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IMS 12 Database and DBRC Enhancements

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March 2, 2011
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Database Enhancements

- Dynamic full function database buffer pools
- Reuse of local DMB numbers
- Display status of randomizers and partition selection exit routines
- Improved information with lock timeouts
- Batch data sharingabend elimination
- Increased VSAM pools from 16 to 255
- Optional release of HALDB OLR ownership when IMS terminates
- Reuse of HALDB partition DB names for non-HALDB databases
- Reorganization number handling by timestamp recovery
- Fast Path 64-bit buffer pool enhancements
- Fast Path DEDB secondary indexing support
- Fast Path logging reduction



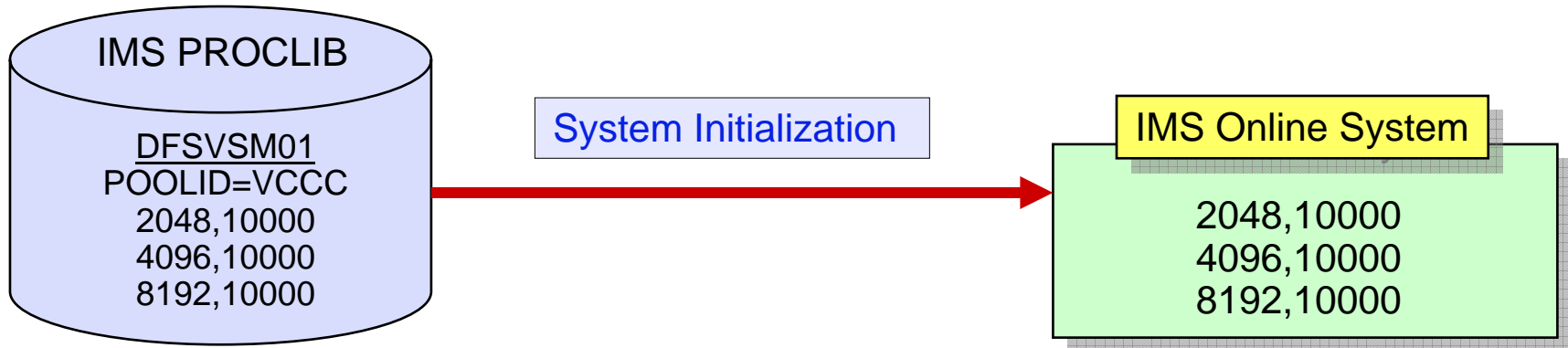
Dynamic Full Function Database Buffer Pools

- **IMS 12 adds dynamic buffer pool support for full function databases**
 - Change number of buffers in a pool
 - Add or delete a buffer pool
 - Change assignment of database data set to another pool

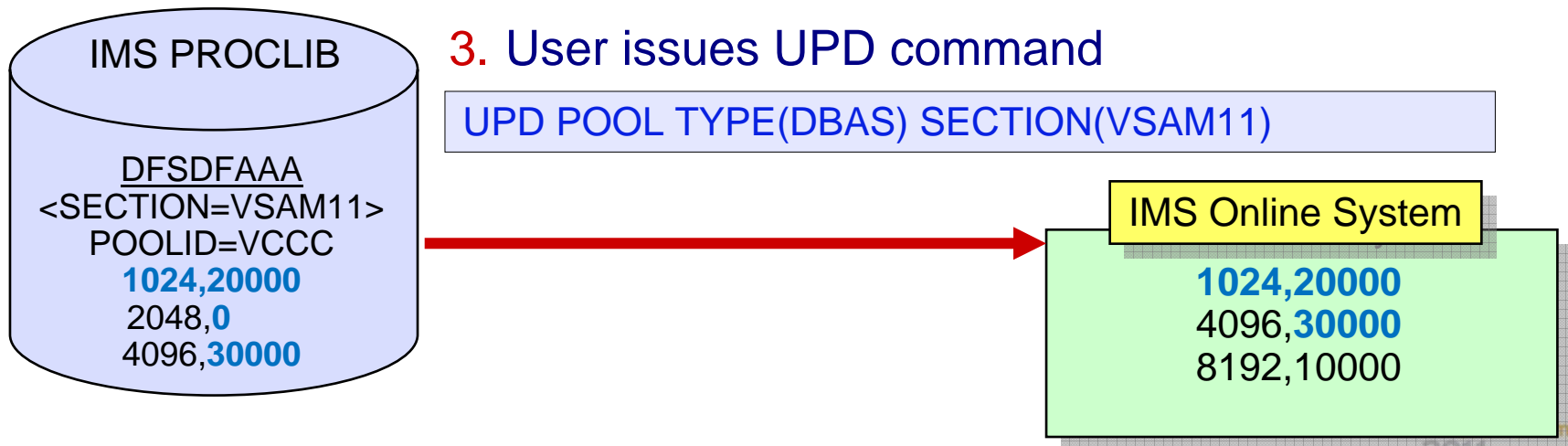
- **Benefits**
 - Eliminates system down time for modifications to buffer pool definitions
 - Improves application performance with improved buffer pool specifications

Overview of Dynamic Full Function Dynamic Buffer Pools

1. System initialization reads buffers definitions from DFSVSMxx



2. User defines changed pools in section of DFSDFAAA



3. User issues UPD command

DFSDFxxx Usage

- Section names in DFSDFxxx must be OSAMxxx or VSAMxxx
 - OSAMxxx contains OSAM pool definitions
 - VSAMxxx contains VSAM pool definitions
 - A DFSDFxxx member may have multiple section definitions
 - OSAMMON, OSAMTUE, VSAMMON, VSAMTUE, etc

- UPD POOL command may specify OSAM and VSAM sections

```
UPD POOL TYPE(DBAS) SECTION(OSAMMON,VSAMMON)
```

- Alternate DFSDFxxx PROCLIB member may be used
 - Default is the member used at initialization of the online system

```
UPD POOL TYPE(DBAS) SECTION(OSAMMON,VSAMMON) MEMBER(002)
```

- Database data sets may be assigned to different pools
 - DBD statements are included in DFSDFxxx member



UPD POOL TYPE(DBAS) Command Processing

- Activity against affected pools must be quiesced
 - VSAM database data sets are closed and reopened
 - OSAM database data sets are not closed
- Affected pools are destroyed and rebuilt to new size
- Database data set reassignment to a different pool
 - Reassignment occurs after database data set is closed and reopened



Initialization and IMS Restart for Buffer Pools

- **IMS Restart**
 - Committed buffer pool changes are written to Restart Data Set (RDS)
 - Emergency Restart will restore buffer pools using RDS
 - Normal Restart will initialize buffer pools from DFSVSMxx

Reuse of Local DMB Numbers

- **IMS creates controls blocks for each database in the system**
 - Created by DATABASE macro or CREATE DATABASE command
 - There is a limit of 32,767 of these control blocks

- **IMS 12 allows these numbers to be reused**
 - After a database definition has been deleted by DRD or Online Change
 - Previous versions did not reuse the numbers

- **Benefit**
 - Cold start of IMS is not required when these numbers reach 32,767

Status Messages for DB Exit Routines

- Status message issued for randomizer when (P)HDAM database is opened or closed by command

DFS2838I RANDOMIZER *name* FOR *database* IS DELETED AND
GONE | SHARED

- 'GONE' appears when routine is deleted from memory
- 'SHARED' appears when routine remains in memory and used by another database

DFS2842I RANDOMIZER *name* FOR *database* IS LOADED | SHARED

- 'LOADED' appears when routine is loaded from library
- 'SHARED' appears when routine is already resident due to use by another database

Status Messages for DB Exit Routines

- Status message issued for partition selection exit routine when HALDB database is opened or closed by a command

```
DFS2406I THE HALDB PARTITION SELECTION EXIT ROUTINE rname  
FOR THE HALDB dbname IS LOADED|GONE|SHARED
```

- 'GONE' appears when the routine is deleted from memory
 - 'LOADED' appears when routine is loaded from library
 - 'SHARED' appears when routine remains in memory or is already resident due to use by another database
- Benefit
 - Allows users to easily determine that an exit routine has been unloaded or a new one has been loaded when replacing the exit routine



Lock Timeout Message and Logging

- **IMS 12 adds optional DFS2291I diagnostic messages for lock timeouts**
 - Timeouts occur only with IRLM and IMS LOCKTIME specified
 - Previous IMS releases provide information only via RMF reports
- **IMS 12 writes log record x'67D0' subtype x'1B' for lock timeouts**
 - Contains same information as the DFS2291I message
 - Written when message is sent
- **Implementation**
 - New statement in DFSDFxxx member selects option
- **Benefit**
 - Information on lock conflicts is more readily accessible

Lock Timeout Message

- New DFS2291I message issued with U3310 abend or 'BD' status code
 - U3310 or 'BD' indicates that waiter has exceeded the specified wait time
 - DFS2291I is either a multiple line message

```

DFS2291I LOCKNAME=0900004288800201D7
DFS2291I DBNAME=DLVNTZ02 LOCKFUNC=GET LCL AND GBL ROOT LOCKS
DFS2291I BLOCKER PST=0001 TRAN=NQF1          PSB=PMVAPZ12 TYPE=MPP
DFS2291I BLOCKER TRANELAPSEDTIME=00:01:11
DFS2291I BLOCKER RECOVERY TOKEN=IMS1          0000000200000000
DFS2291I VICTIM PST=0002 TRAN=SHF1          PSB=PMVAPZ13 TYPE=MPP
DFS2291I VICTIM TRANELAPSEDTIME=00:00:49
DFS2291I VICTIM RECOVERY TOKEN=IMS1          0000003000000000
  
```

- Or a “short” one line message

```

DFS2291I BLOCKER PST=0001 TRAN=NQF1          PSB=PMVAPZ12 TYPE=MPP
  
```



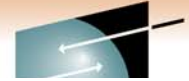
Batch Data Sharing Abend Elimination

- **Batch Data Sharing jobs survive CF cache structure access failures**
 - Previous releases produced U3303 abends when access to OSAM or VSAM cache structures failed
 - IMS 12 causes batch data sharing job to wait for a resolution of the structure problem
 - **Message issued:**
 - DFS2404A AN ERROR WAS ENCOUNTERED WHEN ACCESSING THE
COUPLING FACILITY. STRUCTURE xxxxxxxxxxxxxxxxxxx RSN yyy
- **Benefit**
 - Improved availability and ease of use for batch data sharing jobs
 - Users may move and rebuild OSAM and VSAM structures while batch jobs are executing



Increased VSAM Pools

- **IMS 12 allows up to 255 VSAM database buffer pools**
 - Previous versions were limited to 16 pools
- **Implementation**
 - Users may specify up to 255 POOLID statements in DFSVSMxx member or DFSVSAMP data set
- **Benefits**
 - More VSAM subpools may be specified
 - Increases capabilities to tune VSAM pools for database performance



HALDB Online Reorganization (OLR) Ownership Release

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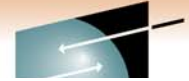
- **IMS 12 adds capability to release ownership of an OLR when IMS terminates**
 - IMS termination may be normal or abnormal
 - In previous IMS versions, OLR ownership was kept by a terminated IMS system
 - If OLR is owned by an IMS system, it may not be started or restarted on another IMS system

- **Benefit**
 - OLRs may be restarted on another available IMS
 - Caution:
 - If an OLR is not owned by a terminated IMS system, it will not be automatically restarted when the IMS system is restarted



Reuse of HALDB partition DB names

- Reuse of HALDB partition DB names for non-HALDB databases
 - IMS 12 allows names of deleted partitions to be used as non-HALDB database names
 - Previous versions of IMS did not free the DDIRs for deleted partitions
 - Required restart of IMS online system
- Benefit
 - More flexibility in the use of database names



Reorganization Number Handling by Timestamp Recovery

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- **IMS 12 Database Recovery utility sets reorganization number of partition based on value in RECON**
 - Previous IMS versions did not coordinate the numbers in RECON and partition data set
 - Reorg number in data set was updated from RECON value by first IMS subsystem which updated the partition
 - Index Builder tool created index pointers based on the reorg number in the data set
 - Index entries needed “healing” when reorg number was changed by updater
 - Pointer Checker reported errors
- **Benefit**
 - IMS 12 eliminates the Index Builder and Pointer Checker problems
 - Reorg number in data set matches the number in RECONs when timestamp recovery is done



Fast Path 64-bit Buffer Pool Enhancements

- **Fast Path pools are more dynamic**
 - Pools are expanded before buffers are needed
 - Pools may be compressed
 - User may set initial size of pools
- **Additional buffers are moved from ECSA to 64-bit storage**
 - FLD calls
 - SDEP calls during /ERE and XRF tracking
- **QUERY POOL command enhancements**
 - Summary statistics available
 - ALL output reformatted
- **Benefits**
 - Smarter use of subpools
 - Reduced ECSA usage

Fast Path DEDB Secondary Index Support

- **Secondary indexes for DEDBs are maintained by IMS**
 - Secondary indexes are full function (HISAM or SHISAM)
 - Multiple HISAM or SHISAM databases may be used for one index
 - Supports very large indexes
 - One index may be built on different fields in a segment
 - e.g. Multiple telephone number fields
- **IMS does not build secondary indexes**
 - Tool or user program must be used to create them
- **Benefit**
 - Access to DEDB via an alternate key
 - Sequential processing via an alternate key or alternate segment type



Fast Path Logging Reduction

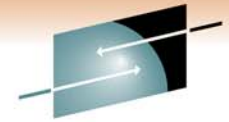
- **Logging**
 - Option to log entire segments for REPL calls instead of only changed data
 - Database change log records may be used for replication
 - Option to not log DLET and REPL call “before images” with data capture

- **Benefits**
 - Reduced logging options for replication and disaster recovery



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DBRC Enhancements

DBRC Enhancements

- CLEANUP.RECON command includes CA records
- GENJCL enhancements
- LIST command enhancements
- User information in IC, RECOV, REORG and CA records
- CA retention period added to CA Group record
- LIST.HISTORY enhancements
- LIST.RECON enhanced to show the number of registered databases

CLEANUP.RECON Command Enhancement

- **IMS 11 added CLEANUP.RECON command**
 - Used to delete old PRILOG, IC, ALLOC, REORG and RECOV information
- **IMS 12 adds deletion of Change Accum execution information**
 - Option to delete CA execution records in addition to other records
 - Option to delete only CA execution records
 - Last CA execution record for a CA Group is only deleted if specifically requested
- **Benefit**
 - Additional information is cleaned from the RECONs

GENJCL Enhancements

- IMS 12 increases the number of user keys in skeletal JCL from 32 to 64
- %DBTYPE keyword may be used when selecting DBDS allocation (ALLOC) records
 - %DBTYPE will be set to FP, DLI or PDATA
 - This is similar to %SELECT DBDS in previous IMS versions

- Example

```

%SELECT ALLOC(PRILOG, LAST)
          %DBNAME      %DBTYPE
```

- Could produce:

```

ABC00D01      DLI
ABC00D02      DLI
ABC00H01      PDATA
```

- Benefits

- Greater flexibility with user written skeletal JCL



/RMLIST Command Enhancement

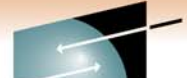
- Previous IMS versions limited /RMLIST command output to 32K
- IMS 12 allows output for /RMLIST command entered through OM API to exceed 32K
 - Output size is restricted by the DBRC private storage available for buffering the output message or OM limitations
- Benefit
 - Increased data available to OM API users, e.g. TSO SPOC



LIST.DB and LIST.DBDS Command Enhancement

- **New NORCVINF keyword for LIST.DB and LIST.DBDS**
 - Suppresses recovery related information
 - ALLOC, IC, RECOV and REORG records are not listed
 - Reduces command output

- **Benefit**
 - Allows users to eliminate unneeded output



User Information in IC, RECOV, REORG and CA Records

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- **IMS 12 adds capability to put user data in IC, RECOV, REORG and CA records**
 - User data is listed when the RECON record is listed
 - User data is available via the DBRC API
- **User data added by CHANGE and NOTIFY commands**
 - CHANGE.IC and CHANGE.CA
 - NOTIFY.IC, NOTIFY.CA, NOTIFY.RECOV and NOTIFY.REORG
 - UDATA('string')
 - String may be up to 80 characters
 - User data for UICs was available in previous IMS versions
- **Benefits**
 - User may keep additional information in these RECON records

CA Retention Period Added to CA Group Record

- **IMS 12 adds a retention period to the CA Group record**
 - Similar to RECOVPD for ICs
 - Added with RECOVPD() keyword on INIT.CAGRP or CHANGE.CAGRP
 - Use to control DBRC's keeping of CA execution records
 - When GRPMAX is exceeded, CA execution record is kept if RECOVPD value is not exceeded
 - RECOVPD() is specified as 0 to 999 days
 - Default is 0 – there is no retention period

- **Benefit**
 - Allows users to keep record of CA executions even when GRPMAX is exceeded



LIST.HISTORY Enhancements

- **LIST.HISTORY output has been enhanced**
 - Full precision timestamps are included
 - Column positions have moved to accommodate the extra 5 characters
 - Page number references have been removed
 - Additional HALDB information
 - Active DBDSs
 - DDNames of inactive DBDSs
 - Current reorganization number for partition
 - Last digit of the reorg# for online reorgs and timestamp recoveries
 - Deallocation record indicates if deallocation was due to database quiesce
 - ‘DQ’ instead of “D” indicates database quiesce
- **Benefits**
 - More complete information for database data sets



```

+-----+
| Timeline for DBDS: POHIDKD POHIDKDM |
|           USID=00000003 AUTHORIZED=00000003 |
|           RECEIVE=00000000 HARD=00000003 |
|           ACTIVE DBDS=M-V OTHER DDN=POHIDKDA REORG#=00004 |
+-----+
+-Time-----+Events-----+--+--+--+
|           | IC | | | |
|           | REORG | | US | Subsystem
|           | RECOV | CA | ID | Logs and Allocs
+-----+

```

```

09.105 13:04:54.612745 IMS1
09.105 13:07:22.371362 s
09.105 13:07:22.587345 GLy4 3 A
09.105 13:07:45.212300 | s
09.105 13:09:08.216336 | s
09.105 13:09:09.112382 s |
09.105 13:09:20.441345 | s
09.105 13:09:33.000775 | s
+-----+

```

In the timeline, only the last digit of USID is shown.

REORG: G = REORG, GL = ONLINE REORG
s = Stoptime if online reorg
y/n = Online reorg may be used as input to recovery

The last digit of the reorg# is shown if the reorg# is not zero

Logs: SSID = Open time, C = Log Close,
v = Vol close, s = DS close

Allocs: D = Dealloc time, A = Alloc time, DQ = Dealloc time with QUIESCE

LIST.RECON Enhancement

- LIST.RECON output includes the number of registered databases
 - DBRC has a limit of 32,767 registered databases
 - When RECONS are upgraded to IMS 12, DBRC always maintains a DMB table record to keep track of which DMB numbers are in use
 - Number also available through the DBRC API RECON Status block (DSPAPQRC)

```
RECON
RECOVERY CONTROL DATA SET, IMS V12R1
DMB#=30756                INIT TOKEN=10057F1940162F
NOFORCER  LOG DSN CHECK=CHECK44  STARTNEW=NO
.
.
.
NUMBER OF DATABASES REGISTERED:  12889
```

- Benefit
 - Users will know if they are near the limit of 32,767 registered databases



DBRC Enhancements Summary

- CLEANUP.RECON command includes CA records
- GENJCL enhancements
- LIST command enhancements
- User information in IC, RECOV, REORG and CA records
- CA retention period added to CA Group record
- LIST.HISTORY enhancements
- LIST.RECON enhanced to show the number of registered databases