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# DB2 10 for SAP
# Benefits for SAP Customers

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- Overall Conference Evaluation will be provided at the General Session on Friday

- Visit the Expo Solutions Centre

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- Please switch off your mobile phones

- Please remember to wear your badge at all times

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# Agenda

- Overview: DB2 10

- DB2 10 features for SAP – Scalability

- DB2 10 features for SAP – Performance

- DB2 10 features for SAP – Availability

- DB2 10 features for SAP – Autonomics and DBA Productivity

- DB2 10 features for SAP – Portability and Security

# DB2 10 Beta Program

- Announced on February 9

- Beta program started on March 12

- Check www.ibm.com/software/data/db2/zos/db2-10

- Prereqs z/OS 1.10

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# DB2 10 for SAP – Scalability Overview and Values

- **Huge scalability improvement for concurrent workload within single DB2 subsystem**
  - → Thousands of SAP work processes served by single DB2 subsystem
  - → Better workload consolidation
  - → More options for SAP landscape configurations

- **Partition-by-growth tablespaces used for DB2 Catalog tables**
  - → Simplified setup and operations

# Full 64-bit Runtime – 10x more DB2 threads

**Challenge**

Virtual storage for different DB2 storage areas in DBM1 address space restricted to 2 GB
→ Restricts maximum number of SAP work processes served by single DB2 subsystem

**Solution**

64-bit support for all relevant storage areas in DBM1

- Particularly, DB2 threads live above the 2 GB bar

- Goal: 5 to 10 times more active threads per DB2 subsystem

- Stack storage space also 64-bit enabled

# Reducing DB2 Catalog Contention

- Some DB2 catalog table spaces use so-called links, which requires page-level locking
  → Favors deadlock and timeout issues with concurrent DDL, DML, utilities
  (for example, SAP BW)
- DB2 catalog and directory is user-managed → Additional complexity

The DB2 catalog and directory table spaces that used to have links are converted to regular UTS PBG table spaces

- One UTS PBG table space per table
  – DSSIZE 64 GB, RRF, SEGSIZE 32, MAXPARTITION 1, row-level locking
- Links are not used anymore
- Row-level locking can be used across the board for all catalog table spaces
- Also, DSNDB01.SYSLGRNX switches to row-level locking

# Reducing DB2 Catalog Contention (continued)

- DB2 catalog and directory become DB2-managed
- Catalog and directory data sets are SMS-managed
- Existing data sets are converted during ENFM processing
- Reduces user efforts to maintain data sets
  - No need to allocated data sets and extends
  - No need to allocated data sets for shadows for online RERG
  - No need to estimate sizes for data sets (some customers used huge sizes)
  - SMS to determine which data set goes to which volume
- Also, new CLOB columns to store SQL statement texts
- Also, new BLOB columns to store packages and DBDs
  - Relief for previous 64 GB limit for SPT01

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# DB2 10 for SAP – Performance Overview and Values

- **SAP database interface layer optimized specifically for DB2 10**
  - → More streamlined and more efficient processing
  - → Huge investment

- **Significant CPU and elapsed time improvements out of the box**
  - → Cost savings

- **Performance boost for typical SAP Banking workloads (heavy INSERT)**
  - → Elapsed time reduction for periodic banking batch jobs

- **Additional performance improvements and disk space savings for LOBs**
  - → Cost savings

- **Combining member clustering and universal tablespaces**
  - → Optimizing DB2 data sharing performance

# Inline LOBs

- Typically, average LOB size with SAP is between 1500 and 3000 bytes
- Performance of small-sized LOBs is slower than its compatible non-LOB data type of the same size

Inline LOBs

- An inline LOB is a LOB that resides completely or partially in the base table space of a table
  - In latter case, the rest of the LOB resides in LOB table space
- How to specify inline LOB
  - A new ZPARM is introduced: LOB_INLINE_LENGTH
  - A new clause INLINE LENGTH is introduced on CREATE TABLE, ALTER TABLE ADD column and CREATE DISTINCT DATA TYPE
  - For existing LOB, immediate change with advisory REORG-pending

# Inline LOBs (continued)

- Inline length of a LOB can be changed
  - Can be decremented and incremented
    - Cannot become shorter than default value
  - Immediate change
    - New rows are inserted with new inline length
    - Existing rows will be changed at next REORG (advisory REORG state)
- Impact of inline LOBs on CPU consumption and elapsed time
  - If all LOB data that is processed is in inline part, big savings as no additional LOB table space needs to be accessed
- Impact of inline LOBs on space usage
  - If the base table space is compressed, inline portion of LOBs is automatically compressed as well
    - Compression dictionary applies to both non-LOB and inline LOB data
  - In LOB table space, each page can hold data of a single LOB only

# Parallel Index Update at INSERT

- For heavy INSERT workload like in SAP Banking or Retail, the defining factor for elapsed time often is the number of indices on the table
    - If table too large, unrealistic to have table and all indices resident in buffer pools
    - For each index, leaf page for new record needs to be read in from disk (sync I/O)

Relevant index leaf pages are read in from disk in parallel

- If DB2 encounters I/O wait time on GETPAGE operation for index leaf page, it inserts into next index

- After first round of inserting into each index, it checks if these succeeded for all indices
    - Very likely that the I/O operations have completed

- If not, DB2 will wait for the I/O operations for the remaining indices

- This processing applies to tables with at least three indices

# Enabling MEMBER CLUSTER for UTS

**Challenge**

- Universal tablespace (UTS) is standard type for new SAP tables
  - For implicitly created tablespaces
  - Introduced with DB2 9
  - Better space reuse and delete processing
- UTS incompatible with MEMBER CLUSTER tablespace attribute
  - MEMBER CLUSTER provides best SQL INSERT performance in data sharing

**Solution**

- DB2 10 enables MEMBER CLUSTER for UTS
  - Including special INSERT processing activated by the combination of the following tablespace attributes:
    - FREEPAGE=0 AND PCTFREE = 0 and MEMBER CLUSTER
    - SAP Banking relies on this for crucial tables like BCA_PAYMITEM
- This enables exploitation of UTS across the board

# Optimizer Enhancements

Challenge

Some scenarios not completely considered by optimizer

Solution

- Safe query optimization
  - If there are similar indices, index with more matching columns is preferred
  - RID list access never fails back to table space scan
- Predicate transitive closure on IN-lists
- Matching multiple IN-LIST predicates
  - DB2 translate INLIST into in-memory table
- List prefetch with IN-LIST
  - With IN-LIST matching predicate being transformed into in-memory
- Aggressively merge query blocks
  - Consistently merge views and table expressions

# Optimizer Enhancements (continued)
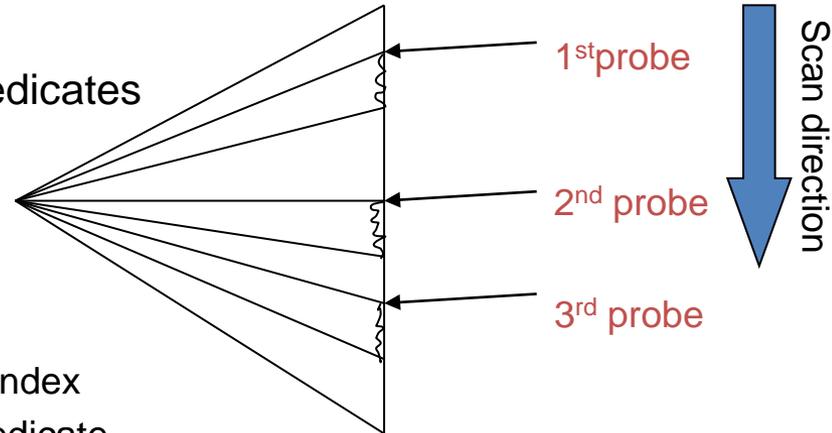
- SQL pagination
    - Introduces new method to process OR predicates
      ```
      (C1 op ? AND C2 op ? AND C3 op ?) OR
      (C1 op ? AND C2 op ?) OR
      (C1 op ?)
      ```
    - New method will be considered if:
        - OR predicate is only referring single table
        - Each disjunct can be mapped to the same index
        - Each disjunct has at least one matching predicate

- Moving sum, moving average
    - AVG(sh.sales) OVER ( ….)
    - Three elements
        - `PARTITION BY` sh.territory --- row should be assigned to partition according to territory
        - `ORDER BY` sh.month --- row sorted in the order of month within each partition
        - `ROW 2 PRECEDING` -- define the aggregation group. It's consists of the current row and the two preceding rows of the partition

1<sup>st</sup> probe

2<sup>nd</sup> probe

3<sup>rd</sup> probe

Scan direction

# Additional Improvements in Performance

- DEFINE NO for LOBs and XML

- LOB streaming between DDF and rest of DB2
  - Faster fetch and insert, lower virtual storage consumption

- Improve NOT PADDED index processing
  - Provide performance close to that of padded indexes

- Internal performance optimizations
  - Improved CPU cache performance
  - Exploit new hardware instructions
  - Streamlined DDF, RDS, DM, Index Mgr. performance-critical paths

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# DB2 10 for SAP – Availability Overview and Values

- **Comprehensive FlashCopy exploitation**
  - → Faster backup and recovery

- **Backward recovery**
  - → Less downtime

- **Less downtime when changing table layout**
  - → Better business continuity

- **Online reorganization of LOBs**
  - → Better business continuity

- **More flexible online rotation of table partitions**
  - → Faster reuse of existing partitions for new data like with SAP BW

# More Online Schema Changes

- During SAP lifecycle management tasks, the layout of table may change
  - Particularly during SAP upgrade
- To change different technical table settings, table needs to be converted (unloaded, dropped, recreated & loaded)
  - → Table not available during this timespan

DB2 10 introduces deferred alterations for the following changes:

- Page size and buffer pool for table spaces and indices
- DSSIZE attribute for table spaces
- SEGSIZE attribute
- MEMBER CLUSTER attribute
- Convert single table segmented into UTS PBG
- Convert single table simple into UTS PBG

Deferred ALTER:

- Statement is put on to-do list in new DB2 catalog table
- Next REORG materializes pending ALTER

# Online Reorganization for LOB table spaces

**Challenge**

DB2 9 introduced REORG support for LOB table spaces to allow reclaiming space.
However, SHRLEVEL REFERENCE only → No concurrent changes allowed

**Solution**

Online REORG for LOBs

- SHRLEVEL CHANGE
- Builds on DB2 9 enhancement
- Base table space must be LOG YES

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# DB2 10 for SAP – Autonomics and DBA Productivity Overview and Values

- **DB2 default settings for SAP and automated setup of WLM environments**
  - → Facilitated setup

- **Immediate compression**
  - → Facilitated operations

- **Auto-stats**
  - → Facilitated operations

- **Safe query optimization and stabilizing access paths**
  - → Better out of the box performance

# DB2 default system parameters for SAP

## Challenge

- DB2 default values for system parameters (ZPARMs) not always adequate for SAP
- Detailed SAP recommendations for DB2 ZPARMs given that need to be implemented

## Solution

- DB2 10 introduces system parameters defaults optimized for SAP systems
- Provided as new CLIST input member `DSNTIDXB`
    - Shipped as part of `SDSNSAMP`
- Besides DB2 ZPARMs, DB2 buffer pools are also configured according to SAP recommendations
    - BP attributes `VPSIZE,` `DWQT` and `VDWQT` are affected
- For DB2 subsystems migrated to DB2 10:
    - Existing bufferpool settings are honored
    - Existing DB2 ZPARM values are honored except if existing value is below new minimum
    - New DB2 ZPARM values are picked up from `DSNTIDXB`

# Automated installation of WLM application environments

## Challenge

- DB2 ships a growing number of stored procedures for different purposes like ease of administration
- SAP ships SAPCL stored procedure to collect DB2 performance data from IFI interface
- However, a prereq to run stored procedures is that suitable application environment exist in z/OS WLM
  - This is a manual step outside the control of DB2 (no batch or API interface)

## Solution

- DB2 10 establishes WLM application environments for DB2 stored procedures as part of installation or DB2 release migration

- New single DB2 job to create all DB2-supplied stored procedures

- New validation program for DB2-supplied stored procedures

# Compress on the fly during INSERT

**Challenge**

Tables need to be reorganized in order to be compressed → Operational complexity

- For example, after SAP install or BW data load

**Solution**

Tables with COMPRESS YES attribute are directly compressed by DB2

- INSERT statement is instrumented to trigger creation of compression dictionary
    - Also applies to MERGE and LOAD SHRLEVEL CHANGE
- Conditions:
    - Table space defined with COMPRESS YES
    - No compression dictionary available
    - Table space contains enough data
- Compression dictionary is built asynchronously

# Extended FlashCopy Exploitation

General direction with SAP is to rely on FlashCopy technology for DB2 backups

- With DB2 9, some non-FlashCopy image copies still need to be taken

- DB2 10 `REPORT RECOVERY` includes `BACKUP SYSTEM` backups
- DB2 10 automatically deletes CF structures during first DB2 restart after recovery
- Data-set level FlashCopy for DB2 utilities
  - `COPY`
  - `REORG` inline copy
  - `LOAD` inline copy
  - Copy of indexes in `LOAD, REORG, REORG INDEX, REBUILD INDEX`
- FlashCopy backups can be used as input to:
  - `RECOVER`
  - `COPYTOCOPY`
    - Create sequential copies from FlashCopy
  - To exploit data set-level FlashCopy for UNLOAD:
    - `COPY` → `COPYTOCOPY` → `UNLOAD`

# Backward Recovery

Single SAP table needs to be recovered to a prior point in time and last backup is fairly old

- Single table recovery is exception in SAP context but may happen
- → Recovery can be slow since DB2 always uses last backup as base and then applies log records

- Allow PIT recovery by rolling back on the log rather than restoring recovery base and rolling forward

  - New option for `RECOVER` utility: `BACKOUT`

# Reduce Need for Reorganization of Indices

**Challenge**

If an index is disorganized:

- Sequential prefetch mechanisms may work poorly due to more gaps between leaf pages → More sync I/O
- Tends to have more index tree levels → More efforts to traverse the tree

**Solution**

- DB2 10 can do list prefetch for index leaf pages during query processing based on index non-leaf page information

    - Decision for list prefetch is made at execution time of query

- Reduces CPU time spent on index root page GETPAGE requests

- Rules adapted in stored procedure `DSNACCOX` for `REORG INDEX` recommendations

# Dynamic SQL statements: More granular timers

- For some wait times of SQL statements, DB2 does not provide dedicated timers
- Difficult to find all relevant statements on a table or for SAP transaction, end user, or report

- New IFCID 316 fields added:
    - QW0316W8 - "Wait for page latch"
    - QW0316W9 -  "Wait for Drain Lock"
    - QW0316WA - "Wait for Drain Lock for claims to be released"
    - QW0316WB -  "Wait for log writer"
- New filters for IFCID 316:
    - Filter for first table in a statement: WQALRTRL
    - Filter for client end user ID field of a statement: WQALEUID
    - Filter for client transaction name field of a statement: WQALEUTX
    - Filter for client workstation name field of a statement: WQALEUWN

# Auto-Stats

Customers need to ensure that the right statistics for the DB2 optimizer are collected at the right time

The new Auto-Stats feature provides the following:

- Profile support for RUNSTATS utility:
    - `RUNSTATS TABLESPACE.... SET / USE / UPDATE / DELETE PROFILE`
- New stored procedures
    - `ADMIN_UTL_MONITOR` checks need for new/better statistics based on RTS
    - `ADMIN_UTL_EXECUTE` collects new statistics using `ADMIN_UTIL_SCHEDULE`
- Control tables:
    - `SYSIBM.SYSTABLES_PROFILES` contains the RUNSTATS options at table level
    - `SYSIBM.SYSAUTOTIMEWINDOWS` defines when autonomic procedures can be run
    - `SYSIBM.SYSAUTOALERTS` is populated when `ADMIN_UTL_MONITOR` detects that an action needs to be scheduled for execution
- DB2 Admin Scheduler can be used to automatically run the stored procedures

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# DB2 10 for SAP – Portability and Security Overview and Values

- **Completely overhauled new DBA privileges**
  - → Based on business security policies, specific authorities can be granted
    - Different authorities dedicated to certain roles
  - → Better complying with security regulations
  - → Even SAP install does not require SYSADM privilege anymore

# DB2 10 for SAP – Portability and Security Overview and Values

- Specifying physical tablespace attributes at CREATE TABLE
  - → Prereq for completely streamlined new SAP DBSL optimized for DB2 10

- More granular DBA privileges
  - → Better complying with security regulations

# New DBA privileges with finer granularity

## Challenge

- Protect sensitive data from privileged users
- Separate authority to perform security related tasks
- **Reduce use of SYSADM authority**
- Allow EXPLAIN without execute privilege or ability to access data
- Audit the use of privileged users

## Solution

Based on business security policies, new authorities can be granted

- New system administrative authorities:
  - SECADM
  - System DBADM
  - DATAACCESS
  - ACCESSCTRL
  - SQLADM
  - EXPLAIN
- Fore `REVOKE` options: For example, revoke `SYSADM` from a user using the new `NOT INCLUDING DEPENDENT PRIVILEGES` clause
  - Any grants made by the users do not get revoked

# Q & A

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