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IMS Database Image Copy 2

Greg Vance (gvance@us.ibm.com)

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IMS Database Image Copy 2 -- Topics

- What is IMS Database Image Copy 2
- Key benefits
- Capability
- DFSMS interface
- Invoking the Database Image Copy 2 utility
- DBRC support
- Requirements

Database Image Copy 2 Overview

- The Database Image Copy 2 utility (DFSUDMT0) invokes DFSMS Concurrent Copy to copy IMS databases
  - Utility was introduced in IMS Version 6
- Consistent ('clean') or 'fuzzy' copies are produced, per user specification
  - Image copy types SMSNOCIC and SMSCIC are produced
- The Database Recovery utility (DFSURDB0) and IMS Online Recovery Service (ORS) accept 'SMS' image copies as input
  - DFSMSdss is invoked to RESTORE the data set during database recovery processing

Why use Image Copy 2?

- Takes advantage of DFSMS Concurrent Copy and Virtual Concurrent Copy (Snapshot)
  - For databases that reside on supported hardware
    - 3990 Storage Control with Concurrent Copy feature
    - RAMAC Virtual Array (RVA) with Snapshot capability
    - Enterprise Storage Server (ESS) -- SHARK
- Integrates DFSMS Concurrent Copy function with IMS image copy function
  - Minimizes user interaction
  - Allows use of Concurrent Copy for IMS databases with integrity
- For 'clean' copies, reduces the time that the database or area must be offline (or not available for update)

Why use Image Copy 2? (cont'd.)

- 'Fuzzy' KSDS image copies can be taken
  - The Database Image Copy utility (DFSUDMP0) does not support fuzzy KSDS copies
- Supports data sharing environment
  - Online Database Image Copy (DFSUICP0) does not support data sharing
- Up to 4 output copies can be created
  - Primary and secondary copies are registered with DBRC
  - Additional copies may be used for 'second site'/disaster recovery purposes

IMS Image Copy utilities

	Database Image Copy (DFSUDMP0)	Database Image Copy 2 (DFSUDMT0)	Online Database Image Copy (DFSUICP0)
Environment	batch	batch	online (BMP)
Full function or FP	both	both	Full function only
Fuzzy KSDS copies	N	Y	Y
Reduced DB outage for clean copies	N	Y	N
Supports datasharing (DB/area available on all IMSs for fuzzy copy)	Y	Y	N
Hardware requirement	N	Y	N
Number of output copies	2	4	2
Copies multiple data sets per execution	Y	N	Y

Image Copy 2 capabilities

- Clean image copies can be taken with a minimal amount of database or area down time
- DFSMS Concurrent Copy processes in two phases
  - Logical copy phase (concurrent copy initialization) -- takes a very quick 'snapshot' of the data
  - Physical copy phase -- produces the physical dump data set(s)
- Database/area can be made available for update after logical copy phase has completed
  - Consistent copy is produced even though updates occur during the physical copy phase

DFSMS Concurrent Copy Write Interception

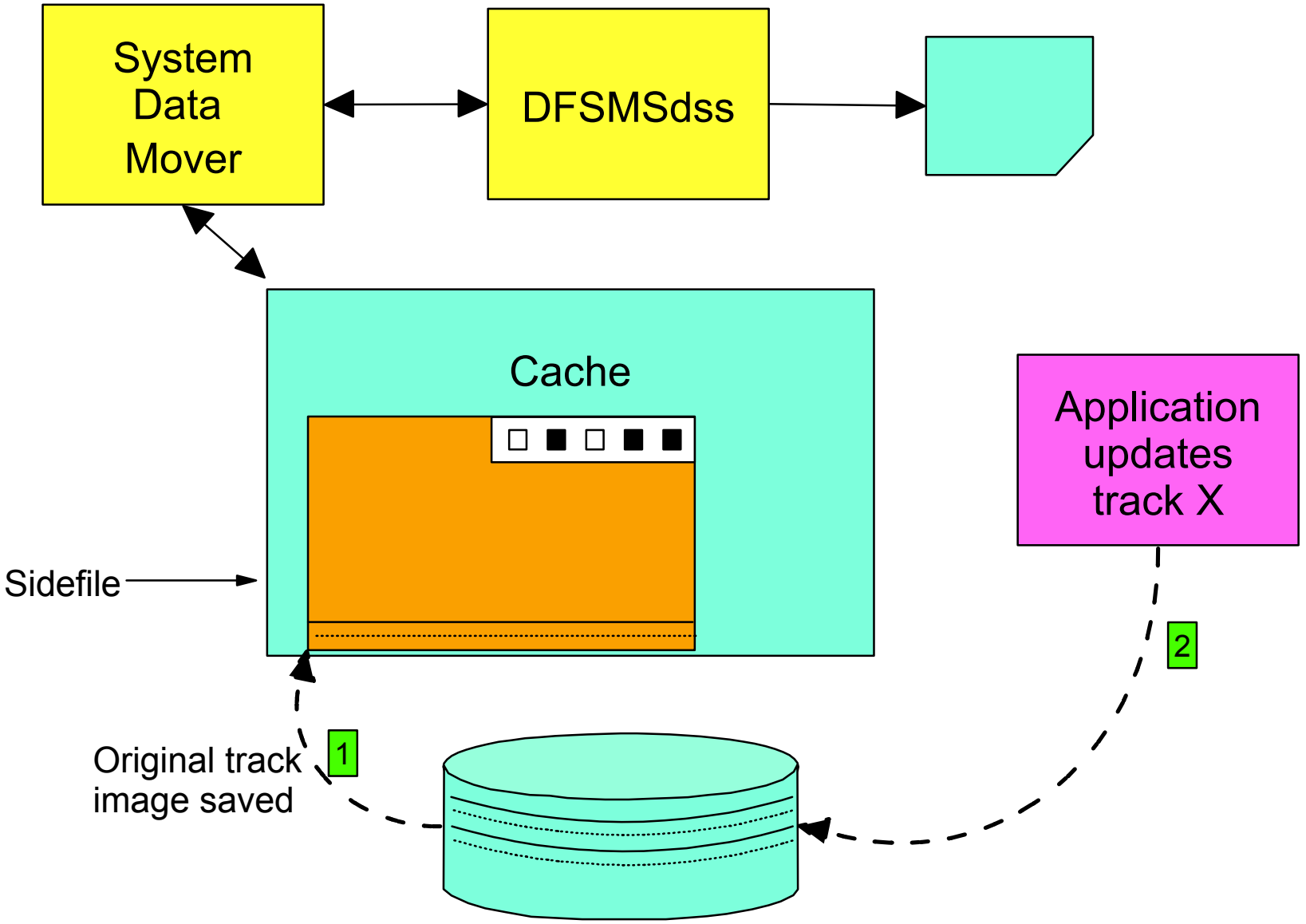

Image Copy 2 capabilities (cont'd.)

- Virtual Concurrent Copy is used for databases that reside on RAMAC Virtual Array (RVA) DASD
  - Virtual Concurrent Copy is also called 'Concurrent Copy-compatible Snapshot'
- Virtual Concurrent Copy uses Snapshot capability
  - Logical copy phase consists of taking a Snapshot copy of the data set
  - Snapshot copy is offloaded to the image copy output data set(s) during the physical copy phase
  - Use of Snapshot vs. Concurrent Copy is transparent to the IMS utility
    - handled by DFSMSdss
  - Snapshot copy is not visible to the Image Copy 2 utility
    - is not externalized or recorded in the RECON

Image Copy 2 capabilities (cont'd.)

- For clean copies, the option exists to disallow update access until physical copy completion
  - Use when a clean copy taken at a specific point in time is required
- Fuzzy image copies can also be taken
  - KSDS data sets are supported for fuzzy copying
- 'SMS' image copy types
  - SMSNOCIC -- image copy created by the Database Image Copy 2 utility (DFSUDMT0) while update access to the database was not allowed
  - SMSCIC -- image copy created by Database Image Copy 2; the copy was taken concurrent with update access

Image Copy 2 capabilities (cont'd.)

- Summary of copy options

- Clean copy -- allow updates after logical copy
  - reduced database downtime
  - 'XL' option (eXclusive, release after Logical copy)

- Clean copy -- disallow updates until after physical copy
  - like Database Image Copy (DFSUDMP0) without CIC option
    - CIC = concurrent image copy
  - 'XP' option (eXclusive, release after Physical copy)

- Fuzzy copy -- no impact on database availability
  - 'S' option (Shared)

Image Copy 2 capabilities (cont'd.)

- Provides data set level processing
  - Does not support volume dump/restore
- Copies a single data set per utility execution
- Up to 4 output copies can be created
  - Primary and secondary copies are registered with DBRC
  - Additional copies may be used for 'second site'/disaster recovery purposes
- Output copies can be in compressed format
  - Compress option was added in IMS Version 7

Image Copy 2 setup requirements

- Database data sets must reside on
  - 3990 Storage Control with Concurrent Copy capability, or
  - RAMAC Virtual Array subsystem with Snapshot capability, or
  - Enterprise Storage Server
- Databases and areas must be registered with DBRC
- For fuzzy KSDS image copy
  - KSDS must be SMS-managed
  - BWO(TYPEIMS) must be specified for the KSDS via DEFINE or ALTER CLUSTER
    - BWO = backup while open
- DFSMS/MVS Version 1 Release 3 or higher is required

Database Image Copy 2 -- general

- DFSUDMT0 invokes DFSMSdss for DUMP specifying the CONCURRENT (CC) option
- DFSMSdss is invoked through the DFSMSdss cross memory API
  - via ADRXMAIA
  - DFSMSdss processing runs in a separate 'server' address space (IEESYSAS)
- Image copy data sets produced by Database Image Copy 2 are in DFSMS dump format

Database Image Copy 2 -- invocation

- Database Image Copy 2 (DFSUDMT0) executes as an offline IMS utility
- DFSUDMT0 executes under the IMS region controller -- stand-alone mode is not supported

```
-//TOCOPY1  EXEC PGM=DFSRRC00,PARM='ULU',DFSUDMT0,...
```

- DBRC is required for execution
- Image copy options are specified on the utility control (SYSIN) statement

Image Copy 2 -- invocation (cont'd.)

Format of the DFSUDMT0 control statement:

position	description
1	
2	Number of output copies
3	
4 - 11	Input database name
12	
13 - 20	Input DD name or area name
21	
22 - 29	Copy 1 (primary output copy) DD name
30	
31 - 38	Copy 2 (secondary output copy) DD name
39	
40 - 47	Copy 3 DD name
48	
49 - 56	Copy 4 DD name

Image Copy 2 -- invocation (cont'd.)

Format of the DFSUDMT0 control statement (cont'd.):

position	description
57	
58	S|X -- S (for "Shared") specifies a fuzzy copy (SMSCIC); X (for "eXclusive") specifies a clean copy (SMSNOCIC)
59	L|P -- for clean copy, updates are to be allowed after Logical copy (L) or after Physical copy (P); ignored for fuzzy copy
60	C -- compress output copies
61 - 72	Reserved

Image Copy 2 -- processing

- DD DUMMY can be specified for COPY 2, COPY 3, and or COPY 4
- Only the first two output copies, the primary and secondary, are recorded in the RECON
- Image copy processing is aborted if I/O errors occur on the primary and secondary output copies
- Message DFS3121I is issued (via WTO) at logical copy completion

Image Copy 2 -- processing (cont'd.)

- For a Fast Path area, error CIs must not exist in the area data set (ADS) that is being copied
  - Image Copy 2 cannot selectively read and copy CIs from multiple ADSs
- The utility selects a 'good' ADS and supplies it on the DFSMSdss dump request
  - Image copy processing fails if all ADSs contain error queue elements (EQEs)
- Processing is aborted if an EQE exists for the selected ADS at the end of the logical copy phase

Scenario: Taking a clean image copy

- For an SMSNOCIC (consistent) image copy, update processing of the database/area must be quiesced
  - Issue /DBDump or /DBRecovery command before executing Database Image Copy 2
- If updates are to be allowed after the logical copy phase
  - 'XL' must be specified on the utility control statement
  - /START the database/area after logical copy completion
    - DFS3121I message is issued at logical completion -- may be automated
- If updates are not to be allowed until the physical copy is complete
  - 'XP' must be specified on the utility control statement
  - /START the database/area when the utility terminates successfully

DFSMS DUMP options

- The following DFSMS DUMP options are specified on the DFSMSdss request:

- OPTimize(1) -- for fuzzy (SMSCIC) copies
  - causes DFSMSdss to read a track at a time
  - physical copy takes longer, but less DASD contention

- OPTimize(4) -- for consistent (SMSNOCIC) copies
  - causes DFSMSdss to read a cylinder at a time
  - reduces physical copy time, but more DASD contention

DFSMS DUMP options (cont'd.)

- VALIDATE for KSDS data sets
  - causes the KSDS to be validated as it is being dumped
  - only the data portion is dumped
    - restore operation results in a reorganization
- COMpress -- if specified on the Image Copy 2 control statement
  - decreases image copy data set space at the expense of increased processor and elapsed times
  - compress option is not available in IMS Version 6

Recovery with 'SMS' image copies

- The Database Recovery utility (DFSURDB0) provides recovery from SMSCIC and SMSNOCIC image copies
  - Must be run with DBRC to process 'SMS' image copies
  - Existing JCL and/or skeletal JCL for GENJCL.RECOV can be used
- IMS Online Recovery Service (ORS) also provides recovery from 'SMS' image copies
- DFSMSdss is invoked to RESTORE the data set
  - Change accumulation data is not merged with image copy data during restore -- change accum is applied after restore
  - The recovery utility does not report count of image copy records applied

DBRC support for Image Copy 2

- New image copy types are registered in the RECON
  - SMSNOCIC - DFSMS dump taken while DB was unavailable for update
  - SMSCIC - DFSMS dump taken while DB was available for update
  - The primary and secondary output copies are recorded; copies 3 and 4 are not
- DBRC indicates to the Database Recovery utility and to the Online Recovery Service that the IC is an 'SMS' type

DBRC support for Image Copy 2 (cont'd.)

- GENJCL.IC support
- One skeletal JCL member supports both utilities, DFSUDMP0 and DFSUDMT0
- SMSCIC and SMSNOCIC keywords specify that JCL to invoke Image Copy 2 (DFSUDMT0) is to be generated
  - Mutually exclusive with existing specifications --
    - CIC | NOCIC | SMSCIC | SMSNOCIC
  - SMSNOCIC indicates that update access is not allowed while the copy is being taken
    - 'X' is generated on the Image Copy 2 control statement
  - SMSCIC indicates that the IC will be taken concurrent with updates
    - 'S' is generated on the control statement

DBRC support for Image Copy 2 (cont'd.)

- GENJCL.IC support (cont'd.)
- COMPRESS keyword can be specified for SMSCIC and SMSNOCIC
  - CIC | NOCIC | SMSCIC(COMPRESS) | SMSNOCIC(COMPRESS)
- For SMSNOCIC, the DBREL(**L**|P) parameter specifies the 'DB release' option for the control statement
  - 'L' -- updates allowed after logical copy
  - 'P' -- updates allowed after physical copy
- Support for 3 or 4 output copies is provided for database data sets defined with NOREUSE attribute
  - COPIES(3) and COPIES(4) can be specified along with
    - UNIT3 or UNIT4
    - VOLLIST3 or VOLLIST4

DBRC Support for Image Copy 2 (cont'd.)

GENJCL.IC Example

GENJCL command:

```
GENJCL.IC DBD(DBDVSAM1) DDN(DDNVSAM1) SMSNOCIC(COMPRESS)
          DBREL(L) COPIES(4) VOLLIST1(IC2001)
          VOLLIST2(IC2002) VOLLIST3(IC2003) VOLLIST4(IC2004)
```

Generated JCL:

```
//IC1       EXEC   PGM=DFSRRC00,REGION=800K,
//                      PARM='ULU,DFSUDMT0,,,,,,,,,,,Y,,,,,,,'
                .
                .
                .
//SYSIN
 4 DBDVSAM1 DDNVSAM1 DATAOUT1 DATAOUT2 DATAOUT3 DATAOUT4 XLC
/*
```

Image Copy 2 -- User Requirements

- Support copying multiple data sets in a single execution of the utility
- Provide "logical copy complete" notification at the database level
  - Also at the database group level
- Allow user to specify the DFSMSdss OPTIMIZE option
- Automatically quiesce/start databases
- Provide support for Snapshot image copies
- Others...?

IMS Database Image Copy 2 -- Summary

- IMS Database Image Copy 2 exploits DFSMS Concurrent Copy and DFSMS Snapshot
- Improves DB availability when taking clean image copies
- Provides support that is missing from other IMS image copy utilities
  - Supports KSDS fuzzy image copies
  - Supports SYSPLEX data sharing

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