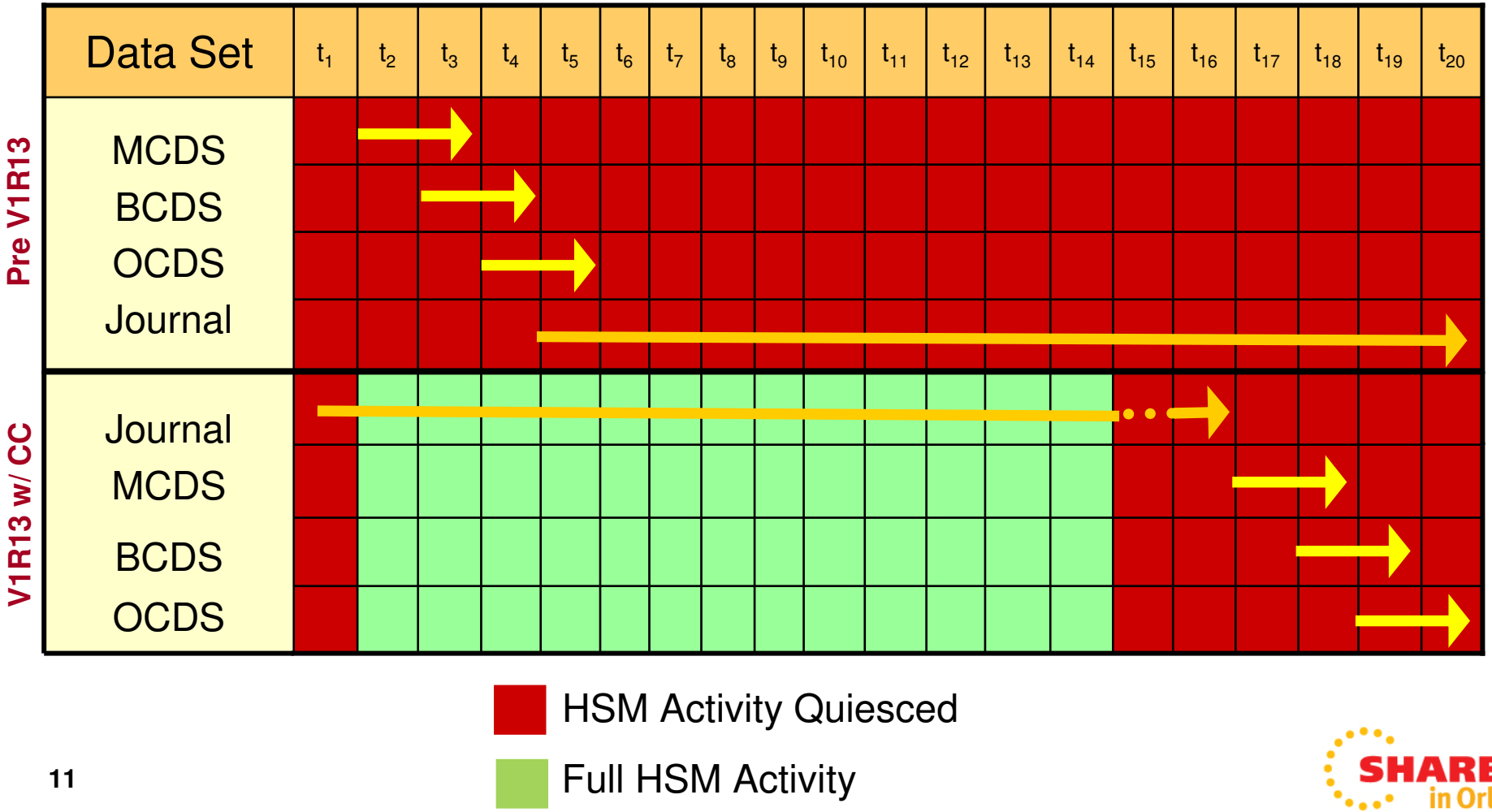


HSM Activity Quiesced

V1R3: CC

General: V1R13
Nondisruptive CDS Backup

Journal Backup Detail



General: V1R13
Nondisruptive CDS Backup

- CDS Recovery process is unchanged
- Migrating to new function
  - The journal backup enhancement requires the coexistence APAR to be active for a full backup cycle before becoming fully enabled
  - If you use the function on a V1R13 system that never had the coexistence applied, then not until the *second* and subsequent CDS backups will the function be fully enabled
  - Remove DFSMShsm HOLD commands scheduled before the start time of CDS Backup
- Coexistence
  - When using RLS, the full benefit isn't seen until *all* hosts are at V1R13

General: V1R13
ONLYIF

- IBM recommends a single, shared ARCCMDnn member for all DFSMShsm hosts
  - Eliminates chance of discrepancies between ARCCMDnn members across systems
- Pre-V1R13 ONLYIF support is *very* basic
  - Used when commands are unique to one or more DFSMShsm hosts
  - Example: Only hosts A & B run Automatic Dump:

```
ONLYIF HSMHOST(A)
    SETSYS ADSTART(1800 2400)
ONLYIF HSMHOST(B)
    SETSYS ADSTART(1800 2400)
ONLYIF HSMHOST(A)
    SETSYS MAXDUMPTASKS(7)
ONLYIF HSMHOST(B)
    SETSYS MAXDUMPTASKS(7)
```

General: V1R13
ONLYIF

- V1R13
  - Support for BEGIN and END operators
  - Enables multiple host IDs on the HSMHOST keyword

```
ONLYIF HSMHOST(A,B)
  BEGIN
    SETSYS ADSTART(1800 2400)
    SETSYS MAXDUMPTASKS(7)
  END
```

- Coexistence
  - Pre-V1R13 systems will correctly parse new syntax introduced on a V1R13 system

General: V1R13
Usability

- RELEASE RECALL(DASD)
  - If there is an issue with tape drives and HOLD RECALL is issued, there used to be no way to release just ML1 recalls without also releasing tape recalls
  - New RELEASE RECALL(DASD) converts a HOLD RECALL state to a HOLD RECALL(TAPE) state

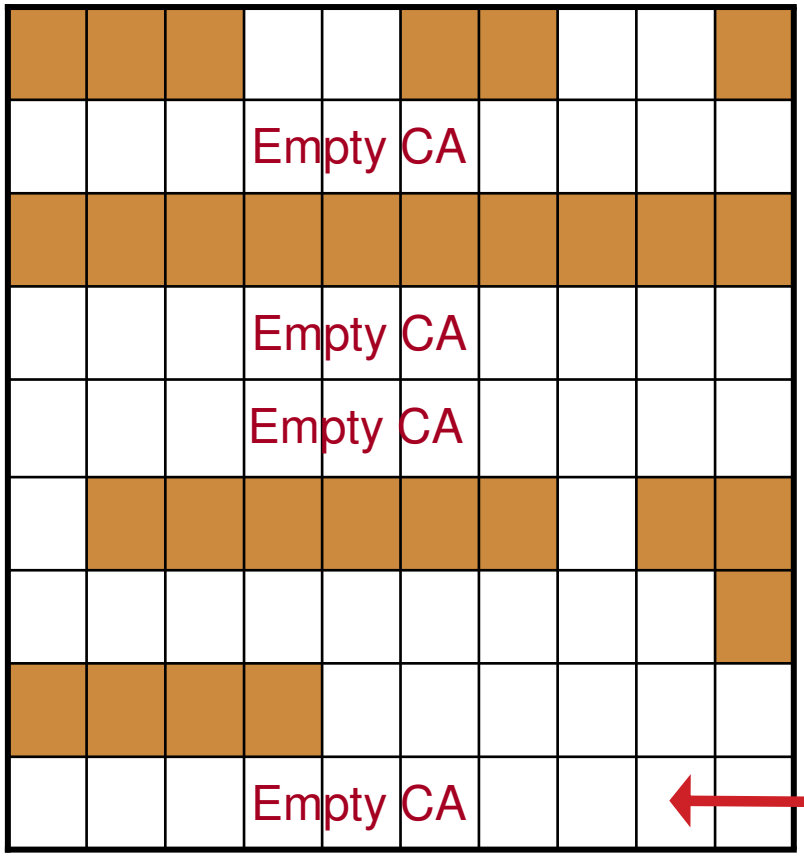
- QUERY COMMONQUEUE(RECALL) output shows the host that initiated each recall request
  - If a request in the CRQ needs to be canceled, the cancel must be done on the host that initiated the Recall
  - New information on ARC1543I eliminates need to issue QUERY on each HSM host

General: V1R12
CA Reclaim

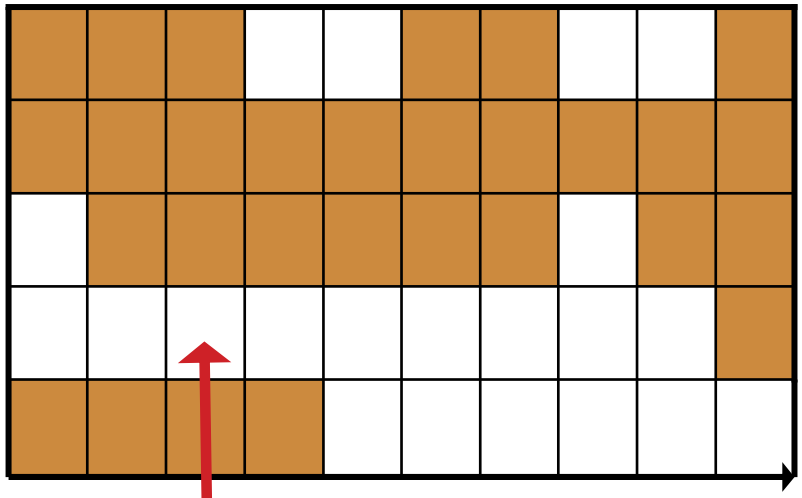
- Necessity to reorganize the DFSMShsm CDSs impacts…
  - Availability – Must stop all DFSMShsm hosts
  - Performance – increased CI/CA splits afterwards
  - Integrity - Doing it incorrectly is a common cause for CDS breakage
- VSAM provided a **CA (Control Area) Reclaim** function
  - Reclaims empty CAs that remain after all records are deleted
  - Common for DFSMShsm
    - Many records written with the date in the key
- What this means for DFSMShsm…
  - Significantly *reduces* the need for CDS reorgs
  - Significantly *reduces* the need for SDSP reorgs
  - *Doesn't eliminate* need to reorg
- Session 9007

General: V1R12
CA Reclaim

CDS w/o CA Reclaim



CDS w/ CA Reclaim Enabled



Why reorgs aren't eliminiated

Reorg required to reclaim empty CAs!

General Deduplication

- TS7680 ProtecTier Deduplication
  - Virtual Tape Library
  - Inline data deduplication
  - Replication – Only deduplicated data is transmitted

- DFSMShsm data
  - DFSMShsm ‘wraps’ blocks of native data with meta data, making all blocks unique
  - TS7680 has logic specific for DFSMShsm blocks so that it can deduplicate them

General

Extended Address Volumes

V1R12

- Support for all data set types
- ★ ML1 / $ML2_{disk}$ and Backup volumes may now use all space

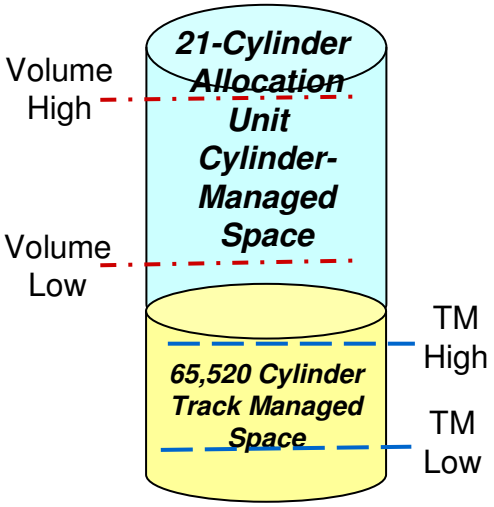
SETSYS USECYLINDERMANAGEDSPACE(Y|N)

! DO NOT specify (Y) until ALL hosts are V1R12 or higher

★ Good candidates for ML1 Overflow volumes

! Use caution when using as standard ML1

- All of the unused space cannot be released from migration data sets because allocation is done in Multi-Cylinder Units
- Leaves free space in migration copy



General: V1R12
DFSMSdss Cross Memory

More granular control of which functions use DFSMSdss Cross Memory

- All functions can be turned on or off using the existing

SETSYS DSSXMMODE(Y|N)…

or individual functions can be specified using

SETSYS DSSXMMODE(BACKUP(Y|N) CDSBACKUP(Y|N) DUMP(Y|N) MIGRATION(Y|N) RECOVERY(Y|N))

- Must be specified in ARCCMDxx member

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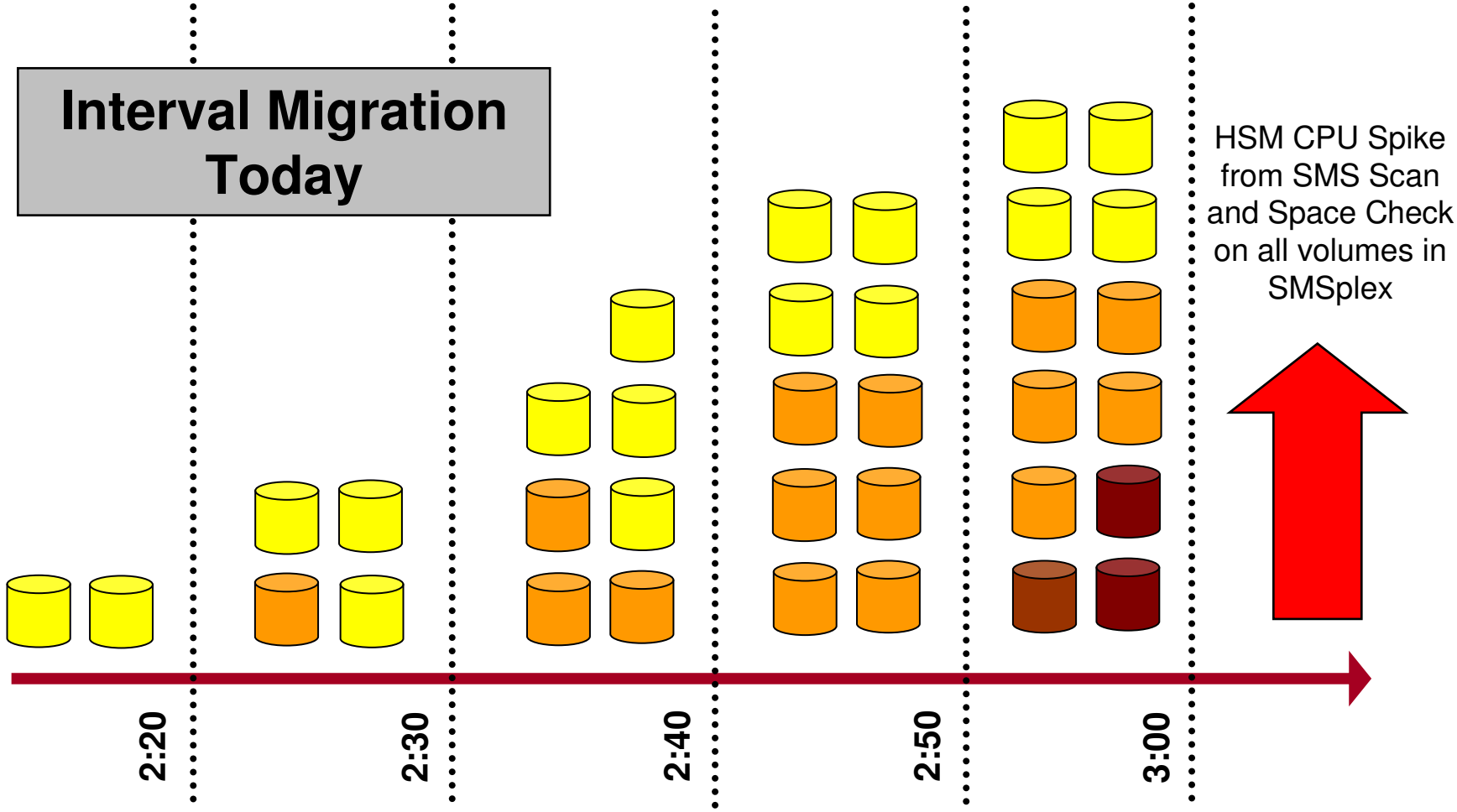
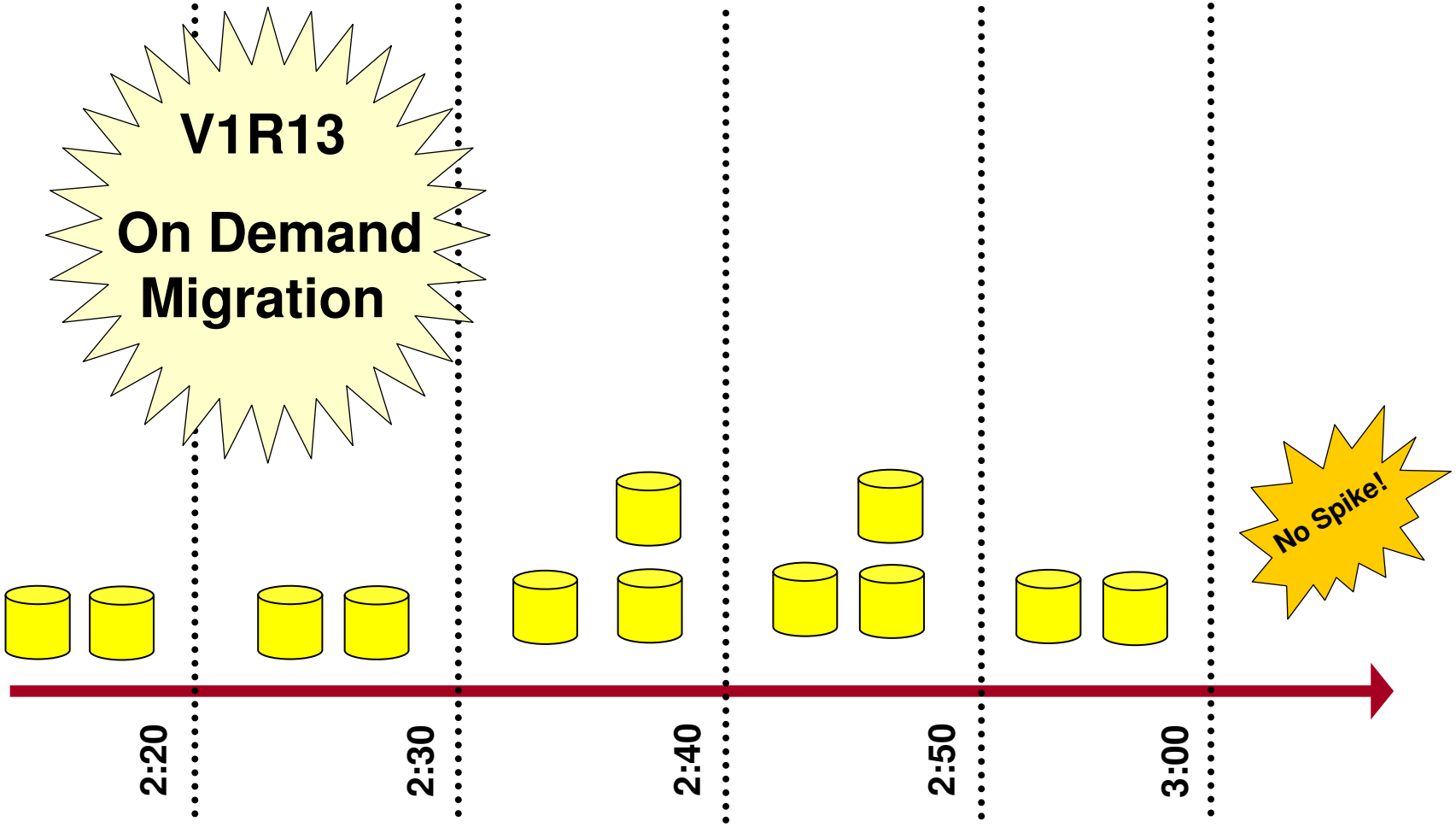
General: V1R13
On Demand Migration



General: V1R13
On Demand Migration



General: V1R13
On Demand Migration

- New SMS ENF 72
  - When an allocation (new data set or extent) causes a volume to go over its high threshold, SMS issues ENF 72
    - For EAVs, issued for both track-managed and cylinder-managed space
  - Additional ENFs issued at each 25% increment of (100% - High threshold)
    - If the high threshold is 80%, then an ENF is issued at 80%, 85%, 90%, …
    - If the high threshold is 92%, then an ENF is issued at 92%, 94%, 96%, …
    - ENF issued for every allocation after threshold exceeds 97% increment of high threshold
  - SMSplex wide ENF

General: V1R13
On Demand Migration

- DFSMShsm SETSYS command to enable function

  SETSYS ONDEMANDMIGRATION (Y|N)

  - Y- Enables ODM
    - ODM performed for volumes in storage group with AM=Y
    - SETSYS INTERVALMIGRATION is ignored for SMS volumes
      - *Except, storage groups with AM=I*
    - Interval Migration will still run for nonSMS volumes
  - If you use AM=I, consider changing to ODM and AM=Y
    - **AM=I**: Volume eligible when space exceeds midpoint between low and high threshold (used for TMM)
    - **AM=Y**: Volume eligible when space exceeds high threshold

General: V1R13
On Demand Migration

- When ODM is enabled, DFSMShsm host will listen for ENF 72
  - When ENF 72 is received, volume is added to work queue
  - Multiple hosts should be enabled. Only one host will process the volume.
    - Don't setup a single point of failure (single host enabled)
- Standard volume-level space management is performed
  - Volume processed below low threshold or until no more eligible data sets
  - If no data sets are processed, then there are no eligible data sets
    - To prevent the volume from being repetitively processed, the volume will not be reselected for 14 hours

      PATCH .MGCB.+138 X '00015180' /* 24 hours in seconds – default value*/
- In order to catch exception cases where a large number of volumes are concurrently going over threshold, DFSMShsm issues a highlighted message to the console

ARC1901E NUMBER OF VOLUMES ELIGIBLE FOR ON DEMAND MIGRATION HAS REACHED nnnnn

  - Updated as number of volumes increases/decreases. Removed from console after the number of volumes drops below the specified number

SETSYS ODMNOTIFICATIONLIMIT(nnnnn)
(100 is default)

General: V1R13
Space Mangement

- **PreV1R13**
  - During every interval migration window and before every Primary Space Management window, DFSMShsm scanned every volume in SMSplex to look for changes
- **V1R13**
  - DFSMShsm now listens for ENF 15 – SMS configuration change
  - Scan is only done if there was a configuration change
    - If you use this patch to turn off the scan, you can remove it:

      PATCH .MCVT.+C8 BITS(1…….)

  - If running ODM, you can remove any patches for changing the frequency of running Interval Migration
    - There are several. They are documented in the *DFSMShsm Implementation and Customization Guide*

Migration: V1R12

Performance Improvement

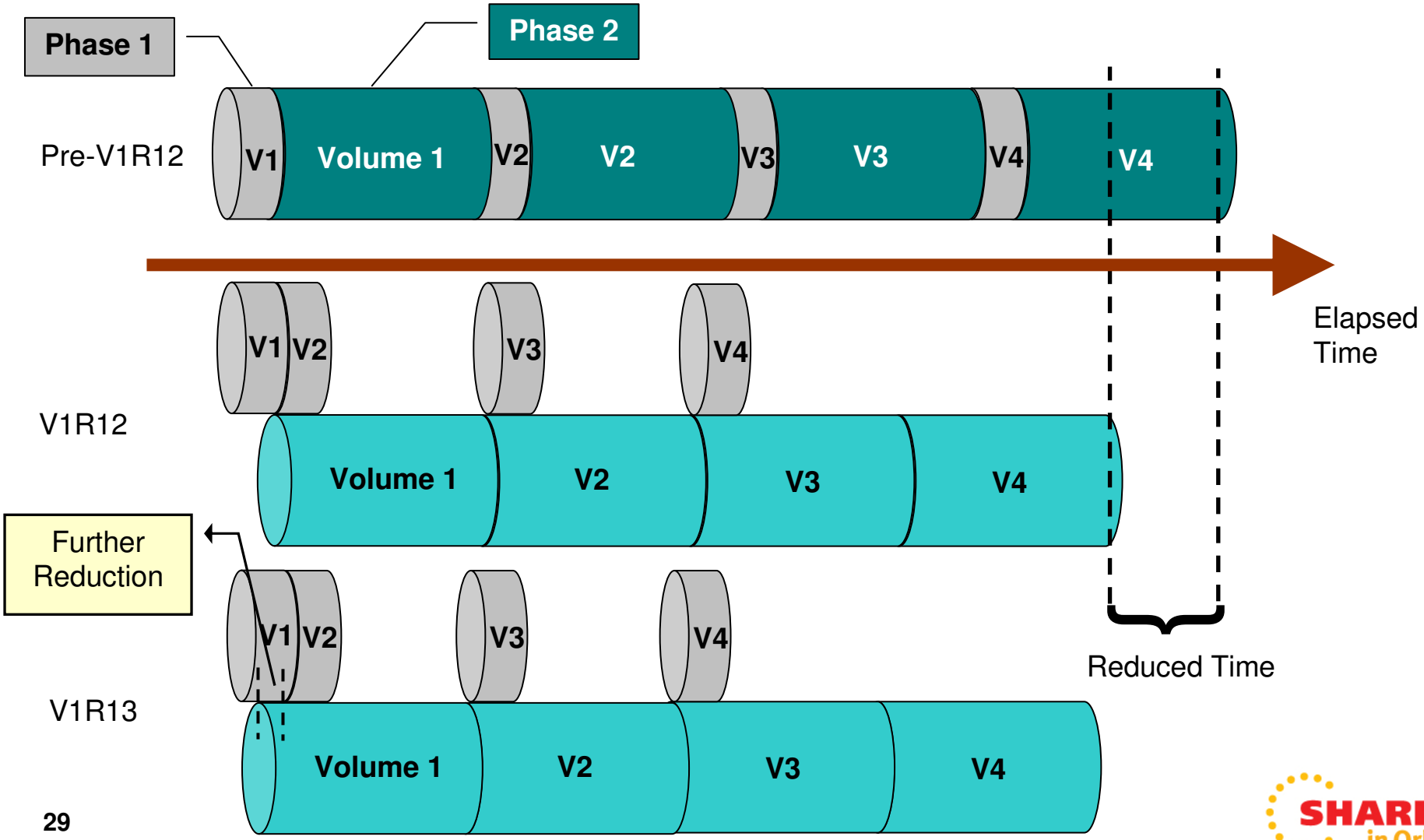
To improve performance, two phases of volume migration process are overlapped

- **Phase 1**
  - Obtain a list of all data sets on the volume
  - Process the data set list
    - Expire
    - Partial Release
    - Reconnect
    - Generate migration/extent reduction Queue
- **Phase 2**
  - Process Queue

- **New task started for Phase 2**
- **Phase 1 task continues to the next volume**

Migration: V1R12 & 13

Performance Improvement *(cont)*



Migration: V1R12

Performance Improvement *(cont)*

Supported for Volume Level Space Management

- Primary Space Management
- On Demand Migration
- Interval Migration
- MIGRATE PRIMARY command (nonSMS volumes)

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Backup: V1R12

Full Volume Dump – Optimal Block Size

DFSMSdss enhanced DUMP and RESTORE to use the optimal block size for the output tape device

- Up to 256KB for newer devices

DFSMShsm BACKVOL/FRBACKUP DUMP, AUTOMATIC DUMP and RECOVER/FRRECOV FROMDUMP will take advantage of this enhancement

- If you use these functions, examine your setting for SETSYS DUMPIO(*n,m*)
- *n* indicates the number of tracks that DFSMSdss reads at a time for DUMP.
  - 1 is the default for 1 track
  - 4 specifies that a cylinder should be read – requires much more storage

Backup: V1R12

Multitask Recovery From Dump Tape

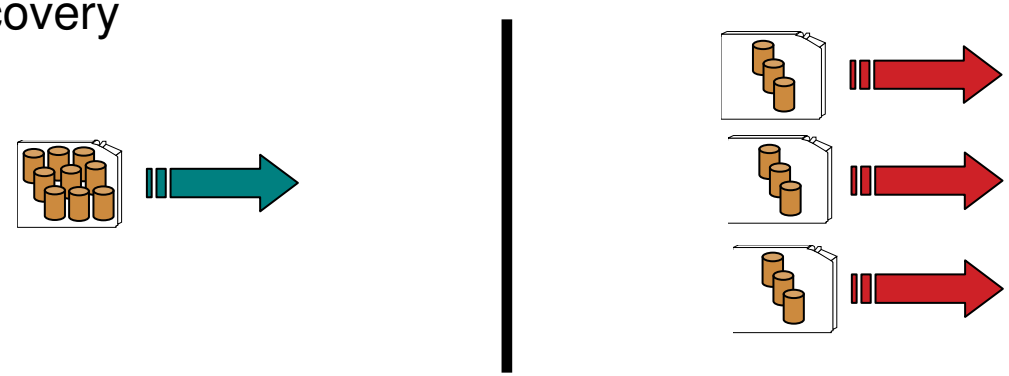
Full Volume Recovery from Dump Tape enhanced to support multiple concurrent tasks

SETSYS MAXDUMPRECOVERTASKS(*1-64*)

★ Multiple concurrently queued volume recovery requests on the same tape will be processed with a single tape mount

Stacking

- Use a stacking value that will enable you to maximize the parallelism of the recovery



Backup: V1R12
Dump Stacking

Dump Stacking limit increased from 99 to 255

DEFINE DUMPCLASS(*class* STACK(***nnn***))

BACKVOL SGROUP(*sgroup*) DUMP(DCLASS(*class*) STACK(***nnn***))

Coexistence

- Increased values can only be specified on V1R12 and higher
- Lower level releases will honor a Dump Class stack value > 99

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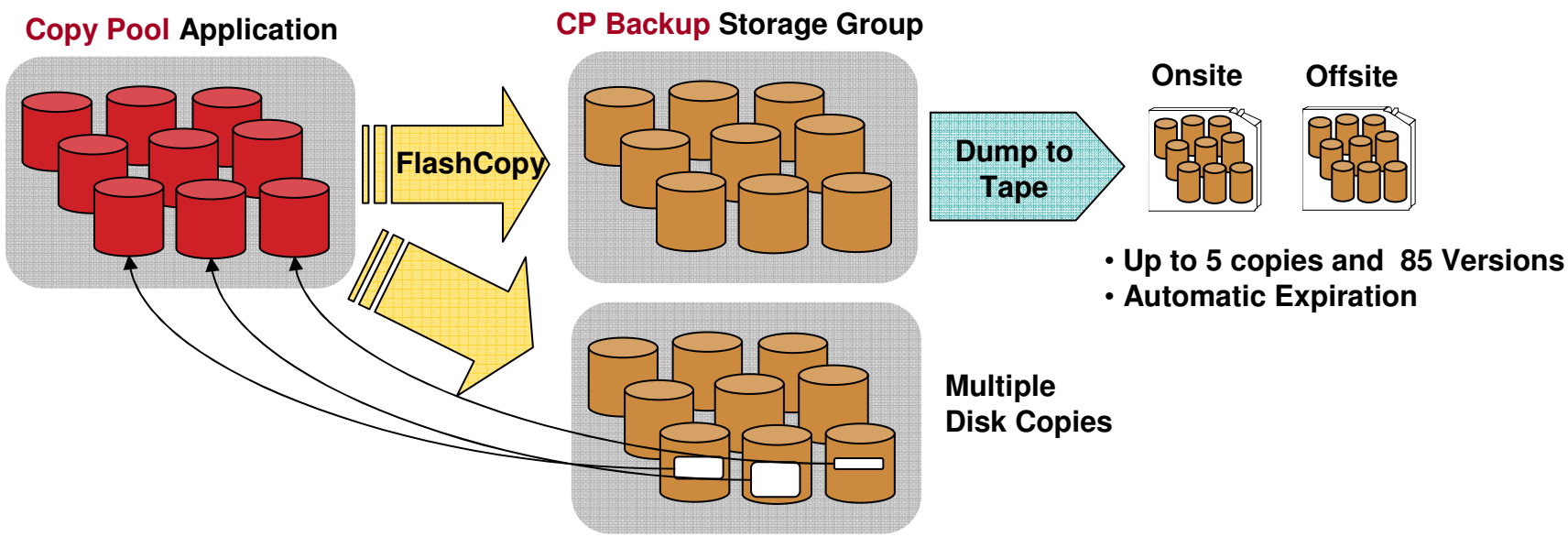
Fast Replication Overview

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: V1R12

Copy Pool Recovery from Tape

Copy Pool recovery from tape

- Prior to V1R12, HSM could only recover an entire copy pool from disk
- DB2 or native DSS had to be used to recover from tape

With this enhancement…

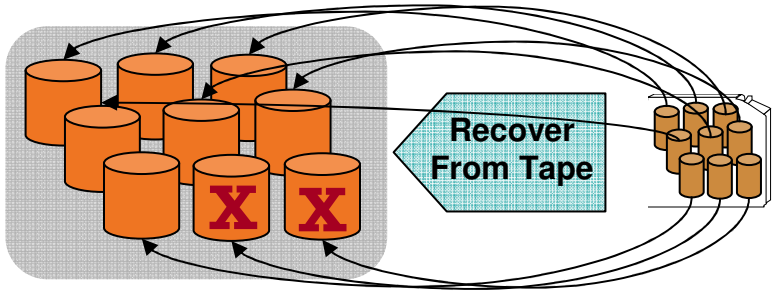
- DFSMShsm supports recovery of entire copy pool from tape
  - Made possible with the multitask recovery from dump tape support
  - Fast Replication tape copies are full-volume dump copies that represent the time that FlashCopy disk copy was created
- Enables solution to be used for Disaster Recovery
- Once again, stacking level of dump tapes may limit recovery parallelism

Fast Replication: V1R12

Copy Pool Recovery from Tape

Retry Logic

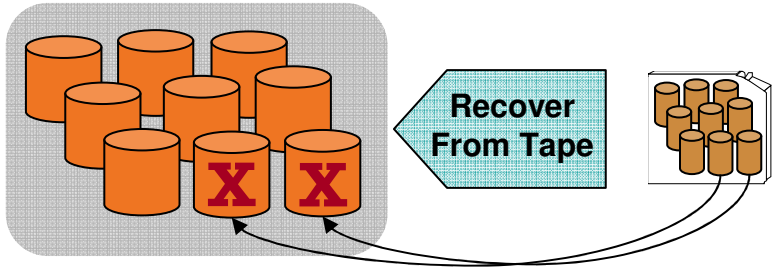
- If there is an error recovering one or more volumes…



- Correct the problem
- Reissue the FRRECOV command

★ DFSMShsm will only process those volumes that previously failed

★ LIST COPYPOOL output indicates if a particular version recovery is resumable



RESUME(NO) option to retry all volumes

(YES) is the default

Fast Replication: V1R12

Copy Pool Recovery from Tape

QUERY ACTIVE indicates the progress of the recovery…

ARC1822I FRRECOV OF COPY POOL *cpname* FOR USER *userid*, REQUEST *request-number* ON HOST *host_id* IS IN PROGRESS: NOT PROCESSED = *xx*, TOTAL = *yy*

- TOTAL indicates the total number of volumes being recovered
- NOT PROCESSED indicates the number of volumes that have not yet been recovered

Helpful messages

- ARC1802 will list overall return code when all volumes complete
- ARC1803 will summarize failed volumes with DFSMSdss message ids

CANCEL REQUEST(*reqnum*)

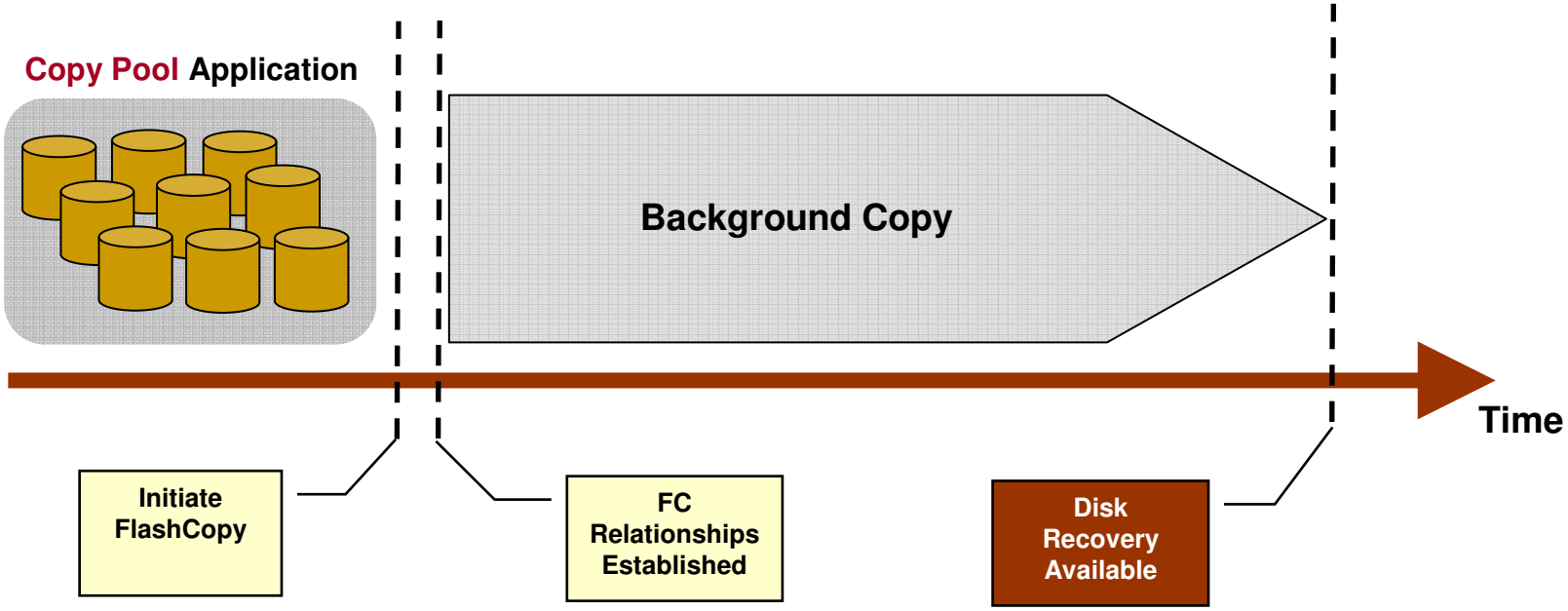
- All volumes being recovered will have the same request number
- A single CANCEL command will cancel all volumes

Fast Replication: V1R12

Fast Reverse Restore

Prior to V1R12

- Disk recovery could not be performed until the physical background copy was complete (*hours* after the logical backup was created)
- Disk recovery from a NOCOPY version was not supported

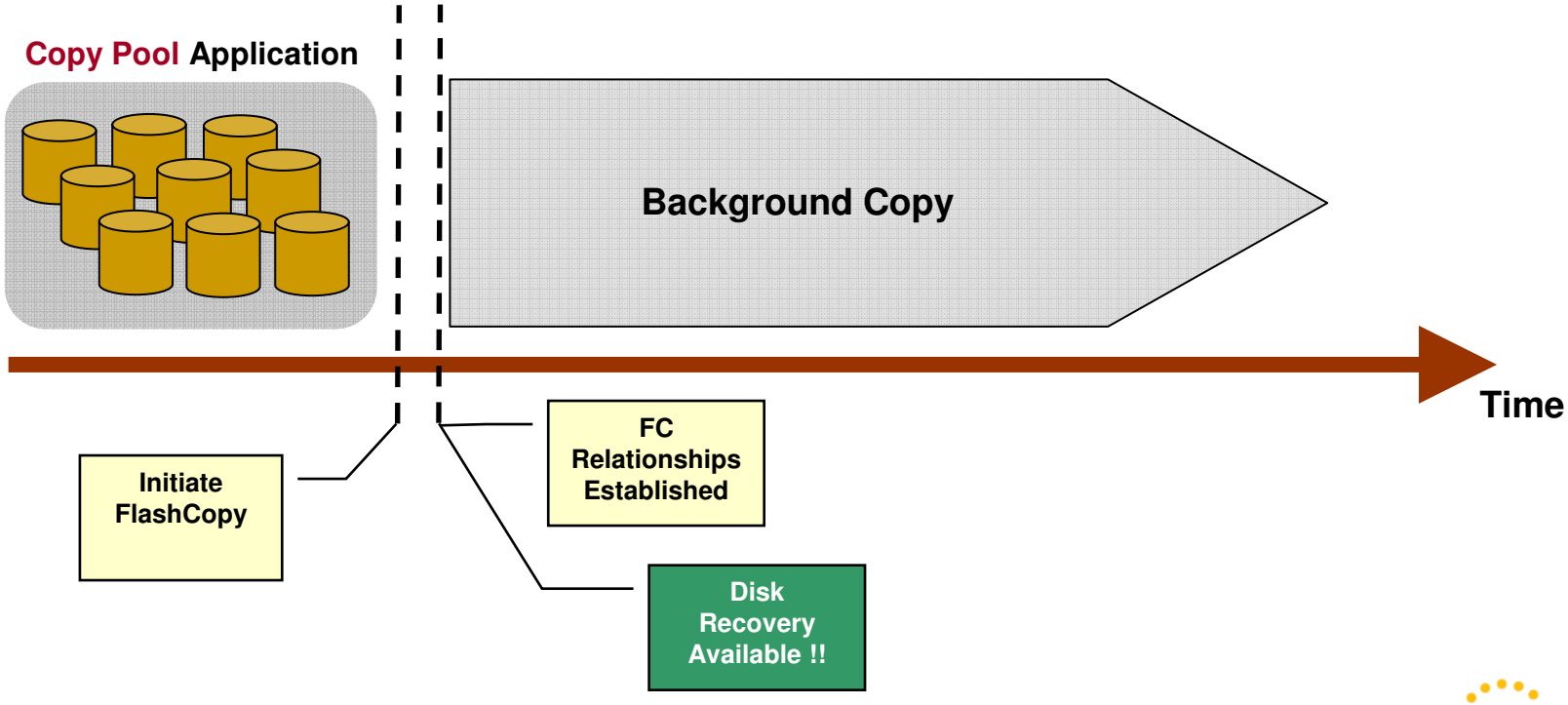


Fast Replication: V1R12

Fast Reverse Restore

Fast Reverse Restore

- Enables DFSMShsm to FlashBack for recovery even though the background copy has not completed
- Enables recovery from NOCOPY versions



Fast Replication: V1R12

Fast Reverse Restore

Restrictions

! Since the background copy does not complete, the backup is invalidated as part of the recovery

! Source volumes can't be in any other active relationships

! Only supported for recovery of entire copy pool

Resume after failure

- If one or more volumes fail, similar to recovery from tape, just reissue the command and only the set of previously failed volumes is retried

Fast Replication: V1R12

Fast Reverse Restore

- New copy pool setting indicates if FRR is enabled for the copy pool
  - YES indicates that it is acceptable to recover a version before the background copy is complete and for the backup to become invalidated
- QUERY COPYPOOL indicates percent complete
  - Determine if you should just wait for background copy to complete

```
ARC1820I THE FOLLOWING VOLUMES IN COPY POOL CP1, VERSION 003,
         HAVE AN ACTIVE FLASHCOPY BACKGROUND COPY
ARC1820I (CONT.) SGNAME   FR-PRIMARY FR-BACKUP PCT-COMP
ARC1820I (CONT.) SGRP1    SRC01B     TGT01B     70
ARC1820I (CONT.) SGRP1    SRC02B     TGT02B     80
```

- FORCE keyword if the disk copy is currently being dumped to tape
  - Incomplete dump volumes will be discarded

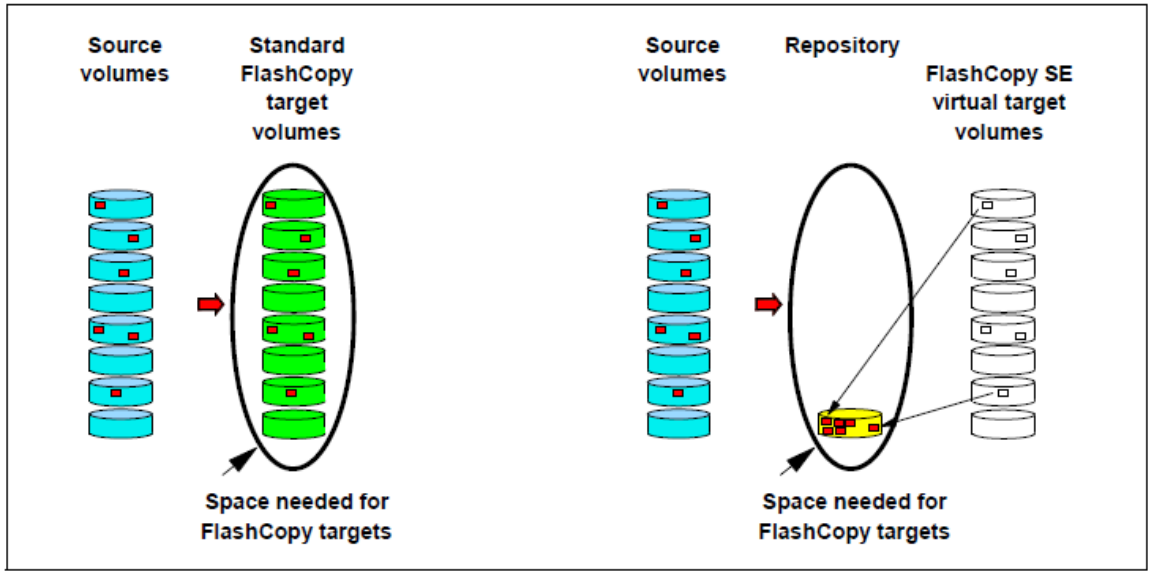
Fast Replication: V1R12

Fast Reverse Restore

- Hardware Dependencies
  - DS8000 series storage servers with the following **minimum** LMC:
    - 5.3.1.450
    - 5.4.21.540
    - 5.4.30.253
    - 6.5.0.220
- Software Dependencies
  - PK99337 ICKDSF – Support DFSMShsm invocation of INIT

Fast Replication: OA30816

Space Efficient Volumes



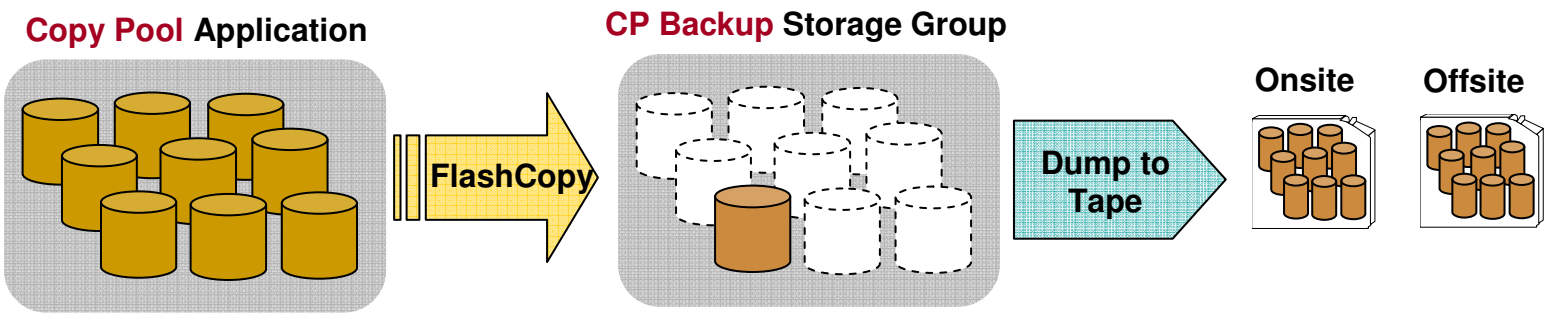
Space Efficient Volumes

- Space Efficient volumes don't take physical space until the space is actually needed
- Only a fraction of the space is required for target volumes
  - ✓ License is required
- Valid when **NOCOPY** is the FlashCopy technique

Fast Replication: OA30816
Space Efficient FlashCopy

HSM selects available Space Efficient target volumes when NOCOPY (VERSIONS=0) is selected

(V1R9 and higher)



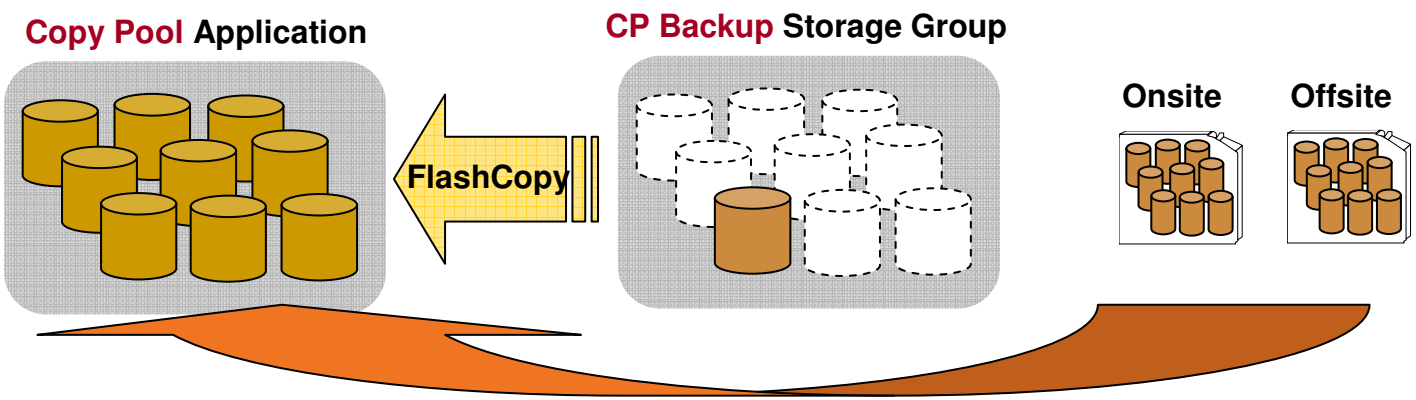
Fully Provisioned

- 1 TByte copy pool needs 1 TByte of copy space

Space Efficient Target Volumes

- ★1 TByte copy pool that changes <10% in-between copies only needs 100 GBytes of target space

Fast Replication: V1R12
Space Efficient FlashCopy

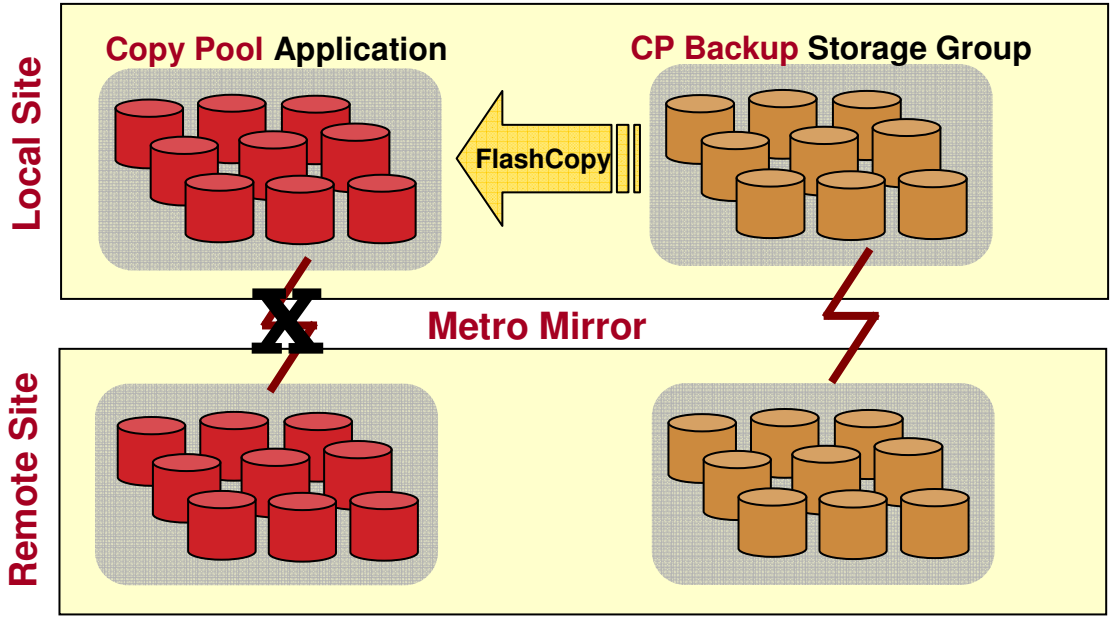


With Fast Reverse Restore…

- In addition to being able to recover from tape, a disk recovery can be performed!

Fast Replication: New Function APARs
FlashCopy to PPRC Primary

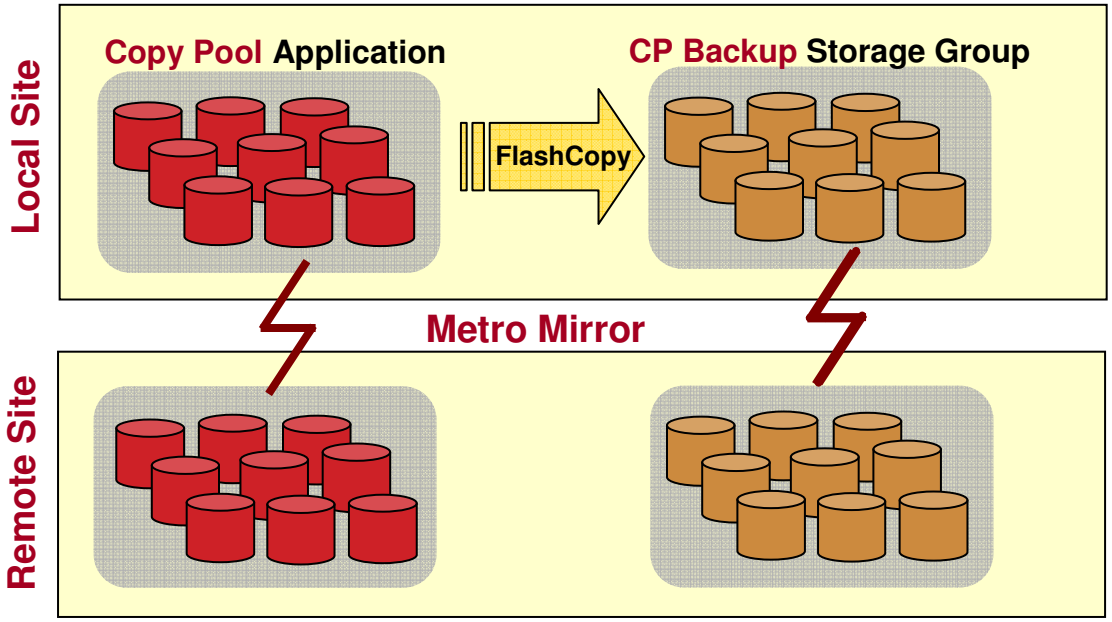
- Without new support, DFSMShsm does not support FlashCopy to mirrored volumes
- This means that you have to break pairs before each FlashCopy and re-establish pairs after FlashCopy



Fast Replication: New Function APARs
FlashCopy to PPRC Primary *(Cont)*

OA23849 (V1R9) – Enable FlashCopy to a PPRC Primary Volume

- Enables easier implementation of backup volumes at remote site *(Metro Mirror Only)*
- Pair is put into a *'Duplex Pending'* state until volumes re-synched
- Enabled for Recovery, but you generally don't want production volumes to go in a 'Duplex Pending' state

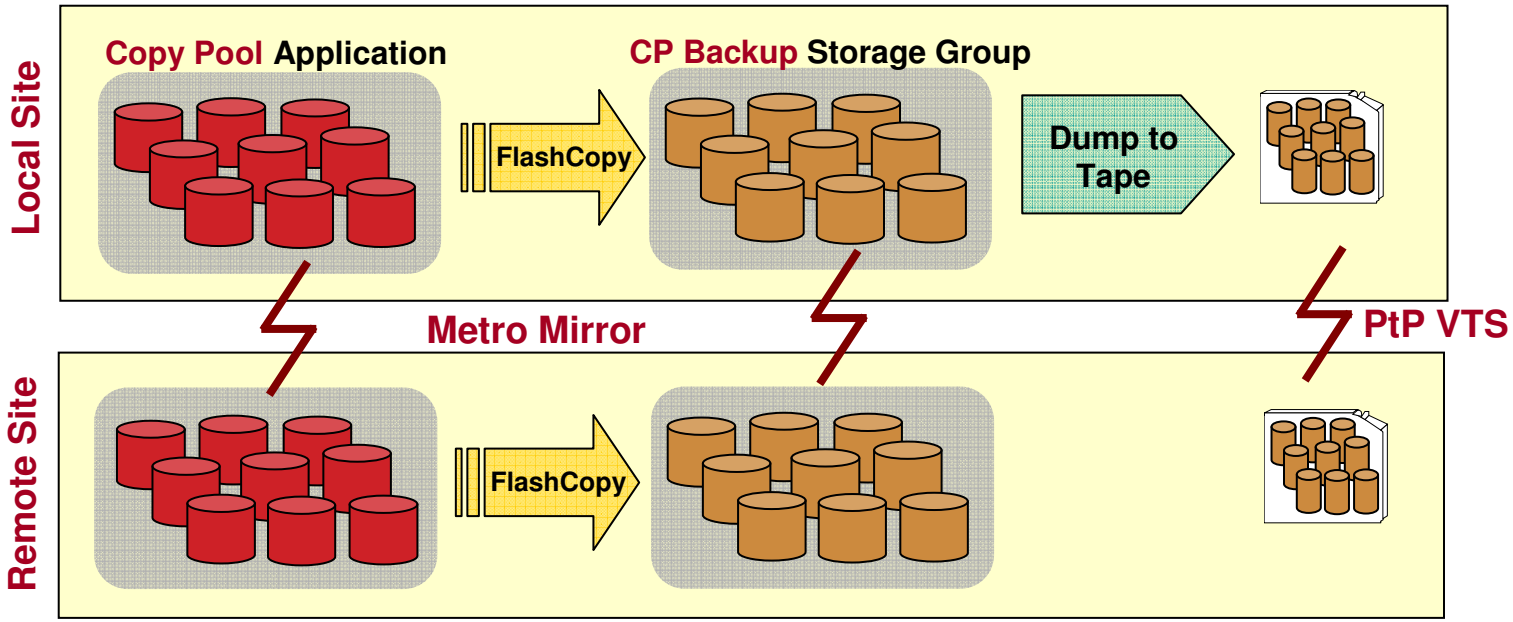


Fast Replication: New Function APARs
FlashCopy to PPRC Primary *(Cont)*

OA24814 (V1R9) – Preserve Mirror Support SPE

- "Remote Pair FlashCopy" DS8000 Support
  - Technical Information section of announcement letter ENUS109-119, located at http://www-01.ibm.com/common/ssi
- FlashCopy to PPRC Primary volume *while maintaining Full Duplex*

! *Fast Reverse Restore and Space Efficient cannot be used in this environment*



Fast Replication: OA32494

Volume Preferencing

DFSMShsm will select target volumes in same cluster

- FlashCopy background copy is more efficient when the source and target are within the same DS8000 cluster
- When selecting target volumes, DFSMShsm will prefer target volumes in the same cluster as the source

- Pre-V1R12, enable with PATCH .FRGCB.+A BITS(....1...)
- V1R12+, enabled by default

Fast Replication: V1R13

Usability

SETSYS replaces patch for volume pairing messages

SETSYS FASTREPLICATION(VOLUMEPAIRMESSAGES(YES|NO))
SETSYS FR(VPM(Y|N))

- Controls issuing ARC1809I message for volume pairing failures
- Replaces PATCH .FRGCB.+9 BITS(.1……)

Reduced messaging

- ARC1809I RC2 used to be issued for every source volume that attempted to be paired to a target volume that was already paired
- Now the message is only issued once per target volume for each storage group in the copy pool

Fast Replication: V1R13

Usability

FASTREPLICATION(DataSetRecovery) default changed to NONE

- When fast replication is used for data set recovery, a subsequent FRBACKUP cannot be performed until the background copy of the recovery completes
  - FRBACKUP will fail, but the reason will just say that there is an existing relationship
  - When standard I/O is used for the recovery, HSM will fail the FRBACKUP with a specific message indicating that another function hasn't completed

AUDIT COPYPOOLCONTROLS detects and fixes orphaned records

- 'Orphaned' target volume records (FRTV) will prevent a target volume from being selected
- AUDIT will now identify these records and optionally delete them

Fast Replication: V1R13

UCB Refresh

Pre-V1R13

- If the FlashCopy moves the VTOC (source VTOC is in a different location than the target VTOC), then the target volume has to be varied offline/online before it can be accessed on systems other than the one that did the FlashCopy

V1R13

- DSS builds an ENF64 that can be used to automatically refresh the UCB on all systems in sysplex
- To enable the function
  - PARMLIB member DEVSUPxx: ENABLE(REFUCB)

    or
  - MODIFY DEVMAN …
- To disable the function
  - DISABLE(REFUCB)

Agenda

- **General**
  - NonDisruptive CDS Backup
  - ONLYIF
  - Usability
  - CA Reclaim
  - Deduplication
  - EAV Support
  - Cross Memory
- **Migration**
  - On Demand Migration
  - Performance Improvements
- **Backup**
  - Dump Block Size
  - Dump Stacking Limit
  - Multitask Recovery from Dump Tapes
- **Fast Replication**
  - Copy Pool Recovery from Dump Tape
  - Fast Reverse Restore
  - Space Efficient
  - Preserve Mirror
  - UCB Refresh
- **Miscellaneous**

Miscellaneous

(V1R11) IEFBR14 DELETE will not recall a migrated data set before it is deleted

- Change made to Allocation
  - SETALLOC SYSTEM,IEFBR14_DELMIGDS=NORECALL

  or
  - ALLOCxx keyword: IEFBR14_DELMIGDS(NORECALL)

(V1R12) DELETE GDG FORCE will not recall a migrated GDS before it is deleted

- Change made to Catalog

Miscellaneous

(V1R12) GDG Serializaton

- For existing Migration, GDG base is serialized when migrating a generation
- Serialization scheme is changed to not require the GDG base to be serialized

(V1R12) 100% Threshold

- SMS allows value of 100 for High Threshold
- Primary Space Management and Interval Migration are unchanged
  - DFSMShsm rounds up values, so 99.1% and higher are considered 100%

(V1R12) WTOR support

- Based on z/OS support, default responses have been established for DFSMShsm WTOR messages

Summary

- Significant number of new and enhanced functions
  - Emphasis on addressing customer requirements, increasing throughput and reducing MIPS
- Some critical new functions provided as “Development APARS”
- Expanded functionality of DFSMShsm Fast Replication Support
- These items demonstrate IBM’s commitment to continual improvement of the DFSMShsm product