

# *IMS V10 Database and DBRC Enhancements*

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# IMS Version 10 Teleconferences

- Previously presented - Replays are available
  - ◆ IMS Integration Suite
  - ◆ System Enhancements
  - ◆ DRD and Online Change Enhancements
- Today
  - ◆ Database and DBRC Enhancements
- Future
  - ◆ Transaction Manager and Connectivity Enhancements
  - ◆ Migration

# Database Enhancements

- HALDB ILDS Rebuild Enhancement
- Image Copy 2 Fast Replication
- Fuzzy User Image Copy Support
- ACBGEN Exploitation of Storage Above 16M
- Fast Path Command Enhancements
- Fast Path Capacity Enhancements
- XQuery Support with XML DB

# HALDB ILDS Rebuild Enhancement

- New option for HALDB Index/ILDS Rebuild utility (DFSPREC0)
  - ◆ ILDS entries (ILEs) are written to ILDS sequentially in load mode
    - Avoids CI/CA splits during rebuild
    - Creates free space according to data set definition
  - ◆ ILDS entries are sorted in data spaces before they are written
- Benefits
  - ◆ Much faster execution of DFSPREC0 when rebuilding an ILDS
  - ◆ Free space may improve performance of subsequent reorganizations
    - Reduce CI/CA splits

# Image Copy 2 Fast Replication

- Fast replication highlights
  - ◆ Uses DFSMSdss COPY command with FASTREP(REQ) parameter
    - Invokes FlashCopy on ESS, DS8000 (invokes SnapShot on RVA)
  - ◆ Copy is done in one phase
    - Time is comparable to the logical copy time for concurrent copy
  - ◆ Copies database data sets to other data sets on the same storage system
    - Output is in same format as database data set
  - ◆ Supports both fuzzy and clean image copies
  - ◆ DD statements for the output data sets are not required
  - ◆ Support in Database Recovery utility for these image copies
    - Restores the data set with a DFSMSdss COPY command with FASTREP(PREF) parameter
  - ◆ Requires z/OS V1R8
    - Provides data set fast replication enhancements

# Image Copy 2 Fast Replication

- **Benefits**

- ◆ Exploits FlashCopy and SnapShot
  - Single phase copies
  - Copies produced in seconds
  - Uses minimal CPU resources
- ◆ Supports both clean and fuzzy image copies
- ◆ Full DBRC GENJCL support
  - Image Copy 2 and Database Recovery utilities

# Fuzzy User Image Copy Support

- DBRC support for fuzzy user image copies
  - ◆ Fuzzy image copies taken by utility or tool without a DBRC interface
    - Pack dump, DFSMSdss DUMP or COPY not invoked by IC2, etc.
  - ◆ Support:
    - NOTIFY.UIC can specify a fuzzy user image copy
      - With BATCH and STOPTIME(time) parameters
    - GENJCL.RECOV can be used to generate recovery from logs after fuzzy user image copy has been restored
- Benefits
  - ◆ Integration of fuzzy user image copies into DBRC environment

# ACBGEN Use of Storage Above the 16M Line

- Previous releases were limited in the number of PCBs per PSB
  - ◆ Limitation was due to use of "below the line" storage
    - PSBs with more than approximately 500 PCBs could result in S80Aabend by ACBGEN
- IMS V10 ACBGEN allocates most of its working storage above 16M
  - ◆ Eliminates these out-of-storage abends
- **Benefit**
  - ◆ Allows up to 2500 PCBs per PSB



# Starting All Areas with UPD DB Command

- Option to start all areas when starting a DEDB

```
UPDATE DB NAME(name) START(ACCESS) AREA(*)
```

- AREA(\*) starts all areas of the database
  - ◆ In previous releases areas had to be started separately
- **Benefit**
    - ◆ Separate UPDATE AREA commands are not required for each area

# Keeping Randomizer Resident when Stopping DEDB

- Option to keep the randomizer resident when stopping access to DEDB

```
UPDATE DB NAME(name) STOP(ACCESS) OPTION(NORAND)
```

- OPTION(NORAND) does not unload the randomizer
- ◆ In previous releases, the randomizer would be unloaded if not used by any database
- **Benefit**
  - ◆ Avoids ECSA fragmentation from unloading and reloading randomizers

# Increased Maximum Number of FP Buffers

- IMS V10
  - ◆ Up to 4,294,967,295 FP buffers may be specified (DBBF=)
    - Theoretical limit since available storage will limit the practical size
- Previous releases:
  - ◆ Maximum number of FP buffers was 65,535
- Benefit
  - ◆ Fast Path can exploit large capacities of new processors

# Increased Maximum for FP Output Threads

- IMS V10
  - ◆ Maximum number of FP output threads is 32,767
- Previous releases:
  - ◆ Maximum number of FP output threads was 255
    - OTHR cannot exceed MAXPST value
- Benefit
  - ◆ Fast Path can exploit large capacities of new processors

# DBFCONT0 Converted to Multiple Modules

- Previous releases:
  - ◆ Most Fast Path control blocks and buffers were placed in one module (DBFCONT0 )
    - DBFCONT0 contents included: ECNTs, MSDBs, MSDB blocks, Buffer Headers (DHMRs), Buffers, DEDB blocks, output threads, and BALGs
- IMS V10
  - ◆ These Fast Path control blocks and buffers are placed in five modules
- Benefit
  - ◆ More efficient use of ECSA storage
    - Required contiguous area is smaller

# XQuery Support with XML DB

- XQuery is a hierarchical query language for XML documents
  - ◆ Used to query XML documents and return newly created XML documents from the data that satisfy the query criteria
  - ◆ XQuery is a W3C Recommendation
    - XQuery is compatible with several W3C standards, such as XML, Namespaces, XSLT, XPath, and XML Schema
  - ◆ XQuery is to XML as SQL is to relational databases
    - Or, DL/I is to IMS databases
  - ◆ XQuery is built on XPath expressions
    - XPath is used to navigate the XML hierarchy
      - Similar to a path call for IMS hierarchies
  - ◆ Simple tutorial on XQuery is available at:  
<http://www.w3schools.com/xquery/default.asp>

# XQuery Example with XML DB

```

SELECT retrieveXML(B,'<library> {
  for $x in /bib/book
  where $x/price<75 and $x/@year > 2004 }
  return
    <book { $x/@year } >
      { $x/title }
    </book> }
  </library>')
FROM PCB.BOOKS

```

path to the data

Look at each book and find those that meet these criteria

For each match return this

element

attribute

Result: <library>

```

<book year="2006"><title>An Introduction to IMS</title> </book>
<book year="2007"><title>All Data Is Naturally Hierarchical</title> </book>
</library>

```

# XQuery Support with XML DB

- Sample document on which XQuery was done

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<bib>
  <book year="2005">
    <title>An Introduction to IMS</title>
    <author><last>Meltz</last><first>Dean</first></author>
    <publisher>IBM Press</publisher>
    <price>69.99</price>
  </book>
  <book year="2007">
    <title>All Data Is Naturally Hierarchical</title>
    <author><last>Lewis</last><first>Rich</first></author>
    <publisher>Lewis Books</publisher>
    <price>21.95</price>
  </book>
  <book year="2007">
    <title>Data, So Much Data</title>
    <author><last>Smith</last><first>Bill</first></author>
    <publisher>Smith and Lewis</publisher>
    <price>85.95</price>
  </book>
  ...
</bib>
```



# DBRC Enhancements

- DBRC Timestamp Precision
- RECON READONLY Access
- Improved SAF Support for RECONs
- DBRC API Enhancements
- Parallel RECON Access



# DBRC Timestamp Precision

- DBRC timestamps will be recorded to microsecond
  - ◆ Previously recorded to tenth of second
    - Could lead to duplicate timestamps (log open, log close, allocation)
  - ◆ Increased precision not in effect until MINVERS('10.1') is specified
    - For compatibility with previous releases
  - ◆ Abbreviated timestamps still supported
    - Unspecified part of time will be padded with zeros
- Benefits
  - ◆ Avoids possible duplicate timestamps

# READONLY Support for RECONS

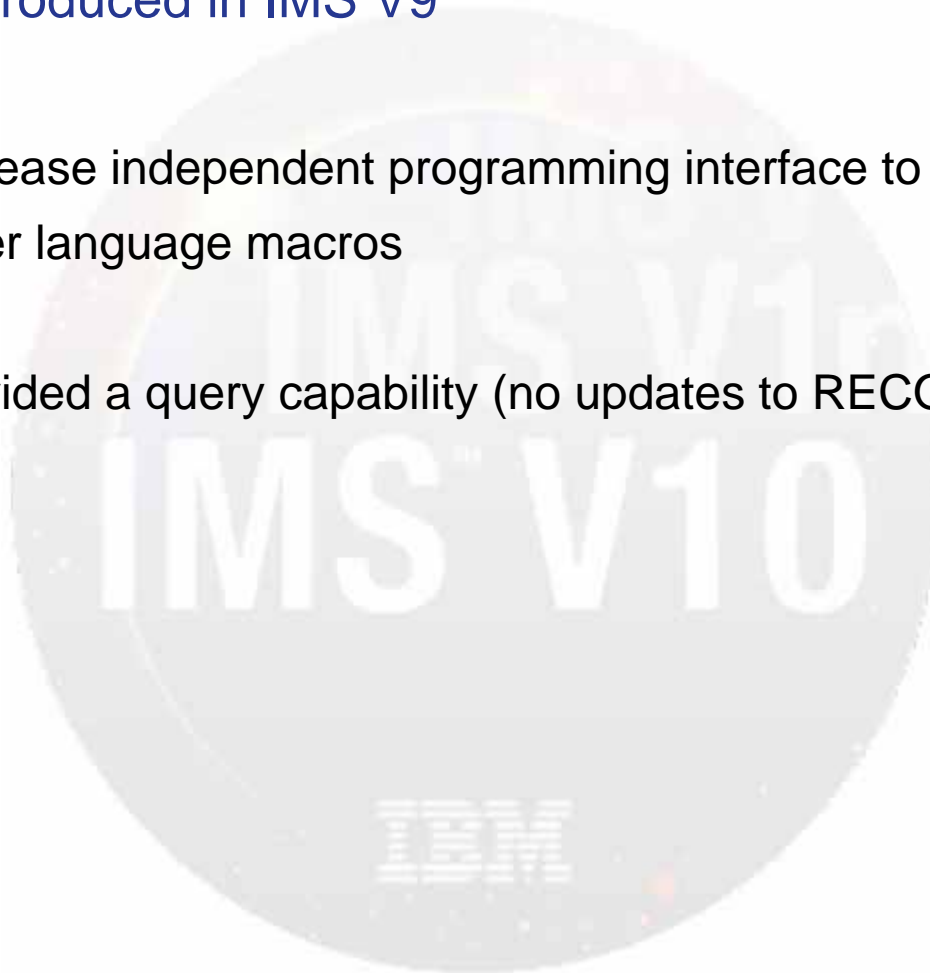
- V10 READONLY support
  - ◆ Specification:
    - PARM(READONLY) on DSPURX00 EXEC statement
    - READONLY=YES on DBRC API FUNC=STARTDBRC macro
  - ◆ Use for users with only READ authority
    - Causes RECONS to be opened for input
- Benefit
  - ◆ Users need only READ authority to list RECON contents

# Improved SAF Support for RECONs

- **IMS V10 SAF authority for RECONs**
  - ◆ READ is sufficient for readers
  - ◆ UPDATE is sufficient for accesses except DELETE and DEFINE
  - ◆ ALTER required for DELETE and DEFINE
  - ◆ CONTROL is never required
- **Previous IMS releases**
  - ◆ Required CONTROL authority for all RECON access
- **Benefits**
  - ◆ Users need only UPDATE authority for DBRC update commands
  - ◆ Users need only READ authority for READONLY use

# DBRC API Enhancements

- DBRC API introduced in IMS V9
  - ◆ Provided release independent programming interface to RECON data
    - Assembler language macros
  - ◆ IMS V9 provided a query capability (no updates to RECONs)



# DBRC API Enhancements

- IMS V10 enhancements:
  - ◆ RECON update capability via DBRC command support
    - INIT, CHANGE, and NOTIFY
  - ◆ QUERY enhancements
    - Queries for DBDS, Partition, Log
    - Wildcard support
  - ◆ Alternate RECON and IMS DD names
    - May be used to access multiple sets of RECONs and ACBLIBs easily
  - ◆ Application may register as subsystem and authorize databases
    - Allows application to do utility functions with authorization integrity
  - ◆ SAF(RACF) invocation for API security
    - Extension of DBRC command authorization
- **Benefits**
  - ◆ Complete API interface for users and IMS tools

# Parallel RECON Access

- Allows multiple DBRC instances to access the RECONS concurrently
  - ◆ DBRC instance: IMS Online subsystem, batch job, or utility
- Eliminates serialization of accesses between DBRC instances
  - ◆ Data set RESERVE (or global enqueue) eliminated
- Reduces RECON contention
  - ◆ Could provide better responsiveness from IMS online and batch
  - ◆ Removes growth constraint
- Parallel RECON Access is optional
  - ◆ Specified by DBRC command for a set of RECONS

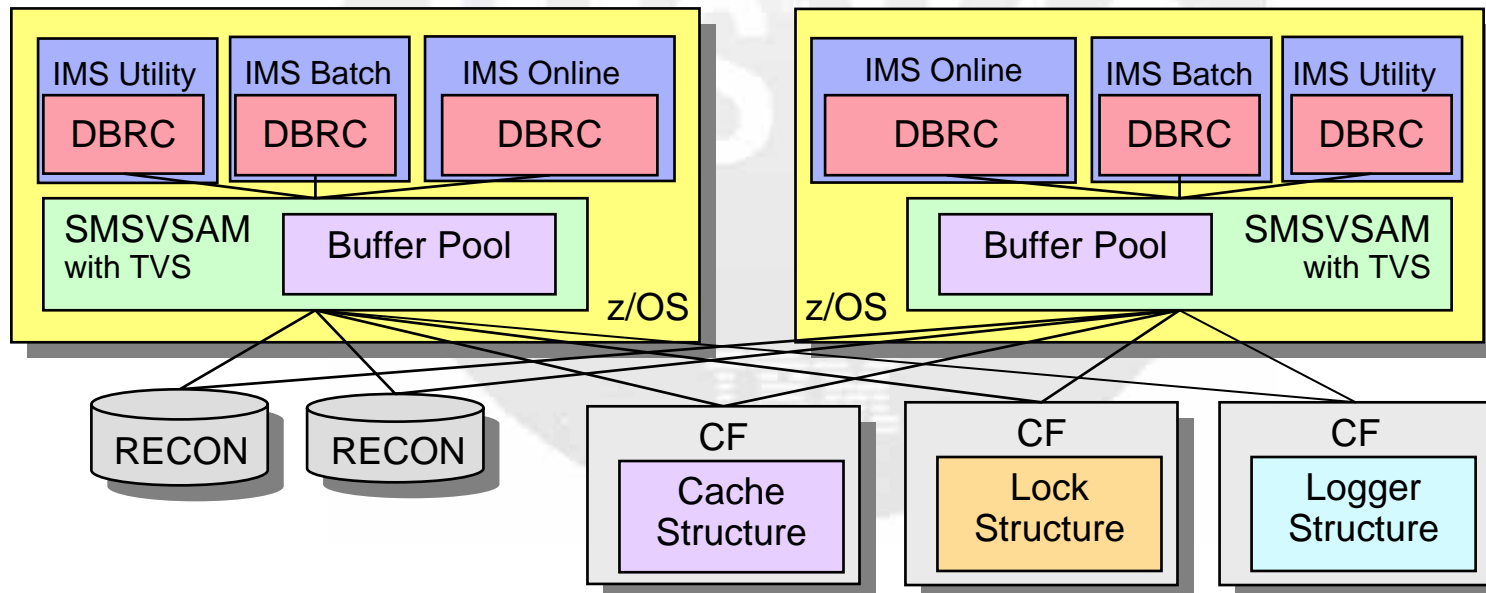
# Parallel RECON Access

- Uses Transactional VSAM
  - ◆ System facility that provides locking, logging, caching, and commit for concurrent updates to VSAM data sets (RECONs)
    - Exploits Parallel Sysplex
- Prerequisites
  - ◆ Hardware
    - Parallel Sysplex environment
      - Requires Coupling Facility
  - ◆ Software
    - z/OS DFSMS Transactional VSAM (DFSMSStvs)
      - Requires RRS for DFSMSStvs (IMS use of RRS is not required)
      - DFSMSStvs is an optional feature
        - Software license required
        - Special bids will be considered



# Transactional VSAM (DFSMStvs) Overview

- TVS uses a cache structure in CF and a buffer pool in SMSVSAM address space
  - ◆ When a buffer in one SMSVSAM is updated, buffers with the same record in other SMSVSAM address spaces are invalidated
- VSAM record is locked when accessed by a user of TVS
  - ◆ SMSVSAM has its own lock manager
  - ◆ RECON record locked by a DBRC instance



# Transactional VSAM (DFSMStvs) Overview

- Recovery of failed users
  - ◆ Each DFSMStvs instance has an undo log
  - ◆ Used for backout after failures
- Recovery for failed SMSVSAM address space
  - ◆ Restarted automatically if it fails
    - Backs out in-flight work and releases retained locks
- Recovery for failed z/OS system
  - ◆ Peer recovery
    - Back outs done by another SMSVSAM address space on another LPAR
    - Locks released

# Parallel RECON Access Implementation

- PRA is turned on with a RECON setting

```
CHANGE.RECON ACCESS(SERIAL | PARALLEL)
```

```
INIT.RECON ACCESS(SERIAL | PARALLEL)
```

- PARALLEL turns on PRA
- SERIAL turns off PRA
- IMS does not have to be shut down to change access

# PRA Migration and Coexistence

- Parallel RECON Access cannot coexist with serial access for a set of RECONS
- PRA requires MINVERS('10.1')
- PRA requires DFSMStvs environment
  - ◆ IGDSMSxx parameters
  - ◆ Structure and log stream definitions
  - ◆ SHCDS data sets
  - ◆ RACF authority
  - ◆ RRS
  - ◆ SMSVSAM address space
  - ◆ Updated operation and recovery procedures

# PRA Summary and Benefits

- **Parallel RECON Access**
  - ◆ Exploitation of Transactional VSAM
  - ◆ Concurrent RECON activity by multiple DBRC instances
- **Benefits**
  - ◆ Reduction of RECON contention
  - ◆ Increased throughput
  - ◆ Reduction of interference with online systems from batch jobs and utilities
  - ◆ Removal of growth constraint

# IMS Version 10

*Integration*

*Security*

*Ease of Use*

*Performance*

*Capacity*

*Programming*

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- ◆ Fast Path Capacity Enhancements
- ◆ XQuery Support with XML DB

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- ◆ RECON READONLY Access
- ◆ Improved SAF Support for RECONS
- ◆ DBRC API Enhancements
- ◆ Parallel RECON Access