IMS 12
Database and DBRC Enhancements

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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 sharing abend 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

   IMS PROCLIB
   DFSVSM01
   POOLID=VCCC
   2048,10000
   4096,10000
   8192,10000

   System Initialization

   IMS Online System
   2048,10000
   4096,10000
   8192,10000

2. User defines changed pools in section of DFSDFxxx

   IMS PROCLIB
   DFSDFAAAA
   <SECTION=VSAM11>
   POOLID=VCCC
   1024,20000
   2048,0
   4096,30000

3. User issues UPD command

   UPD POOL TYPE(DBAS) SECTION(VSAM11)

   IMS Online System
   1024,20000
   4096,30000
   8192,10000
**DFSFxxx 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    0000002000000000
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 xxxxxxxxxxxxxxxx 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

- 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

- 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
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- 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**
  - Could produce:
    
    | DBNAME   | DBTYPE |
    |----------|--------|
    | 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

- 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
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
<table>
<thead>
<tr>
<th>Timeline for DBDS: POHIDKD POHIDKDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>USID=00000003  AUTHORIZED=00000003</td>
</tr>
<tr>
<td>RECEIVE=00000000  HARD=00000003</td>
</tr>
<tr>
<td>ACTIVE DBDS=M-V  OTHER DDN=POHIDKDA  REORG#=00004</td>
</tr>
</tbody>
</table>

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

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- LIST command enhancements
- User information in IC, RECOV, REORG and CA records
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- LIST.HISTORY enhancements
- LIST.RECON enhanced to show the number of registered databases