Using FlashCopy in the DB2 Utilities

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<th>Enterprise Storage Server*</th>
<th>IP PrintWay</th>
<th>RMF</th>
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<td>ES/9000*</td>
<td>Language Environment*</td>
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<td>DB2*</td>
<td>FlashCopy*</td>
<td>Lotus*</td>
<td>S/390*</td>
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<td>GDPS*</td>
<td>Multiprise*</td>
<td>Tivoli*</td>
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<td>HiperSockets</td>
<td>MVS</td>
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<td>DFSMSdfp</td>
<td>IBM*</td>
<td>Notes*</td>
<td>WebSphere*</td>
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<td>IBM eServer</td>
<td>OS/390*</td>
<td>z/Architecture</td>
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<td>IBM e(logo)server*</td>
<td>Parallel Sysplex*</td>
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<td>zSeries*</td>
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Agenda

- **FlashCopy Overview of Basic Concepts**
- Using FlashCopy in the DB2 Utilities
  - COPY/LOAD/CHECK/REBUILD/REORG/RECOVER
- **FlashCopy Overview of Advanced Concepts**
- Using FlashCopy in system level backups
- Using FlashCopy in system and object level recoveries
- Using the object level recovery (from system level backup) enhancement
FlashCopy w/ Background Copy

FlashCopy established at time $t_0$ (time-zero)

$\begin{array}{c}
\text{source} \\
data \\
t_0 \quad t_0 \quad t_0 \quad t_0 \quad t_0 \quad t_0
\end{array}$

$\begin{array}{c}
\text{target} \\
data
\end{array}$

Figure 8-2 FlashCopy at time $t_0$

Source: IBM System Storage DS8000 Copy Services for IBM System Z
FlashCopy w/ Background Copy

Source: IBM System Storage DS8000 Copy Services for IBM System Z
FlashCopy w/out Background Copy (FCNOCOPY)

- Same pictures as the previous slides, however, the relationship lasts until one of the following occurs:
  - it is explicitly withdrawn
  - until all data in the source relationship is modified
  - until all the data in the target relationship is modified

Source: IBM System Storage DS8000 Copy Services for IBM System Z
FlashCopy in a Metro Mirror Environment

Figure 8-10  Remote Pair FlashCopy preserves Metro Mirror FULL DUPLEx state

Source: IBM System Storage DS8000 Copy Services for IBM System Z
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Using FlashCopy in the DB2 Utilities

• The utilities that invoke DFSMSdss COPY are:
  • DB2 for z/OS V8
    • CHECK INDEX with SHRLEVEL CHANGE
  • DB2 for z/OS V9
    • CHECK DATA|LOB with SHRLEVEL CHANGE
  • DB2 for z/OS V10
    • COPY, LOAD, REBUILD INDEX, REORG TABLESPACE | INDEX with FLASHCOPY YES or FLASHCOPY CONSISTENT

Source: DB2 10 for z/OS Utility Guide and Reference (Subsystem parameters for refining DFSMSdss COPY operation with utilities)
Understanding the stack

System Z

- DB2 utilities
- DFSMSdss
- DS8000 FlashCopy

Processes

CHECK/LOAD/COPY
REBUILD/REORG

FlashCopy call

Efficiently copy data

Source: Casebook: DB2 backup, recovery and cloning for SAP environments
Invoking FlashCopy using the DB2 utilities

- *CHECK object SRHLEVEL CHANGE
- COPY FLASHCOPY YES or CONSISTENT
- LOAD FLASHCOPY YES or CONSISTENT
- REBUILD INDEX FLASHCOPY YES or CONSISTENT
- REORG INDEX FLASHCOPY YES or CONSISTENT
- REORG TS FLASHCOPY YES or CONSISTENT

- CHECK_FASTREPLICATION FLASHCOPY_PPRC
- FLASHCOPY_COPY FLASHCOPY_PPRC
- FLASHCOPY_LOAD FLASHCOPY_PPRC
- FLASHCOPY_REBUILD_INDEX FLASHCOPY_PPRC
- FLASHCOPY_REORG_INDEX FLASHCOPY_PPRC
- FLASHCOPY_REORG_TS FLASHCOPY_PPRC

- FR(PREF) FCNOCOPY FCTOPPRCP(PMR)
- FR(PREFERRED) FCTOPPRCP(PMR)
- FR(PREFERRED) FCTOPPRCP(PMR)
- FR(PREFERRED) FCTOPPRCP(PMR)
- FR(REQUIRED) FCTOPPRCP(PMR)
- FR(REQUIRED) FCTOPPRCP(PMR)

*With PTFs for PM34776 applied*
Asking the right questions to simplify choice of FlashCopy options

- Can I tolerate my metro mirror to get out of sync due to a FlashCopy
  - No – FCTOPPRCP(PreserveMirrorRequired)
  - Yes – FCTOPPRCP(PreserveMirrorPreferred)

- Can I tolerate extended unavailability in order to run my utility
  - No – FR(Required)
    - Note that if FlashCopy cannot be used the utility will have to be run at a later time when it can be used
  - Yes – FR(Preferred)
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- Using FlashCopy in system and object level recoveries
- Using the object level recovery (from system level backup) enhancement
Incremental FlashCopy relationships

**Source:** IBM System Storage DS8000 Copy Services for IBM System Z

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Complete your session evaluations online at www.SHARE.org/Pittsburgh-Eval
Fast Reverse Restore

Requires Full Volume Relation

Source: IBM System Storage DS8000 Copy Services for IBM System Z

Complete your session evaluations online at www.SHARE.org/Pittsburgh-Eval
Consistency Groups

- For applications that have data spread over multiple volumes
  - Creates a consistent point in time copy across multiple volumes
- Maintains the order of dependent writes

1. Write to log volume: Data Record #2 is being updated.
2. Update Data Record #2 on data volume.
3. Write to log volume: Data Record #2 update complete.

If the copy of the data contains any of these combinations, then the data is \textit{consistent}:
- Operation 1, 2, and 3
- Operation 1 and 2
- Operation 1
Space Efficient FlashCopy

Incremental Not supported

NOCOPY only

Source: IBM System Storage DS8000 Copy Services for IBM System Z
Dump Conditioning for full volume FlashCopy
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• Using FlashCopy in system and object level recoveries
• Using the object level recovery (from system level backup) enhancement
Understanding the system level backup stack

System Z

- DB2 BACKUP SYSTEM
- DFSMSHsm Fast Replication Services
- DFSMSdss
- DS8000 FlashCopy

Processes

DB2 subsystem or data sharing group
Copy pool
FlashCopy call
Efficiently copy data

Source: Casebook: DB2 backup, recovery and cloning for SAP environments
Controlling FlashCopy in system level backups

- DB2 BACKUP SYSTEM
  - ESTABLISH FCINCREMENTAL
  - END FCINCREMENTAL

- DFSMSHsm FRBACKUP
  - FCINCREMENTAL
  - FCINCREMENTALLAST
Controlling FlashCopy in system level backups

- DFSMShsm copy pool definition
  - Number of DASD Fast Replication Backup Versions with Background Copy
  - FRBACKUP to PPRC Primary Volumes allowed (NO, PN, PP, PR or blank)
  - FlashCopy Consistency Group
  - Allow Fast Reverse Restore (Y or N)
  - Capture Catalog Information for Data Set Recovery (R, P or N)

*FCINCREMENTAL cannot be used in combination with space efficient FlashCopy.

*The preserve mirror operation cannot be used in combination with space efficient FlashCopy.

Source: DFSMShsm Storage Administration
Using FlashCopy during system level backups

BACKUP SYSTEM
- ESTABLISH FCINCREMENTAL
- END FCINCREMENTAL

FRBACKUP CP(cp)
- FCINCREMENTAL
- FCINCREMENTALLAST
Copy Pool Definition
- Number of DASD FR Backup Versions
- FRBACKUP to PPRC Primary
- FlashCopy Consistency Group
- Allow Fast Reverse Restore

COPY FULL DC INDY(volser) FR(REQ)
- FCINCREMENTAL
- FCINCREMENTALLAST
Copy Pool Definition
- 0 – FCNOCOPY FCSETGTOK(FAIL)
- FCTOPPRCP(PMN|PMP|PMR)
- FCCGFREEZE
- FCFULLVOLUMERELATION

System Z

BACKUP SYSTEM

DFSMShsm

DFSMSdss

DS8000 FlashCopy

Subsystem / DSG

Copy pool

FlashCopy call

Efficiently copy data

Source: Casebook: DB2 backup, recovery and cloning for SAP environments
Realizing FlashCopy combinations during system level backups without Metro Mirror

 Allow Fast Reverse Restore would add FCFULLVOLUMERELATION

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<th>FRBACKUP to PPRC Primary</th>
<th>Number of Backup Versions</th>
<th>Consistency Group</th>
<th>ESTABLISH FCINCREMENTAL</th>
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<th>ESTABLISH FCINCREMENTAL</th>
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Realizing FlashCopy combinations during system level backups with Metro Mirror

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• Using FlashCopy in the DB2 Utilities
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• FlashCopy Overview of Advanced Concepts
• Using FlashCopy in system level backups
• Using FlashCopy in system and object level recoveries
• Using the object level recovery (from system level backup) enhancement
Controlling FlashCopy in system level recoveries

• DB2 RESTORE SYSTEM

• DFSMSHsm Copy Pool Definition
  • FRRECOV to PPRC Primary Volumes allowed (NO, PN, PP, PR or blank)
  •  
    DFSMSdss FCTOPPRCPRIMARY(NONE|PMP|PMR)
Using FlashCopy during system level restore

**Source:** Casebook: DB2 backup, recovery and cloning for SAP environments

**RESTORE SYSTEM**
- FRRECOV CP(cp)
  - FASTREPLICATION
  - ALLOWPPRC
  - Copy Pool Definition
  - FRRECOV to PPRC Primary
  - Allow Fast Reverse Restore

**DS8000 FlashCopy**
- Efficiently copy data

**DFSMSdss**
- FlashCopy call

**DFSMSHsm**
- Copy pool

**Subsystem/DSG**
- Processes
Realizing FlashCopy combinations during system level recoveries without Metro Mirror

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<th>FRREC0V to</th>
<th>Backup created with</th>
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<th>Action</th>
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### Realizing FlashCopy combinations during system level recoveries with Metro Mirror

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<tr>
<td>PMP</td>
<td>PMR</td>
<td>Yes</td>
<td>Yes</td>
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</table>
Controlling FlashCopy when recovering objects

- **RECOVER OBJECT**
  - REC_FASTREPLICATION subsystem parameter can also control FASTREPLICATION specification FASTREPLICATION(REQUIRED|NONE)

- FLASHCOPY_PPRC subsystem parameter can also control FCTOPPRCPRIMARY specification to FCTOPPRCPRIMARY(PRESERVE|MIRROR|PREFERRED|NONE)
Controlling FlashCopy when recovering objects

- DFSMSHsm Copy Pool Definition
  - FRRECOV to PPRC Primary Volumes allowed (NO, PN, PP, PR or blank)
  - *DB2 parameters override copy pool definition settings*
Using FlashCopy when recovering objects

**System Z**

- **RECOVER object**
- **DFSMSShsm**
- **DFSMSdss**
- **DS8000 FlashCopy**

**Processes**

- **Efficiently copy data**
- **FlashCopy call**
- **Copy pool**
- **TS/IX/LOB**

**Source:** Casebook: DB2 backup, recovery and cloning for SAP environments

**RECOVER object**

- REC_FASTREPLICATION
- FLASHCOPY_PPRC

**FRRECOV dsname**

- FASTREPLICATION
- ALLOWPPRC
- SETSYS
- Copy Pool Definition
- FRRECOV to PPRC Primary

**COPY DATASET(dsname) INDY(volser)**

- FASTREPLICATION(PREFERRED)
- FCTOPPRCP(PMR)
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Object Level Recovery Today

- DB2 RECOVER object from a system level backup
Enhancement to Object Level Recovery

- DB2 RECOVER object from a system level backup
Enhancement to the object level recovery

- Requires DFSMSdss and DFSMShsm PTFs
  - DFSMSdss
    - V1R13 OA41275 PTF – UA73031
  - DFSMShsm
    - V1R13 OA41298 PTF – UA73035
    - V2R1 – OA42298 PTF - UA70295
When would an image copy recovery fail

- T0 - take a system level backup
- T1 - take an image copy backup
- T2 - image copy backup completes
- T3 - corruption to table space
- T4 – recover object from image copy backup
  - If system level backup has not completed from T0 then this will fail because the target of your recovery is the source of a FlashCopy relationship.
  - *Cannot have a cascaded FlashCopy relation*
Multiple Incremental FlashCopy

- DFSMS/hsm and DFSMS/dss, in conjunction with the DS8000 will support Multiple Incremental FlashCopy relationships
  - Currently available by RPQ
  - Supports up to twelve incremental FlashCopy relationships
- Transparent to DB2
References

• DFSMSdss Storage Administration
• DFSMSHsm Storage Administration
• DB2 for z/OS Utility Guide and Reference
• Casebook: DB2 backup, recovery and cloning for SAP environments
• IBM System Storage DS8000 Copy Services for IBM System Z
System Z Social Media Channels

Top Facebook pages related to System z:
- IBM System z
- IBM Academic Initiative System z
- IBM Master the Mainframe Contest
- IBM Destination z
- Millenial Mainframer
- IBM Smarter Computing

Top LinkedIn groups related to System z:
- System z Advocates
- SAP on System z
- IBM Mainframe- Unofficial Group
- IBM System z Events
- Mainframe Experts Network
- System z Linux
- Enterprise Systems
- Mainframe Security Gurus

Twitter profiles related to System z:
- IBM System z
- IBM System z Events
- IBM DB2 on System z
- Millenial Mainframer
- Destination z
- IBM Smarter Computing

YouTube accounts related to System z:
- IBM System z
- Destination z
- IBM Smarter Computing

Top System z blogs to check out:
- Mainframe Insights
- Smarter Computing
- Millenial Mainframer
- Mainframe & Hybrid Computing
- The Mainframe Blog
- Mainframe Watch Belgium
- Mainframe Update
- Enterprise Systems Media Blog
- Dancing Dinosaur
- DB2 for z/OS
- IBM Destination z
- DB2utor

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