DB2 for z/OS Backup and Recovery Update - V9 and V10

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Disclaimer

Agenda

- *DB2 Managed FlashCopy Solution in V8*
  - ∫ *DB2 System Level Backup using Copy Pools*
  - ∫ *Backup System and Restore System Utilities*
- *Backup and Recovery Enhancements in DB2 9*
  - ∫ *Automatically manage Copy Pool backups to tapes*
  - ∫ *Allow table space recovery using System Level Backups*
  - ∫ *Incremental FlashCopy*
- *Backup and Recovery Enhancements in DB2 10*
- *Copy Pool Enhancements in z/OS 1.12*

DB2 Managed FlashCopy Solution

- *Provide an easier and less disruptive way for fast volume-level backup and recovery*
  - ∫ *Use FlashCopy to backup DB2 data and logs*
  - ∫ *No longer need to suspend logs*
  - ∫ *Backups are managed by DB2 and DFSMShsm to support system level PIT recovery, Disaster Recovery and Cloning*

DBs   Logs

BSDSs   ICFs

FlashCopy

DBs   Logs

BSDSs   ICFs
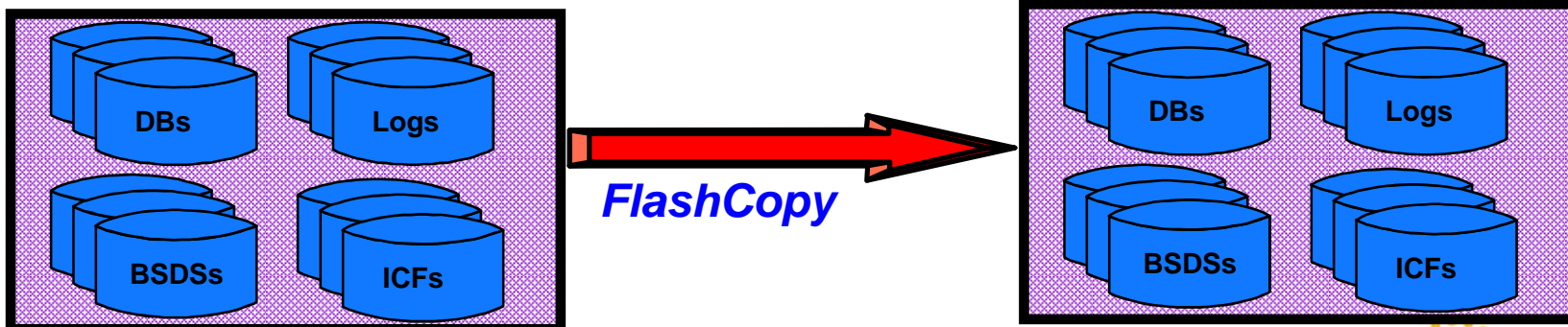
DB2 Managed FlashCopy Solution ...

- *new utilities in DB2 for z/OS V8:*
  - ∫ *BACKUP SYSTEM*
  - ∫ *RESTORE SYSTEM*

- *Takes system-level copies of data and logs*
  - ∫ *Exploits SMS Copy Pool*
  - ∫ *DB2 data and logs must be SMS-managed*
  - ∫ *Write log activity is NOT suspended*
  - ∫ *Suspends data set creation, deletion, rename, and extend operations*

SMS COPYPOOL

- *SMS construct*
- *Set of SMS storage groups - maximum 256*
- *Has a VERSIONS attribute - maximum 85*
- *Each DB2 system has two SMS COPYPOOLs*
  - ƒ *DATA COPYPOOL (DSN$location_name$DB)*
  - ƒ *LOG COPYPOOL (DSN$location_name$LG)*

- *Copy Pool Backup*
  - ƒ *New storage group type*
  - ƒ *Used to hold volume copies of DASD defined in the COPYPOOL*

SMS COPYPOOL - Example

CopyPool

Name: DSN$P870$DB

Versions: 2

Storage Group

Type: Pool
Name: DSNCAT
CopyPool Backup Name: CPB1

Storage Group

Type: Pool
Name: DSNDB
CopyPool Backup Name: CPB1

CopyPool

Name: DSN$P870$LG

Versions: 2

Storage Group

Type: Pool
Name: DSNLOG
CopyPool Backup Name: CPB1

Storage Group

Type: CopyPool Backup
Name: CPB1
CopyPool Backup Name: N/A
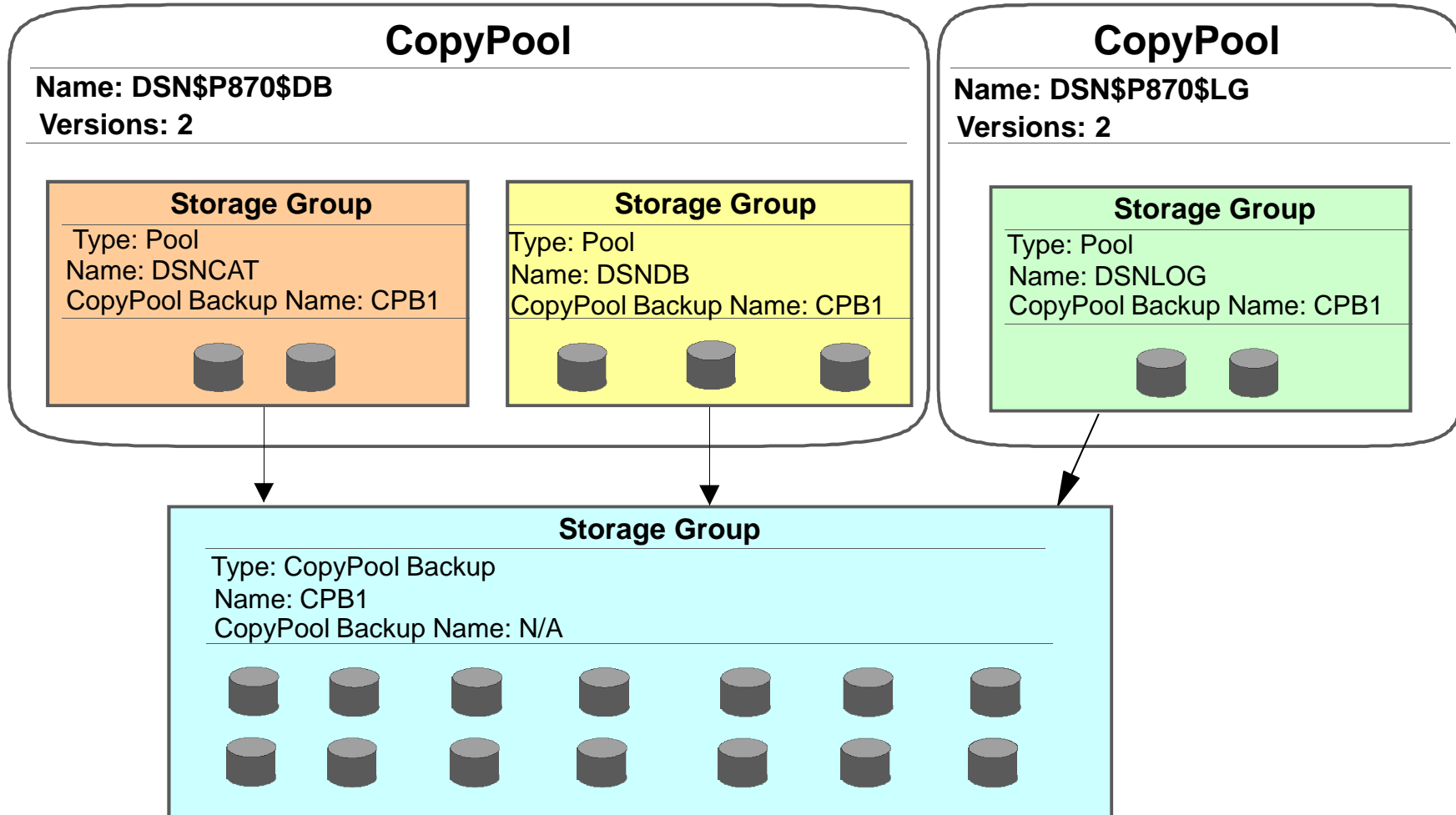
Backup and Recovery Enhancements in DB2 9

DB2 9 Enhancements

- *BACKUP SYSTEM and RESTORE SYSTEM utilities will manage Copy Pool backups to/from tapes*

  ∫ *Up to five tape copies can be created*

- *Support Incremental FlashCopy*

- *RECOVER utility can use Copy Pool backups as the source for recovery of DB2 tables and indexes*

  ∫ *Backups can be on DASDs or Tapes*

- *Prereq. DFSMShsm and z/OS 1.8*

CopyPool Backups on Tapes

- *Customer benefits – Reduce disk space for maintaining multiple Copy Pool backups*

"This sure makes Copy Pool dump & restore management a lot easier "
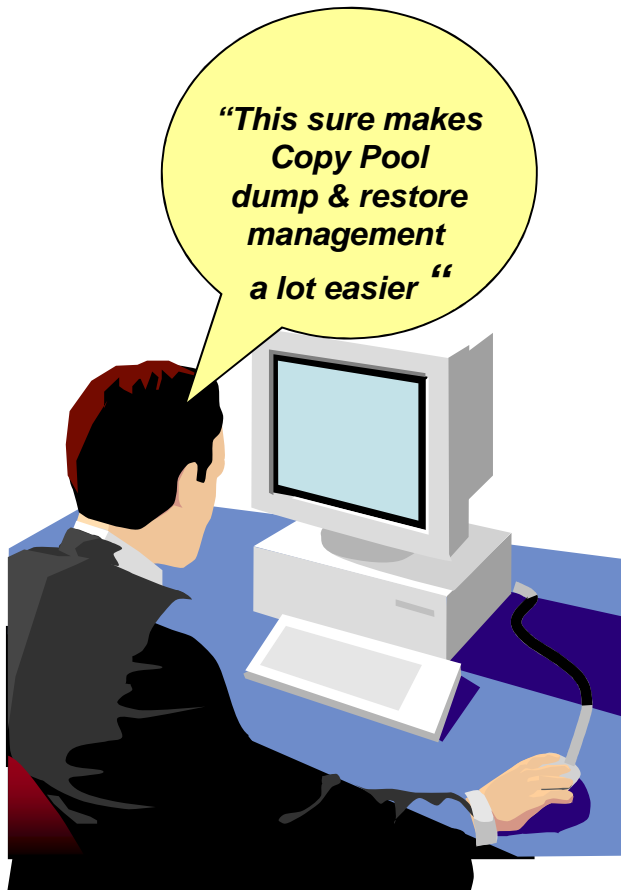
- *Integrated tape management between DB2 and DFSMShsm*

- *Retaining Copy Pool backups for long term use*

- *Providing a means of recovery from media failure*

- *Remote site recovery*

RESTORE SYSTEM – Tape Support

- *Restore the DB copy pool from tapes in parallel*
- *If the data copy pool backup resides on DASD and on tape, then the DASD version is chosen as the recovery base*
- *Install ZPARM options*
  - ∫ *FROMDUMP - user can specify that they don't want to use the DASD version*
  - ∫ *DUMPCLASS (dc) - user can specify a specify HSM dump class to restore from*

RECOVER utility – use Copy Pool backup

- *RECOVER utility enhancements permit using a backup taken at the system-level as the recovery base for a subset of objects in the system*
- *Need to set ZPARM System_Level_Backups = YES*

Connecting system-level backups with object level recoveries

BACKUP SYSTEM

FULL or DATA

System Level Backup

FULL or DATA

RECOVER

TS 1

TS 2
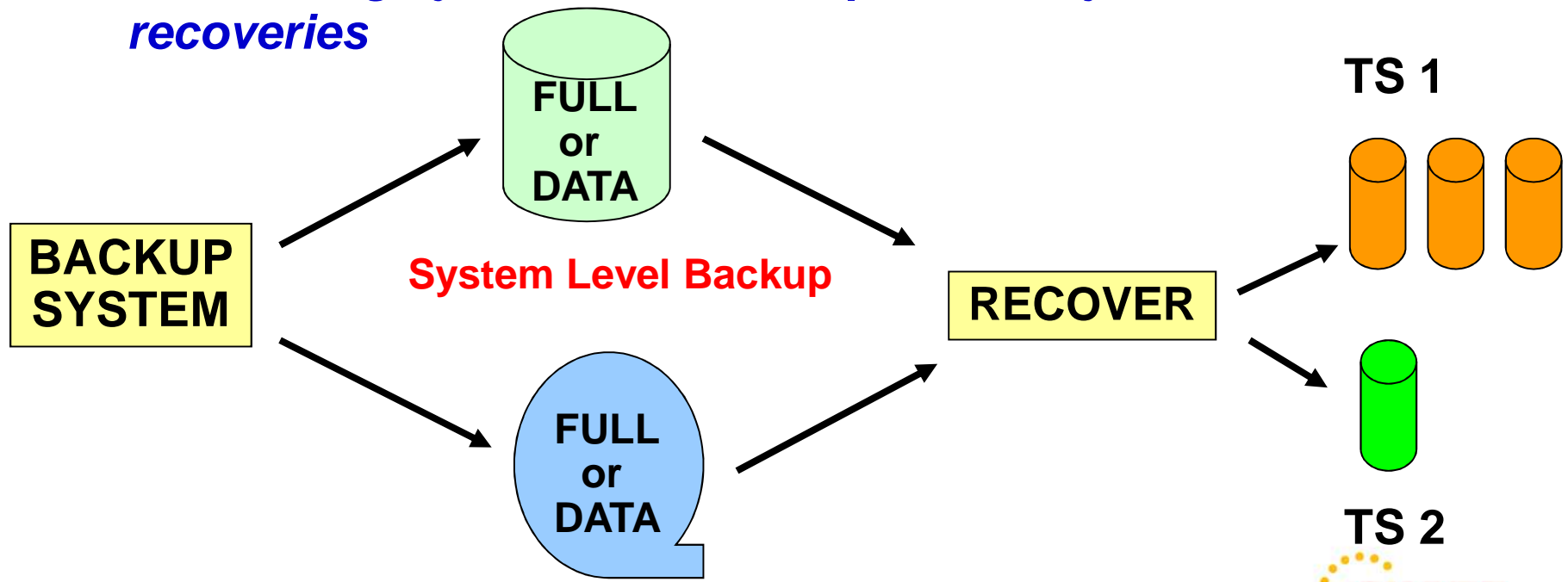
RECOVER utility – use Copy Pool backup ...

- *Most recent recovery base (prior to the recovery point) is chosen:*
  - ∫ *could be image copy, concurrent copy, log yes event, or Copy Pool backup*
- *Takes sub-second to restore a data set if the backup is on DASD (independent of its size)*
- *Use normal I/O (i.e. not FlashCopy)*
  - ∫ *If FlashCopy background copy is not complete*
  - ∫ *If the production volume is the source of PPRC/XRC*
    - • *Use FlashCopy with Remote Pair Flash Copy on DS8K 4.2.*
  - ∫ *Make sure SETSYS FASTREPLICATION(PREFERRED) is used, which is the default*
- *When restoring a list of objects, the restore process is done in parallel*

RECOVER utility – use Copy Pool backup ...

- *Data set must be cataloged and allocated on the same volumes that it resided on at the time of the backup*
  - ƒ *Support for data sets that have extended to new volumes*
  - ƒ *DB2 Recovery Expert V2 can alleviate this problem*
  - ƒ *DFSMS support is in z/OS 1.11 (require DB2 apar PK92725)*
    - *SMS option to capture ICFCTLG for Copy Pool*
    - *Allow recovery for moved/deleted data sets*
    - *Still need to have sufficient free space on the original DASD volume*

- *If the restore of datasets from DASD fails, then the recovery of the object will not proceed*
  - ƒ *Use the RECOVER RESTOREBEFORE option to direct the utility to use a recovery base prior to the system-level backup*

- *If FROMDUMP is specified:*
  - ƒ *Data sets are restored from tapes*

Incremental Flash Copy

- *Introduced by DFSMShsm in z/OS 1.8*
    - ∫ *Initial incremental FlashCopy creates full base backup*
    - ∫ *Subsequent incr. FlashCopies copy changed tracks to backup volumes only (overriding initial backup)*
- *Minimizes I/O impact (⅓ DB2 incremental IC)*
- *Considerably reduces elapsed time of physical copy*

Initial FlashCopy
(Background Copy with Change Recording enabled)

A — Initial copy → B

Incremental FlashCopy
(Copies only changed data)

A — Changed data → B

OR

A ← Changed data — B
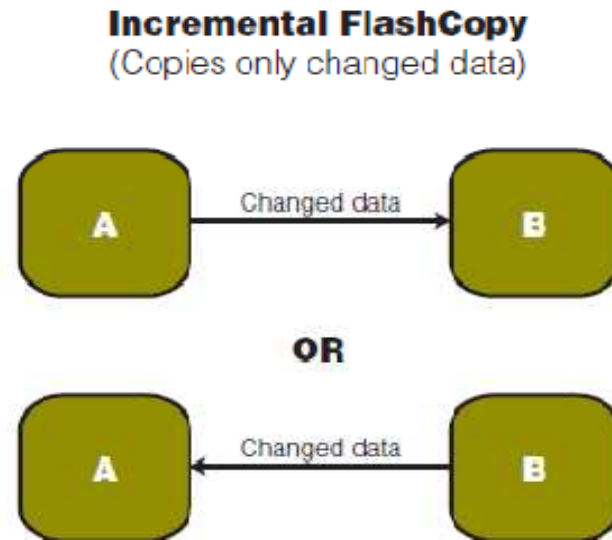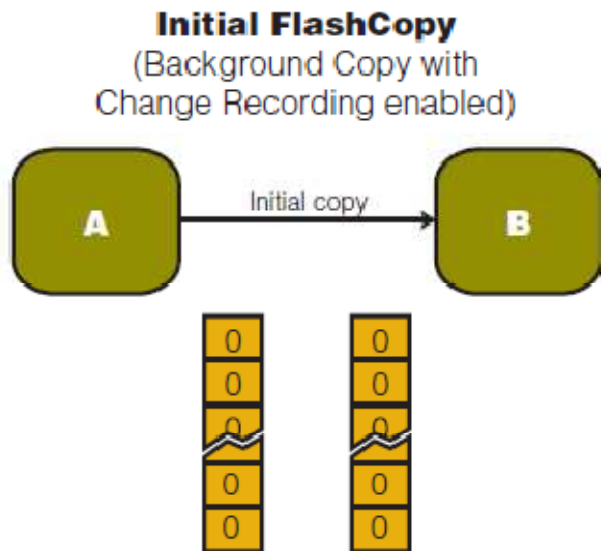
RECOVER to PIT with consistency

DB2 RECOVER utility will:

- ƒ *Automatically detect the uncommitted transactions running at the recover PIT*
- ƒ *Roll back their changes on the recovered objects.*
- ƒ *Thus ensuring data consistency after PIT recoveries.*
- ƒ *Recovered objects left in a transaction consistent state.*

- ■ *Avoid the need to regularly run the QUIESCE utility*
  - ƒ *Reduces disruption to DB2 users and applications*

Backup and Recovery Enhancements in DB2 10

DB2 10: Copy/Recover Enhancements

- Improved COPY CHANGELIMIT performance
  - Use RTS instead of scanning space map pages
- Dataset level FlashCopy option
  - Inline COPY is optional for REORG (post-GA enhancement)
- FlashCopy backups with consistency and no application outage
- FlashCopy backups as input to:
  - RECOVER (fast restore phase)
  - COPYTOCOPY
    - Create sequential copies from FlashCopy
    - Can be used as input for UNLOAD
  - DSN1COPY/DSN1PRNT
- RECOVER "back to" log point
- REPORT RECOVERY support for system level backups
- MODIFY RECOVERY improved performance

V10: COPY

- Dataset-level Flashcopy support
  - COPY, RECOVER, REORG, LOAD, REBUILD INDEX, REORG INDEX
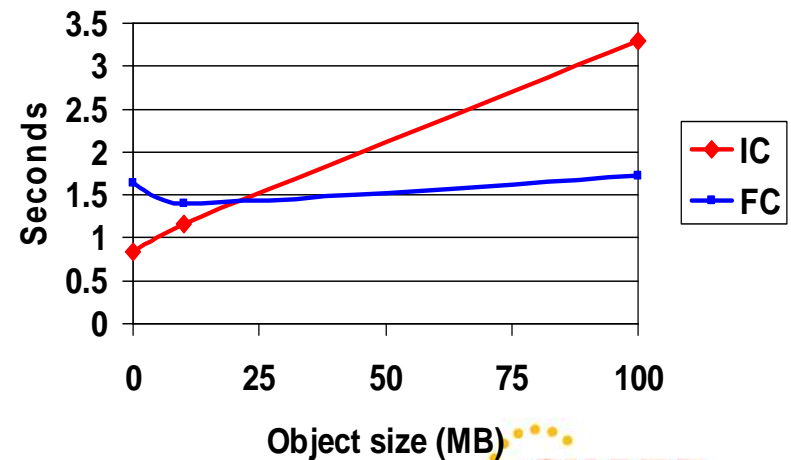 - New zparms & utility parms to govern
  - Significant CPU & elapsed time reduction for large pagesets
  - Create transaction-consistent image copies from SHRLEVEL CHANGE

CPU time per object (z10)
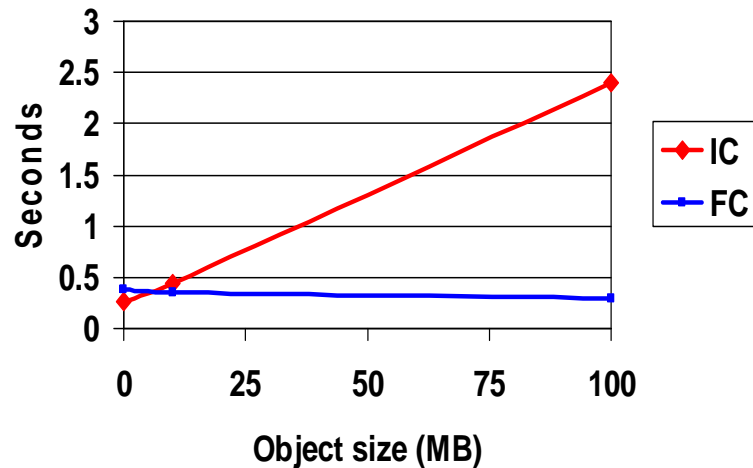
Elapsed time per object (z10)

V10: COPY

- Post-GA Flashcopy enhancements – PM34776
  - Support for REORG AUX YES to FlashCopy aux objects
  - Remove requirement for sequential inline copy for REORG
  - Add a new zparm parameter FLASHCOPY_PPRC which controls whether FlashCopy can be taken against PPRC primary volumes
    - REQUIRED - Require DS8K Remote Pair FlashCopy function to take FlashCopy
    - PREFERRED - Allow to take FlashCopy even if DS8K RPFC is not available (volume pairs will be in GDPS duplex pending state when the background copy is in progress)
    - NONE - FlashCopy does not preserve mirror

CPU time per object (z10)
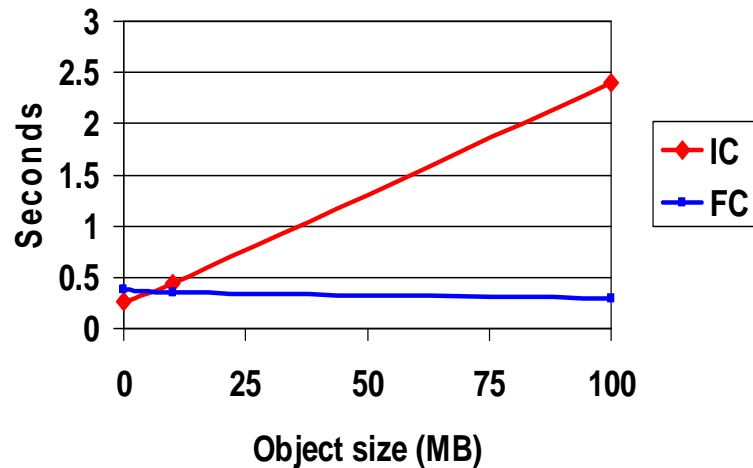
Elapsed time per object (z10)
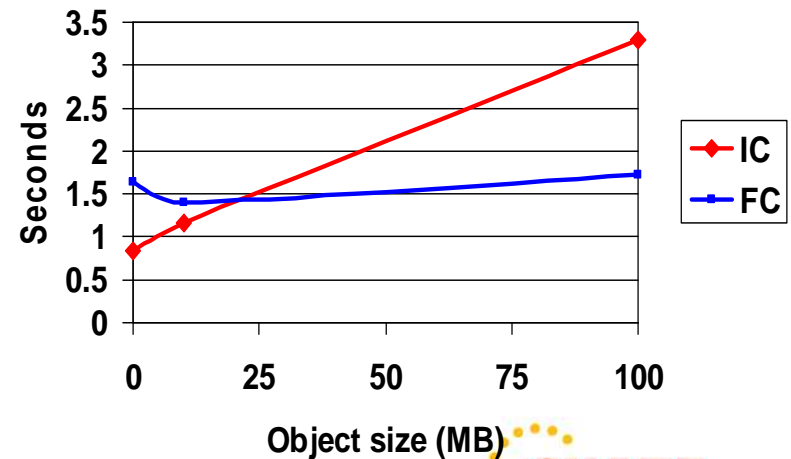
V10: COPY

- Improved dataset management & performance
  - CHANGELIMIT will not allocate copy dataset unless copy taken
    - &ICTYPE now matches actual image copy type
  - Use RTS for CHANGELIMIT performance
    - No longer need to scan space map pages
  - Incremental copy will not allocate copy dataset unless pages changed
  - Insert dummy SYSCOPY record for incremental copy even though no pages changed
  - Delivery post-GA

V10: RECOVER

- **New BACKOUT YES option for point in time recovery**
  - True rollback, not run of generated SQL undo statements
  - Requires COPY YES for indexes
  - Not for media recovery
- **Allow fast data restore from data set level FlashCopy**
- **New ZPARM REC_FASTREPLICATION parameter**
  - PREFERED (default) – use FlashCopy if available
  - REQUIRED – use FlashCopy for recovery
  - NONE – use standard I/O for recovery
- **VERIFYSET option to fail PIT recovery if entire set not included**
  - Base, LOB, XML, history – not RI
- **ENFORCE option to avoid CHKP/ACHKP when subset of set recovered**
  - Improved performance due to avoidance of set checking (RI, aux)

PPRC/XRC Restrictions

- *RESTORE SYSTEM & RECOVER from SLB fails if target is a primary in a PPRC relationship or part of an XRC relationship*

  - ∫ *DFSMShsm APAR OA23849 permits FlashCopy to a PPRC primary*
  - ∫ *But volumes will be in "duplex pending" state until background copy completes*
    - *GDPS / Hyperswap failover fails for volumes in Duplex Pending*
  - ∫ *Resolve this issue by shipping function rather than data through PPRC (DS8K FlashCopy Preserve Mirror solution)*
  - ∫ *No XRC solution in the short term*

HSM Enhancements in z/OS 1.12

- *QUERU COPYPOOL command to display background copy percent-complete information*

- *Allow RESTORE to use Sytem-level backups without waiting for FlashCopy background copy to complete*
    - ∫ *Use DS8K Fast Reverse Restore (i.e. FRR) feature*
    - ∫ *New SMS Copy Pool setting to enable FRR*
    - ∫ *Source volumes can't be in any other FlashCopy relationships*

- *LIST COPYPOOL command to display whether FRR was enabled and the recovery status of using FRR*

Multiple Space Efficient Versions

Copy Pool: CP1

Versions: 3

Storage Group

Name: DATA

Type: Pool

Copy Pool Backup Name: PAYBACK

FRBACKUP CP1

Storage Group

Name: **PAYBACK**

Type: Copy Pool Backup

Version n+2   2%

2% data change since version created

10% data change between versions

Version n+1   12%

12% data change since version created

13% data change between versions

Version n 25%

25% data change since version created

Dump Tape

Total 'real' storage: 39%

CP1 Version n

HSM Enhancements in z/OS 1.12

- *Allow Backup System to use Space Efficient FlashCopy to keep backups on tapes*
  - *CopyPool with Version = 0*
- *Space Efficient Volumes*
  - *Not consume physical space until writes take place*
  - *Requires FlashCopy SE licensed feature*
  - *HSM selects SE target volumes when Copy Pool is defined with NOCOPY (VERSIONS = 0)*
- *If FRR is enabled, recovery of the entire Copy Pool can be performed from the disk backup (in addition to a dump tape version)*

Summary

- *A fast and non-disruptive backup solution using*
  - ∫ *FlashCopy and DB2 Backup System Utility*
  - ∫ *Support Incremental FlashCopy*
- *Copy Pool backups can be used as the source for DB2 table/index recovery*
- *Automatically manage Copy Pool backups on tapes*
- *Restore System Utility can recover DB2 system from DASD or Tapes*
- *Recover Utility can recover table space and index to PIT with transaction level consistency*
- *Remote Pair FlashCopy to alleviate PPRC restriction*
- *Tight collaboration between DB2 and Storage teams*

Thank You !