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

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August 9, 2011
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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
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
  - DATA COPYPOOL (DSN$location_name$DB)
  - LOG COPYPOOL (DSN$location_name$LG)

Copy Pool Backup

- New storage group type
- 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

### CopyPool
- **Name:** DSN$P870$LG
- **Versions:** 2

  - **Storage Group**
    - **Type:** Pool
    - **Name:** DSNDB
    - **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. DFSMSShsm 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 DFSMSShsm**

  - **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*
**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
  - Support for data sets that have extended to new volumes
  - DB2 Recovery Expert V2 can alleviate this problem
  - 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
  - Use the RECOVER RESTOREBEFORE option to direct the utility to use a recovery base prior to the system-level backup

- If FROMDUMP is specified:
  - 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 (DB2 incremental IC)**
- **Considerably reduces elapsed time of physical copy**

![Diagram showing Initial FlashCopy and Incremental FlashCopy processes](image-url)
RECOVER to PIT with consistency

DB2 RECOVER utility will:

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

- Avoid the need to regularly run the QUIESCE utility
- 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)**
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 RPF C 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 System-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

Version n+2 2%
Version n+1 12%
Version n 25%

Total ‘real’ storage: 39%

CP1 Version n

Dump Tape

2% data change since version created
10% data change between versions
12% data change since version created
13% data change between versions
25% data change since version created
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 !