

E43

Database Image Copy 2 and V7 Concurrent RECON Upgrade

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E43 (Part 1)

Database Image Copy 2

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Database Image Copy -- Topics



- **What is 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 Version 7 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 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

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

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



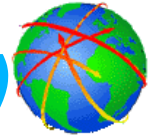
- **DFSUDMT0 invokes DFSMSdss for DUMP specifying the CONCURRENT (CC) option**
- **DFSMSdss is invoked through the DFSMSdss cross memory API**
 - via ADRXMAIA
 - DFSMSdss processing runs in a separate 'server' address space (IEESYSAS)
- **Image copy data sets produced by Database Image Copy 2 are in 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=DFSRRRC00, 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.)



IMS

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	
32 - 38	Copy 2 (secondary output copy) DD name
39	
40 - 47	Copy 3 DD name
48	
49 - 56	Copy 4 DD name
57	
58	<u>S</u> X -- S (for "Shared") specifies a fuzzy copy (SMSCIC); X (for) "eXclusive" specifies a clean copy (SMSNOCIC)
59	<u>L</u> 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 the Database Image Copy 2 (DFSUDMT0) utility

- **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



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

- **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

- **WAIT(0,0)**
 - DFSMSdss will not retry if control (serialization) of the input (database) data set could not be obtained

DFSMS DUMP options (cont'd.)



- **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
- **COMpress -- if specified on the Database Image Copy 2 utility 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

Database 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

- **Online Recovery Service (ORS) in V7 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
 - DFSURDB0 does not report count of image copy records applied

Database recovery w/ 'SMS' image copies...



● Recovering a Fast Path area data set (ADS)

- The source data set for the 'SMS' image copy must be in the ADS list in RECON; if no longer in the list:
 - Database Recovery utility (DFSURDB0): issues DFS3155I with RC=4
 - Online Recovery Service (ORS): issues DFS4225I
- For recovery using the Database Recovery utility, the source data set for the image copy must exist in the catalog
 - Database Recovery utility (DFSURDB0): issues DFS3155I with RC=8 if the source data set does not exist
- Example:
 - ADS list when image copy taken: ADS_P1, ADS_P2
 - Image copy taken using Database Image Copy 2 -- ADS_P1 copied
 - ADS_P3 created, ADS_P1 deleted
 - ADS list when recovery needed: ADS_P2, ADS_P3
 - Recovery fails with DFS3155I RC=4 (DFSURDB0) or DFS4225I (ORS)
 - User action: Add the identified area data set to the ADS list; if running DFSURDB0, create the identified area data set

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 ORS) 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 (SYSIN) 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(LIP) 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 the 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=DFSRRRC00,REGION=800K,
//          PARM='ULU,DFSUDMT0,,,,,,,,,,,,,Y,,,,,,,,,'
          .
          .
          .
//SYSIN
  4 DBDVSAM1 DDNVSAM1 DATAOUT1 DATAOUT2 DATAOUT3 DATAOUT4 XLC
/*
```

Database Image Copy 2 -- 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**
- **Provide support for Snapshot image copies**
- **Others...?**

Database Image Copy 2 -- Summary



- **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
- **Useability characteristics are similar to Database Image Copy (DFSUDMP0)**

E43 (Part 2)

V7 Concurrent RECON Upgrade

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V7 Concurrent RECON Upgrade



- **V7 Concurrent RECON Upgrade allows users to upgrade the RECON to IMS Version 7 *without stopping IMS activity***
- **Provides increased system availability**
 - Addresses a key SYSPLEX requirement
- **Supports upgrading RECONs from IMS Version 6**
 - Upgrading from pre-V6 RECONs requires that IMS activity be stopped

V7 Concurrent RECON Upgrade (cont'd.)



- **CHANGE.RECON UPGRADE** command is used to upgrade the RECON from V6 to V7
 - RECON Upgrade utility (DSPURU00) cannot be used for V6 to V7 upgrade
- **Concurrent upgrade is not available for upgrade from pre-V6 RECONs**
 - RECON Upgrade utility (DSPURU00) must be used
 - CHANGE.RECON UPGRADE does not upgrade pre-V6 RECONs
 - Upgrade utility requires that all IMS systems be stopped (as it has for previous release-to-release upgrades)

CHANGE.RECON UPGRADE command



- **CHANGE.RECON UPGRADE has two modes**
 - Mode is determined by the RECON configuration when the command is executed

- **nonconcurrent mode**
 - Less than three RECON data sets available
 - 1 or 2 RECON data sets, no spare
 - No other jobs can be accessing the RECON
 - Suggestion: Create a backup copy of the RECON before executing the upgrade command

- **concurrent mode**
 - Three RECON data sets available (2 RECONs and a spare)
 - Other jobs may be accessing the RECON
 - may be IMS V5 or IMS V6
 - all systems accessing the RECON during upgrade must have the appropriate V7 RECON coexistence SPE installed

CHANGE.RECON UPGRADE...(cont'd.)



- **CHANGE.RECON UPGRADE must be issued from a Version 7 DSPURX00 job**
 - Not supported as a V6 command
 - Not supported as an online command
- **CHANGE.RECON UPGRADE fails with message DSP0249I ('RECON in use') RC=8 if:**
 - Pre-V7 IMS systems that do not have the V7 coexistence SPE applied are active, or
 - IMS systems are active and there are less than 3 RECON data sets allocated
- **Other keywords can be specified with UPGRADE**
 - (for example, CHANGE.RECON LOGRET(nnn) UPGRADE)
 - Upgrade processing occurs first
 - Other changes are processed after upgrade completes

V6->V7 Upgrade -- 3 RECONs



- **Enqueue the RECON**
 - IMS systems that attempt to access the RECON will wait until upgrade completes
- **Update RECON header records**
 - COPY1 RECON will be upgraded first
 - If upgrade process does not complete, subsequent open will recognize COPY2 as the "current" RECON copy
- **Issue DSP0251I ('RECON COPY 1 upgrade is beginning')**
- **Upgrade COPY1 RECON**
 - Read COPY1 records and write out in Version 7 format

V6->V7 Upgrade -- 3 RECONs (cont'd)



- **If an I/O error occurs on COPY1**

- Reconfigure the RECON
 - copy COPY2 RECON to the spare
 - discard COPY1
- **Abort** upgrade process
 - RECON remains at the V6 level with two RECON data sets and no spare
- User action
 - delete/redefine discarded RECON data set to provide a spare
 - re-issue CHANGE.RECON UPGRADE command

- **Update RECON header records**

- COPY1 is good -- COPY2 will be upgraded
- If upgrade does not complete, subsequent open will recognize COPY1 as the "current" RECON copy

- **Issue DSP0252I ('RECON COPY 1 upgraded successfully')**

V6->V7 Upgrade -- 3 RECONs (cont'd)



- **Issue DSP0251I ('RECON COPY 2 upgrade is beginning')**
- **Upgrade COPY2 RECON**
 - Copy COPY1 RECON to COPY2
- **If an I/O error occurs on COPY2**
 - Reconfigure the RECON
 - Copy COPY1 RECON to the spare
 - discard COPY2
 - Upgrade is complete
 - RECON is at the V7 level with two RECON data sets and no spare
 - User action
 - delete/redefine discarded RECON data set to provide a spare
 - CHANGE.RECON UPGRADE does not need to be re-issued

V6->V7 Upgrade -- 3 RECONs (cont'd)



- **Issue DSP0252I ('RECON COPY 2 upgraded successfully')**
- **Dequeue the RECON after successful upgrade (or after reconfiguration due to I/O error)**
 - IMS systems that waited for the RECON enqueue can now access the RECON

V6->V7 Upgrade -- 2 RECONs, no spare

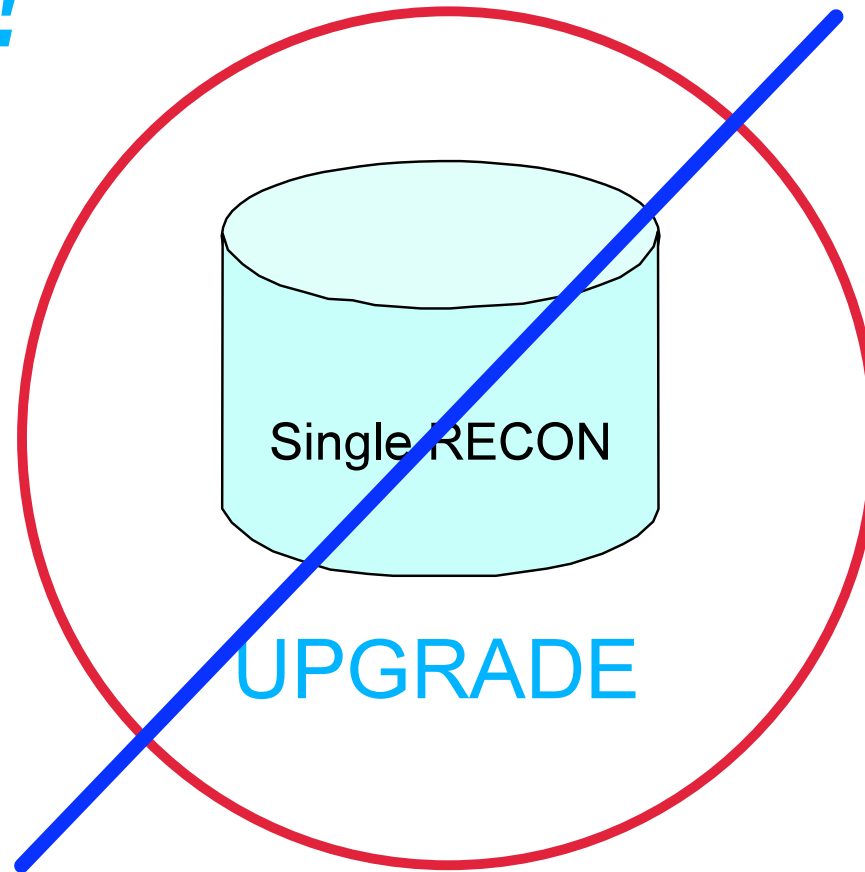


- Same as previous scenario except...
- If an I/O error occurs on COPY1
 - Reconfigure the RECON
 - discard COPY1
 - **Abort** upgrade process
 - RECON remains at the V6 level with a *single* RECON data set
 - User action
 - delete/redefine discarded RECON data set to reinstate dual RECONs
 - re-issue CHANGE.RECON UPGRADE command
- If an I/O errors occurs on COPY2
 - Reconfigure the RECON
 - discard COPY2
 - Upgrade is complete
 - RECON is at the V7 level with a *single* RECON data set
 - User action
 - delete/redefine discarded RECON data set to reinstate dual RECONs
 - CHANGE.RECON UPGRADE does not need to be re-issued

V6->V7 Upgrade -- 1 RECON



Don't!



Before using concurrent upgrade



- **Ensure that all systems that access the RECON have the V7 coexistence SPE applied**
 - Note that subsystem records are not created in the RECON for some utilities, so DBRC cannot detect if they are active and do not have the SPE installed. Unpredictable results can occur.
- **Ensure that two RECON data sets and a spare are available**
 - *Strongly recommended!*
- **The RECON I/O Exit (DSPCEXT0), if used, should be prepared to handle V6 and V7 RECON records**
 - Prior to the upgrade, records presented are V6 format
 - After the upgrade, records presented are in V7 format