IMS 12
Database and DBRC Enhancements

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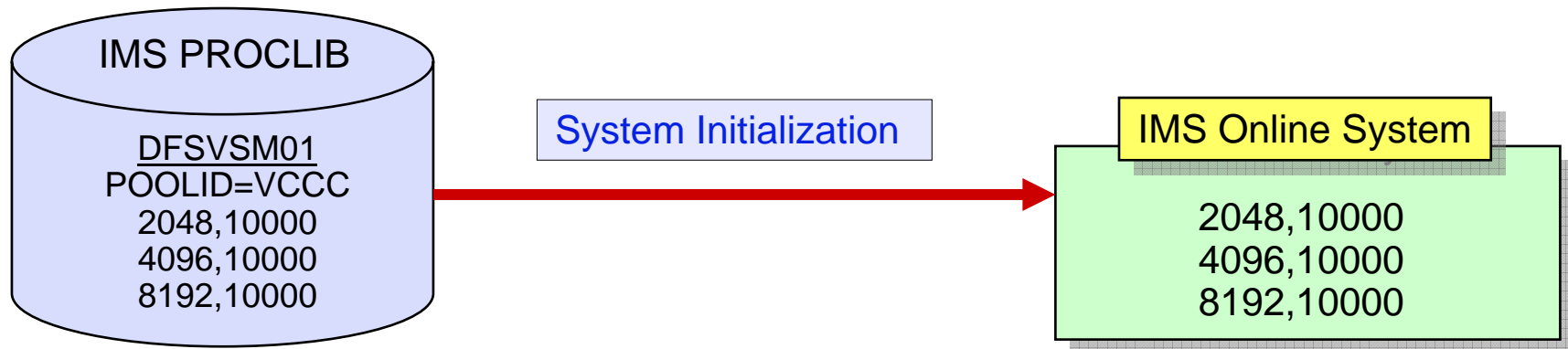
Database Enhancements

- 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
- CICS Threadsafe support
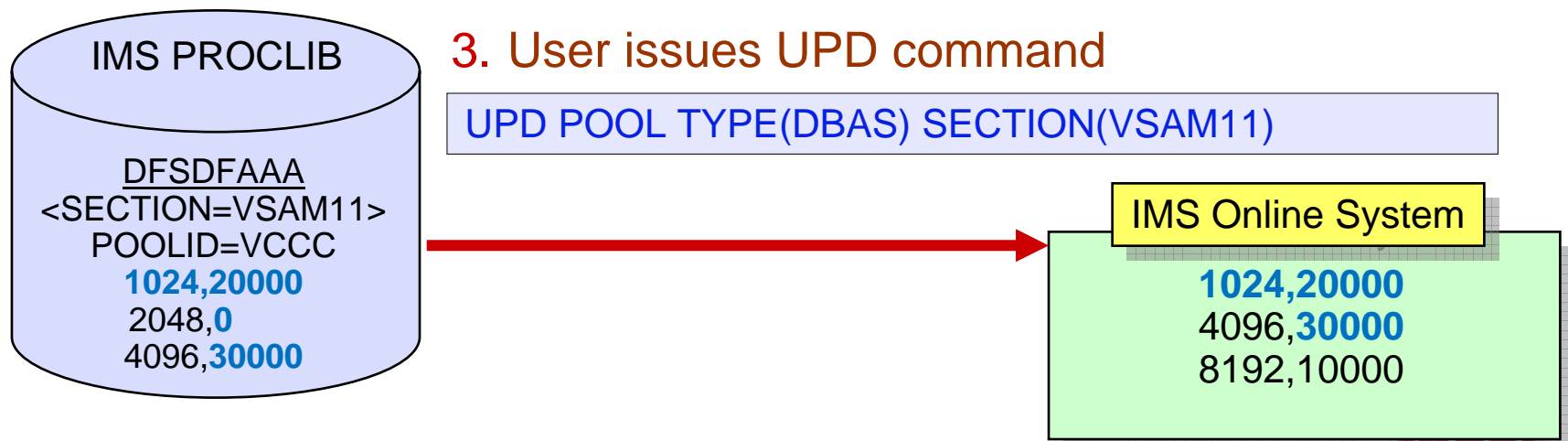
Dynamic Full Function Database Buffer Pools

- 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

DFSDFAAA
<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

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     000000300000000
```

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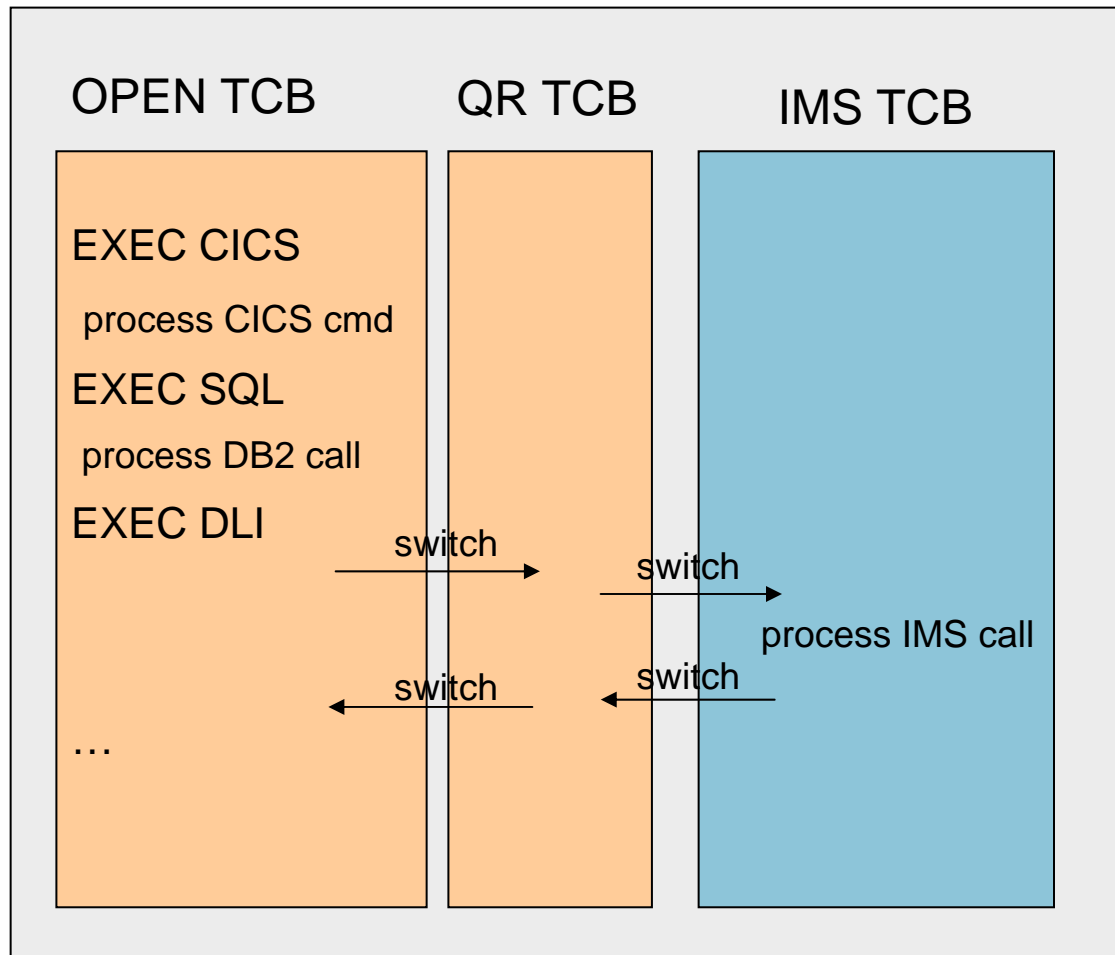
- Logging
  - Option to log entire segments for REPL calls instead of only changed data
    - Database change log records may be used for replication
  - Option to not log DLET and REPL call "before images" with data capture

- Benefits
  - Reduced logging options for replication and disaster recovery
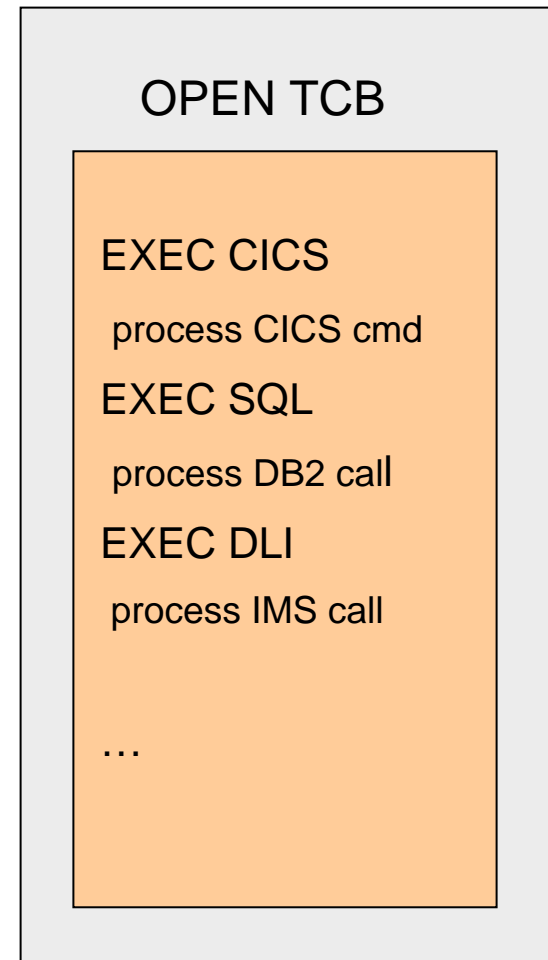
CICS Threadsafe Support

- CICS 4.2 adds support for threadsafe IMS database calls with IMS 12
  - Eliminates TCB switches for IMS database calls
    - Without threadsafe support, IMS call must be done under an IMS TCB
      - *Requires switch from CICS QR TCB to IMS TCB and back to CICS QR TCB*
      - *If application is running under an OPEN TCB, it also requires a switch from OPEN TCB to QR TCB and back from QR TCB to OPEN TCB*
    - With threadsafe support, IMS call may be done under a CICS OPEN TCB
      - *No TCB switch*
      - *CICS has multiple OPEN TCBs*
        - *Multiple DLI calls may be done in parallel under CICS OPEN TCBs*
  - Enhancement applies to both EXEC DLI and CALL DLI
  - Requires IMS 12 APAR PM31420

- Benefits
  - Lower CPU use
  - Increased throughput

CICS Threadsafe Support

Without IMS Threadsafe Support

OPEN TCB	QR TCB	IMS TCB
EXEC CICS		
process CICS cmd		
EXEC SQL		
process DB2 call		
EXEC DLI		
	switch →	switch →
		process IMS call
	← switch	← switch
…		

With IMS Threadsafe Support

OPEN TCB
EXEC CICS
process CICS cmd
EXEC SQL
process DB2 call
EXEC DLI
process IMS call
…

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Database Enhancements

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- Improved information with lock timeouts

- Batch data sharing abend elimination

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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:
```
%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

- 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

```
09.125 15:52:17.512345              LISTING OF RECON                    PAGE  0086
+-----------------------------------------------------------------------------------+
|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

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- 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