

# ***Creating Image Copies of IMS Data Sets With High Performance Image Copy***

***A White Paper on***

***IMS High Performance Image Copy for z/OS Version 3***

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# IMS Image Copies

This paper provides an overview of the alternatives available for creating image copies of IMS database data sets. These include multiple image copy utilities and options within the IMS product and High Performance Image Copy for z/OS (HPIC). HPIC is an IBM IMS tool. It is the replacement for Image Copy Extensions (ICE) for OS/390. The prerequisites, advantages, performance characteristics, and options available with each type of image copy are briefly described.

Image copies are back ups of IMS database data sets. They are required for database recoveries. Database recoveries may be required due to the loss or destruction of a database data set. More often, they are required due to operational or programming errors that create a need to restore a database to a previous state.

## Clean Versus Fuzzy Image Copies

An image copy may be taken while updates to the database are not occurring or while such updates are allowed. If no updates occur during the image copy, the copy is called “clean”. The data in a clean image copy is consistent. Restoring a clean image copy would create a valid database data set that reflected its state at the time of the copy. If updates occur during the image copy, the copy is called “fuzzy”. Restoring a fuzzy image copy would not create a valid database data set. Instead, updates that occurred while the copy was being taken must also be applied to the data set. This is done by including both the fuzzy image copy and log records created while the copy was being taken in the inputs to the recovery process. The advantage of clean image copies is that they may easily be used to restore a database data set to its state at the time of the copy. The disadvantage of clean image copies is that updates must be stopped while the copy is taken.

## Pointer Checking

Many installations like to validate the pointers in their IMS databases on a regular schedule. This ensures that “broken pointers” created by operational errors are detected as soon as possible. Since pointer checking requires reading all of the segments in a database, the reading of the database for image copies is an ideal time to also invoke pointer checking.

## Image Copy Alternatives in the IMS product

The IMS product includes several alternatives for taking image copies. These include three utilities, the Database Image Copy utility (DFSUDMP0), the Database Image Copy 2 utility (DFSUDMT0), and the Online Database Image Copy utility (DFSUICP0).

### Database Image Copy (DFSUDMP0)

The Database Image Copy utility may be used to copy any IMS database data set that supports standard recovery techniques. These are HDAM, HIDAM, HISAM, SHISAM, Index, PHDAM, PHIDAM, PSINDEX, and DEDB databases. The utility is run as a batch job. The utility includes a Concurrent Image Copy (CIC) option. The CIC option is used to create a fuzzy image copy. That is, updates are allowed while using this option. The CIC option is not valid for KSDSs. KSDSs are used for HISAM, SHISAM, Index, and PSINDEX database data sets.

### Database Image Copy 2 (DFSUDMT0)

The Database Image Copy 2 (IC2) utility (DFSUDMT0) may be used to copy any IMS database data set that may be copied with the Database Image Copy utility. It is also run as a batch job. IC2 invokes the concurrent copy capability of DFSMSdss DUMP. This requires that the database data set resides on a DASD system that supports Concurrent Copy. This includes IBM 3990-6, RVA, and Enterprise Storage Server (Shark). IC2 has options to create either clean or fuzzy image copies. A fuzzy image copy may be taken for all IMS database data sets that support standard recovery techniques. This includes those using KSDSs. Clean image copies

can be created while stopping updates to the database for a very short time. This is the time required for the control unit to make the logical copy. This does not include the time for the copy to be physically written to the output data set. IMS V7 IC2 added the capability to write compressed image copies. IMS V8 adds the capability to copy multiple data sets with one execution.

#### ✍ Online Database Image Copy (DFSUICP0)

The Online Database Image Copy (OLIC) utility (DFSUICP0) may be used to copy any full function database data set that may be copied with the Database Image Copy utility. It cannot be used to copy Fast Path databases (DEDBs). OLIC runs as part of an online system. It is a special type of BMP. OLIC can create either clean or fuzzy image copies. Fuzzy image copies of KSDSs are allowed, but the updates must be done in the same IMS system where OLIC is running. Updates to KSDSs by other online systems or batch jobs are not allowed. Since OLIC runs as part of the online system, it uses the online system's database buffer pools. This tends to make OLIC slower than the other utilities and causes it to interfere with other online work.

#### ✍ Fast Path DEDB High-Speed Sequential Processing (HSSP) Image Copy

High-Speed Sequential Processing (HSSP) is an option for non-message driven BMP application programs. It provides a high speed process to read DEDB areas. This is done with anticipatory reads. CIs are read before the application requests segments in them. HSSP is invoked by including H in the PROCOPT for a PCB. HSSP has an image copy option. This is invoked with a SETO control statement in the DFSCTL data set for the program step. HSSP image copies are extremely efficient. They are created as the application program is reading the data. A separate utility execution is not required.

## High Performance Image Copy

High Performance Image Copy for z/OS (HPIC) extends the capabilities of the IMS Database Image Copy utility (DFSUDMP0). It includes all of its capabilities including the CIC option for fuzzy copies. It also has an extension to the capabilities of the IMS Database Recovery utility (DFSURDB0). The extensions include:

#### ✍ Parallel Image Copies

Multiple database data sets may be copied in parallel. One execution of HPIC can copy all of the data sets in a DBRC change accumulation group or database data set group with multiple parallel processes.

#### ✍ Hash Pointer Checking

Pointers in databases may be validated with a hash pointer check. This is done while the data is being read for the image copy. This capability uses the facilities in IMS High Performance Pointer Checker for full function database checking. It uses the facilities in IMS Fast Path Basic Tools for DEDB checking.

#### ✍ Compressed Output

Image copy output may be compressed so that less space is required.

#### ✍ Database Recovery Function

HPIC can be used to invoke the Database Recovery utility (DFSURDB0). This is required when compressed image copies are inputs to a recovery. The HPIC invocation of the utility includes the expansion of the compressed data.

#### ✍ Dynamic Allocation

Input and output data sets do not require DD statements. Data sets may be dynamically allocated.

#### ✍ Stacking of Multiple Image Copies on One Tape

Multiple image copies may be written to one tape volume without rewinding the tape and remounting it for each image copy. This reduces the number of mounts issued and the amount of operator intervention required for image copies. This stacking support may be used with or without dynamic allocation.

#### Creation of Additional Image Copies from Existing Image Copies

HPIC adds the capability to create up to seven new image copies from an existing image copy data set. These image copies may be registered in DBRC as primary or secondary image copies.

## Performance of Image Copies

An image copy is a very simple process. It is just the copying of a data set. By using an adequate number of buffers, the standard image copy utility may be made to run as fast as the input may be read and the output may be written. Typically, a reasonable number of buffers for both the input and the output data sets will minimize the elapsed time. Enough buffers to contain a little over two DASD tracks of data should be adequate. High Performance Image Copy (HPIC) optimizes these buffer specifications for both inputs and outputs.

Image Copy 2 (IC2) can make the elapsed time of the copy less important. It uses the concurrent copy function of the storage system to make the copy. Concurrent copy is done in two phases. The first phase is the logical copy. It is the time during which the storage system sets up the copy. This is just a few seconds. The logical copy is followed by the physical copy. The physical copy writes the copy to the output data set. For fuzzy image copies, updates are allowed during both the logical and physical copies. For clean image copies, updates are allowed only during the physical copy. When updates occur during the physical copy, the storage system maintains records of both the before and after images of the updated blocks. The before images are used for the physical copy. The use of concurrent copy does not shorten the time required to make a copy, but it is important for creating clean copies. It shortens the time for which updates to the data set are not allowed. Typically it reduces it to a matter of seconds.

Online Image Copy (OLIC) uses the resources of the online system for reading database data sets. This includes the online system's buffer handler and buffer pools. This extra overhead is noticeable. It significantly increases the CPU resources required to make image copies. It also elongates the elapsed times of copies. There is no anticipatory read function available for VSAM data sets in online systems. VSAM CIs are read one at a time. For these reasons, the concurrent image copy (CIC) option of the Database Image Copy (DFSUDMP0) utility is preferable to OLIC whenever it can be used. The only advantage of OLIC is its capability to make fuzzy image copies of KSDSs without the hardware requirements of IC2.

## Comparison of Image Copy Alternatives

The following table summarizes the capabilities and restrictions of the image copy alternatives.

	<b>Image Copy (DFSUDMP0)</b>	<b>High Performance Image Copy (HPIC)</b>	<b>Image Copy 2 (DFSUDMT0)</b>	<b>Online Image Copy (DFSUICP0)</b>	<b>High-Speed Sequential Processing (HSSP) Image Copy Option</b>
<b>Part of base IMS product</b>	Yes	No	Yes	Yes	Yes
<b>Execution</b>	Batch job	Batch job	Batch job	Utility BMP	Application BMP
<b>Hardware requirement</b>	No	No	Yes	No	No
<b>Database data sets supported</b>	Full function and DEDBs	Full function and DEDBs	Full function and DEDBs	Full function only	DEDBs only

<b>Fuzzy copies</b>	Yes, with restrictions	Yes, with restrictions	Yes, without restrictions	Yes, with restrictions	Yes, without restrictions
- Fuzzy copies of KSDSs	No	No	Yes	Yes	Not applicable
- Data sharing with fuzzy copies	Yes	Yes	Yes	No	Yes
<b>Minimal database unavailability for clean image copies</b>	No	No	Yes	No	No
<b>Multiple data sets copied in parallel</b>	No	Yes	Yes, requires IMS V8	No	No
<b>Compressed output</b>	No	Yes	Yes	No	No
<b>Pointer checking</b>	No	Yes	No	No	No
<b>Stacked output</b>	No	Yes	No	No	No
<b>Dynamic allocation</b>	No	Yes	No	No	Yes