



Session: A01

DB2 9 for z/OS: A New Spin on a Classic Database

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This presentation details the new features coming in DB2 9 for z/OS. DB2 9 is bringing new life to our already robust DB2 for z/OS database management system. These new features go well beyond the boundaries that were present in the past and also open up new opportunities and uses for the DB2 for z/OS platform in terms of data storage and application exploitation. DB2 9 for z/OS brings new business insight innovations, cost savings through optimization and business resiliency. We will take a detailed look at the new features and as always we look closely at the new performance features.

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No animals were harmed during testing

Abstract



This presentation looks at the new features coming in V9 of DB2 for z/OS. V9 is bringing new life to our already robust DB2 for z/OS database management system. These new features go well beyond the boundaries that were present in the past and also opens up new opportunities and uses for the DB2 for z/OS platform.

DB2 9 for z/OS brings new business insight innovations, cost savings through optimized innovations and business resiliency innovations. We will take a look at the new features providing for this.

V9 New and Improved!



IBM Vision: Enhance DB2's ability to handle new and enterprise applications

- XML support
 - Improved usability
 - Storage, retrieval, family support
- LOB support
 - Improved usability
 - Performance
- SQL
 - Usage
 - Portability
 - Performance and optimization
- Improved online schema
 - Data on demand

V9 New and Improved! (cont..)



V9 enhances DB2 beyond support of just the traditional database and application!

- Enhanced database support
 - Universal tablespace
 - Clone tables
 - Additional data types
- Unicode
- Enhanced utilities
 - LOBs
 - XML
 - Recovery
 - Performance
- Extended security
 - Roles and Trusted Context
- 64-bit virtual storage

High Level V9 Requirements and Prerequisites

Hardware

Any processor that supports z/Architecture™ (* limitations with microcode levels and IBM zSeries emulation software)

Operating System

**z/OS V1.7 Base Services (5694-A01), or later z/OS V1.8
Executing in 64-bit addressing mode**

Software

DB2 UDB for z/OS V8

Other Prerequisites



- DFSMSHsm V1.8
 - DFSMSdss and FlashCopy® V2 for system-level backup and recovery utility
- z/OS Cryptographic Services Integrated Cryptographic Service Facility (ICSF)
 - Encryption support and optional for DRDA Data Stream Encryption
- CF12 - Group Bufferpool Batching
- CF13 - Castout enhancement and lock table cleanup
- CF14 - System Managed Duplexing for lock or SCA structures
- DB2 Connect V9.1
 - CLI support of MERGE and SELECT from MERGE
- msys for Setup
 - For the DB2 Customization Center

Changes and Deletions for Databases and Applications



- TEMP database is gone
 - TEMP database for DTTs (Declared Temporary Tables) and static scrollable cursors is removed
 - Now these objects use the DSNDB07 workfiles
- No more simple table space creation
 - Cannot explicitly (or implicitly) create simple table spaces
 - Support however is continued
- Plans and packages
 - Rebinds recommended (as always)
 - Allows you to benefit from optimizer enhancements
- DB2-managed stored procedure address space support is removed
 - Workload Manager (WLM) is the direction
 - Migration to WLM-managed stored procedure spaces is required

Changes and Deletions for Applications and Tools



- JDBC/SQLJ Driver for OS/390 and z/OS support is removed
 - Use the IBM DB2 Driver for JDBC and SQLJ (was the DB2 Universal JDBC Driver)
- Extenders Removed
 - Audio, Image, Video
 - Text
 - Net Search
- Net.data is removed
 - WebSphere is the direction for providing DB2 data to Web applications
- DB2 Estimator is gone
- Information Management Software for z/OS Solutions Information Center (Information Center)
 - Replaces online help facility
 - Web-based Information Center
 - Updated periodically to provide the most current information

V9 Features



Availability
Scalability
Application Development
SQL
Performance
Security
Usability

Availability



- REORG improvements
 - REORG elapsed time reduction
 - Removal of the BUILD2 phase of Online REORG
 - Change to REORG SHRLEVEL REFERENCE by part
 - Online REORG usability and keyword changes
 - LOB REORG enhancements
- Rename column and index
- Alter index/change page size
 - Can use the ALTER BUFFERPOOL to change the index page size

```
ALTER TABLE  
RENAME COLUMN OLDCOL TO NEWCOL
```

```
ALTER INDEX INDX1  
BUFFERPOOL BP8K0
```

Availability (cont..)



- Modify early code without IPL
 - New command `REFRESH DB2,EARLY`
- Restart improvements
 - Conditional Restart Log Truncation by Timestamp
 - Toleration of DBET errors during DB2 restart
- Table replacement `ALTER TABLE ADD CLONE`
 - CLONE table support
 - Ability to generate a table with the same attributes of one that already exists on the current server
 - “Online load replace” `EXCHANGE DATA BETWEEN TABLE ...`
- APPEND on Insert `CREATE TABLE ...APPEND YES/NO`
 - Allows for fast inserts at the end of the table or partition

Scalability



- Log latch contention reduction
- CREATE/ALTER STOGROUP SMS constructs
 - Can specify Dataclas, Mgmtclas, Storclas
- Universal tablespace
 - Partition by growth
 - Partition by range
- No Log tables
 - NOT LOGGED tables
 - For quick loads (i.e. summary tables)
- Memory improvements
- Larger index page sizes
 - Can have 4K, 8K, 16K or 32K

```
CREATE STOGROUP STG1  
DATACLAS DC1 VCAT USER1
```

```
CREATETABLESPACE TS1  
....LOG NO
```

Application Development



- XML
 - Powerful querying and transformation capabilities
- Native SQL Procedure Language
 - Does not require a C compiler
 - Runtime structure in DB2
 - No cross memory calls
- Data Types
 - BIGINT
 - VARBINARY
 - BINARY
 - DECIMAL
 - FLOAT
- Built in functions
 - 23 Scalar and 3 aggregate
- LOB File reference variable

SQL



- MERGE
 - Conditional updates
- TRUNCATE
 - Fast removal of data
- SELECT FROM UPDATE, DELETE, MERGE

```
SELECT ACCT_BAL INTO :ACCT-BAL
FROM FINAL TABLE UPDATE ACCOUNT
SET PAY_AMT = :PAY-AMT
,ACCT_BAL = ACCT_BAL + :PAY-AMT
,PAY_DATE = CURRENT DATE
,UPD_TSP= CURRENT TIMESTAMP
WHERE ACCT_ID = :ACCT-ID
```

- INSTEAD OF trigger
 - Used to insert, update, and delete data in complex views
- FETCH FIRST and ORDER BY in subselect and fullselect
- INTERSECT and EXCEPT

```
SELECT *
FROM TABLEA
EXCEPT
SELECT *
FROM TABLEB
```

SQL (cont..)



- OLAP extensions

RANK
DENSE_RANK
ROW_NUMBER

- Caseless expressions

- Allows data to be stored as mixed case and run case insensitive searches
- For example, Illinois, ILLINOIS, and illinois are returned by a query
- No need for where upper(:hv) =upper(column)

- Cultural Sort

- Improved sorting for special two character characters that are not correctly sorted in the current DB2 sorting algorithm

a...b...c....d....e....f.....g.....h, ch, i.....j.....
and not:
a...b...c....ch....d.... (as it is now in DB2 sort result)

Performance



- Optimistic Locking
 - Faster more scalable locking alternative to database locking for concurrent access
- Randomization
 - RANDOM option for indexes
- Large index page sizes
 - 4K, 8K, 16K, 32K
- Index compression
 - Need to evaluate with DSN1COMP when choosing page size
 - Trade off between disk space and waster buffers
- Improved handling of index page splits
 - Asymmetric split of the index pages
 - Better detection and support for various insert patterns
- Index on Expression

```
UPDATE PKG_TBL
SET PKG_DESC = :PKG-DESC
WHERE PKG_ID = :PKG_ID
AND ROW CHANGE TIMESTAMP
FOR PKG_TBL = :UPD-TSP
```

```
CREATE INDEX NAME_IDX1 ON NAME_TBL
(YEAR(BRTH_DTE), LAST_NME);
```

Performance (cont..)



- Histogram Statistics
 - More granular statistics
 - Gathers frequency distribution values by quantiles
- Cross query block optimization
 - Instead of each individual block
 - Mostly useful for subqueries
- Sparse Index and In-Memory Data Caching
 - Dedicated above the bar memory
- Dynamic index ANDing for star schema
 - New pair-wise join method
- Runtime Reoptimization for star joins
- Skip Locked Data

MXDTCACH

```
SELECT COUNT(*)  
FROM CUSTOMER  
WHERE CUST_NO >= 500  
SKIP LOCKED DATA
```

Performance (Cont..)



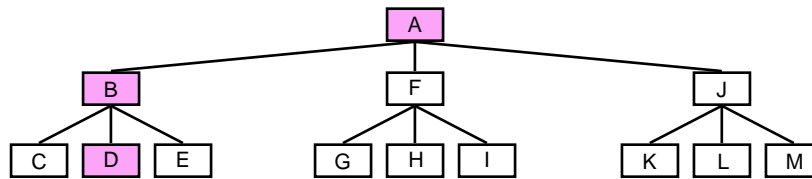
- Nested Compound Statements in SQL Stored Procedures
 - Ability to group other statements together into an executable block (delimited by BEGIN and END)
- Load and Reorg CPU reductions
- Improved varying length data
 - Reordered row format
 - Placing varying length fields at end of row
- Improved logging and inserts
- DPSI Parallelism support
 - Support for parallelism for sorts with DPSIs

```
SELECT * FROM TABLE1 ORDER BY C1;
```

Performance (cont..)



- REOPT(AUTO)
 - Automatic reoptimization of the dynamic statement when DB2 detects the filtering of one or more predicates has big change
 - Will be especially helpful for queries/predicates with skewed data values
- New bind defaults
 - CURRENTDATA(NO)
 - ISOLATION(CS)
- Index Lookaside
 - Possible for more indexes (not just clustering) for in both insert and delete



Performance (cont...)



- Sorts Improvements
 - In-memory work file usage for short running SQL calls in which the number of rows sorted can be small
 - FETCH FIRST n ROWS with ORDER BY(also in subselects), avoid tournament tree sort
 - GROUP by improvements when missing function or index
 - DISTINCT improvements when index missing or only a non-unique index exists

```
SELECT A.ACCT_BAL, H.ACCT_STATUS
FROM ACCOUNT A,
TABLE (SELECT ACCT_STATUS
FROM ACCT_STS_HIST X
WHERE A.ACCT_ID = X.ACCT_ID
ORDER BY STATUS_DTE DESC
FETCH FIRST 1 ROW ONLY) AS H
WHERE A.ACCT_ID = 'A000010';
```

Security



- **Network Trusted Context**
 - Ability to establish a trusted relationship between DB2 and an external entity
- **Role**
 - A database entity, available in a trusted context, that groups together one or more privileges and can be assigned to users
- **Enhanced Auditing**
 - Can specify roles for filtering
 - New IFCIDs for trusted connections
- **Encryption enhancements**
 - Hardware enhancements for z990 for more parallelism
 - Encryption on the controllers
- **Secure Socket Layer (SSL)**
 - Encryption using a new secure port
 - Better, more secure encryption over the wire

Usability



- Optimization Service Center
 - Windows workstation tool
 - Helps you tune and get expert recommendations for statistics to collect
 - To improve the performance of your queries and query workloads
- WLM
 - Used to adjust bufferpool sizes
 - Size is coordinated dynamically with the requirements of data requesters and the systems sysplex workload
- Backup and Restore
 - Using FlashCopy and tape
 - Recovery of single object from a system level backup
- Automatic Object Creation
 - For some objects implicit creation (i.e. LOB tablespaces)

Enterprise Application Features



- SHRLEVEL(REFERENCE) for REORG of LOB tablespaces
- Online RENAME COLUMN, RENAME INDEX, REBUILD INDEX and ALTER COLUMN DEFAULT
- Elimination of REORG Build 2 phase
- Faster REORG with parallelism

Enhancing
SAP by
using
DB2 9 for z/OS
SG24-7239-00

- Renaming SCHEMA, VCAT, OWNER, CREATOR
- LOB lock reduction
- Tape support for backup and restore
- Recovery of individual table spaces and indexes from volume backups
- DB2 trace enhancements
- Spare index and in-memory data caching
- Autonomic reoptimization

Enterprise Application Features



- Lobs network flow optimization
- Faster operations for variable row
- NOT LOGGED table spaces
- Index on expression
- UTS PBG
- Append on insert
- RLF for remote app servers
- Consistent recovery of individual object to prior PIT

- New data types
- MERGE
- FETCH CONTINUE
- Enhanced Current Schema
- IP V6 Support
- Index Compression
- Automatic object creation

Summary – New Spin on DB2!



V9 enhances DB2 beyond support of just the traditional database and application!

- Improved XML and LOB support
- SQL and security enhancements
- Builds upon and extends DB2 traditional strengths
 - Online schema, Unicode, XML, SQL, utilities, security and 64-bit virtual storage
- Data definition on demand
 - Extends online schema capabilities
- Additional Unicode enhancements
- Improved SQL consistency across family and DBMSs
 - Native SQL Procedures
 - SQL Syntax – features
- Utility enhancements supporting new functions
 - LOB and XML support
 - Better performance and improved availability

Session A01



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IBM DB2 Turns 25!

On June 7, 1983, IBM issued a press release announcing a "relational data base management system [RDBMS] for large enterprises", and so began the life of Database 2, now simply called DB2. Tomorrow we celebrate the 25th anniversary of DB2. Here are some of the key happenings that led not only to the birth of DB2 but to the formation of the RDBMS industry as a whole.

-from the 25th Anniversary release



[View the original DB2 press release from 1983!](#)

[View the 25th Anniversary release](#)