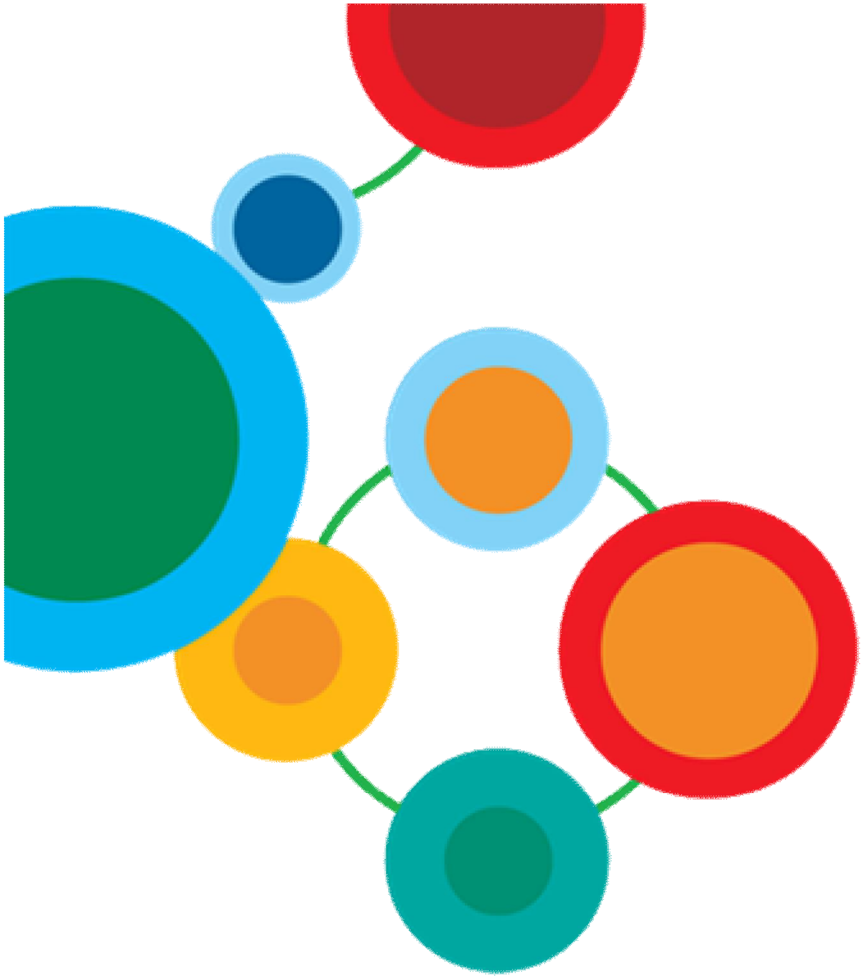

What’s New in DB2 10 for z/OS for DBA

Session Number 1260

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IBM Software
Information On Demand 2011

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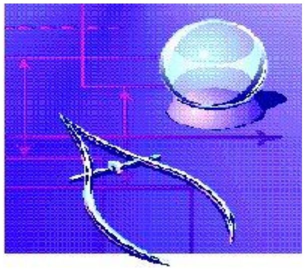

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Agenda

- Online Schema Enhancements
- Index Enhancements
- Buffer Pool Enhancements
- Universal Table Space Enhancements
- Auto-Compress
- Concurrency Enhancements
- RTS Enhancements
- Hash Table Access
- Logging Enhancements
- Utility Enhancements

Without Online Schema

- **Unload data**
- **Drop base tables**
- **Create base tables**
- **Create indexes**
- **Create views**
- **Define authorizations**
- **Load data (Copy, Stats, Check)**
- **Rebind**

Data available for read

Data unavailable

(minutes, hours, days)

Data available

Online Schema Evolution – before V10

- Table or column Changes
  - Increase column size within datatype integer, float
  - Change to expand datatype: char, numeric
  - Change varchar to / from char
  - Rename Table/Column
- Index Changes
  - Add new column to index
  - Change index column type
  - Rename Index
- Dynamic Partitions
  - Add partition
  - Rotate partition

Online Schema Enhancements – V10

- Table Space Changes - deferred
  - Page Size – UTS only
  - DSSIZE – UTS only
  - SEGSIZE – UTS only
  - MAXPARTITIONS
  - Convert single table simple/segmented into PBG
  - Convert classic partitioned table into PBR
  - Convert PBR to PBG
  - Convert Classic Partitioned/PBR/PBG to Member Cluster
  - Table Space is put into Advisory REORG pending
- Index Changes - deferred
  - Page Size
  - Index is put into Advisory REORG pending

Online Schema Enhancements – V10…

- Deferred Alters are materialized at the next table/index space level REORG
  - ➢ Before REORG, pending changes can be dropped via ALTER … DROP …
  - ➢ Quiesce applications using the DBD, plan/package locks during the SWITCH phase
  - ➢ Invlaidate plans/packages/dynamic statement cache when altering table space types
- xAlter Buffer Pool with the same page size – immediate
  - ➢ No longer need to STOP TS/IS in data sharing
  - ➢ Use DRAIN(ALL) to quiesce applications
  - ➢ New BP will be used after commit

Execute ALTER Statement

- Statement is validated.

DB2 semantically validates stmt and checks auth by performing pending DDL (if any), then the requested ALTER (then undoes the catalog changes).

- Assuming all checks out ok:
  - statement is put on to-do-list.
  - Table space is placed in Advisory REORG Pending (non-restrictive).
  - Statement completes with +610 to advertise the Advisory state.

The to-do list is new catalog table, SYSPENDINGDDL

SYSIBM.SYSPENDINGDDL:

DBNAME	TSNAME	DBID	PSID	…	OPTION_ KEYWORD	OPTION_ VALUE	…	STATEMENT_ TEXT

REORG – materialize deferred alters

- Pending DDL is materialized during the SWITCH phase.
- SYSPENDINGDDL entries are removed.
- Stats are collected.
  - Default is TABLE ALL INDEX ALL UPDATE ALL HISTORY ALL unless overridden.
  - Warning message DSNU1166I issued to indicate that some partition statistics may no longer be accurate (COLGROUP, KEYCARD, HISTOGRAM …).
- SYSCOPY entries created to record manifestation.
- Advisory REORG Pending state is reset.

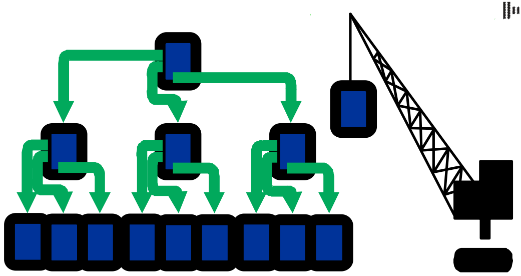
Deferred Alter Restrictions

- May not mix immediate and deferred options in an ALTER statement (-20385).
- Many immediate DDL statements are not allowed while there is pending DDL awaiting manifestation (-20385).
  - CREATE/DROP/ALTER TABLE with pending DDL.
- RECOVER before REORG is not allowed

Online Schema – Immediate

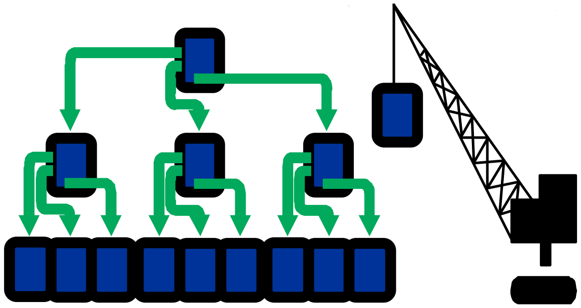
- Alter Index to add included columns - immediate
  - Add non-key columns
  - Index is marked in Rebuild Pending unless new columns are added within the same COMMIT
  - Need to REBUILD index and rebind to benefit for index-only access
- Alter PBR/PBG into Hash - immediate
  - Table is not accessable through hash access due to the overflow index is marked in Rebuild Pending
  - Unable to insert new rows until REORG or REBUILD the overflow index
- Alter LOB to become inline - immediate
  - Use REORG to convert inline for all existing LOBs

Index Improvements – V10



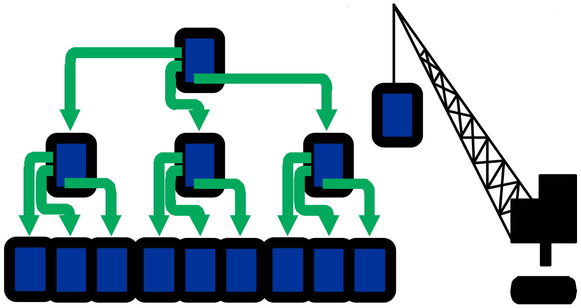
- Parallel index update at insert
  - For tables with more than 2 indexes
  - 2 or more indexes for Member Cluster or APPEND tables
  - I/O parallelism
- Index with included columns
  - Add non-key columns
  - Unique index only
  - Also applies to primary index and indexes used to enforce unique constraints
  - Index will be marked in Rebuild Pending unless columns are added to the table within the same commit
  - Rebind to benefit for index-only access

Index Improvements – V10 …



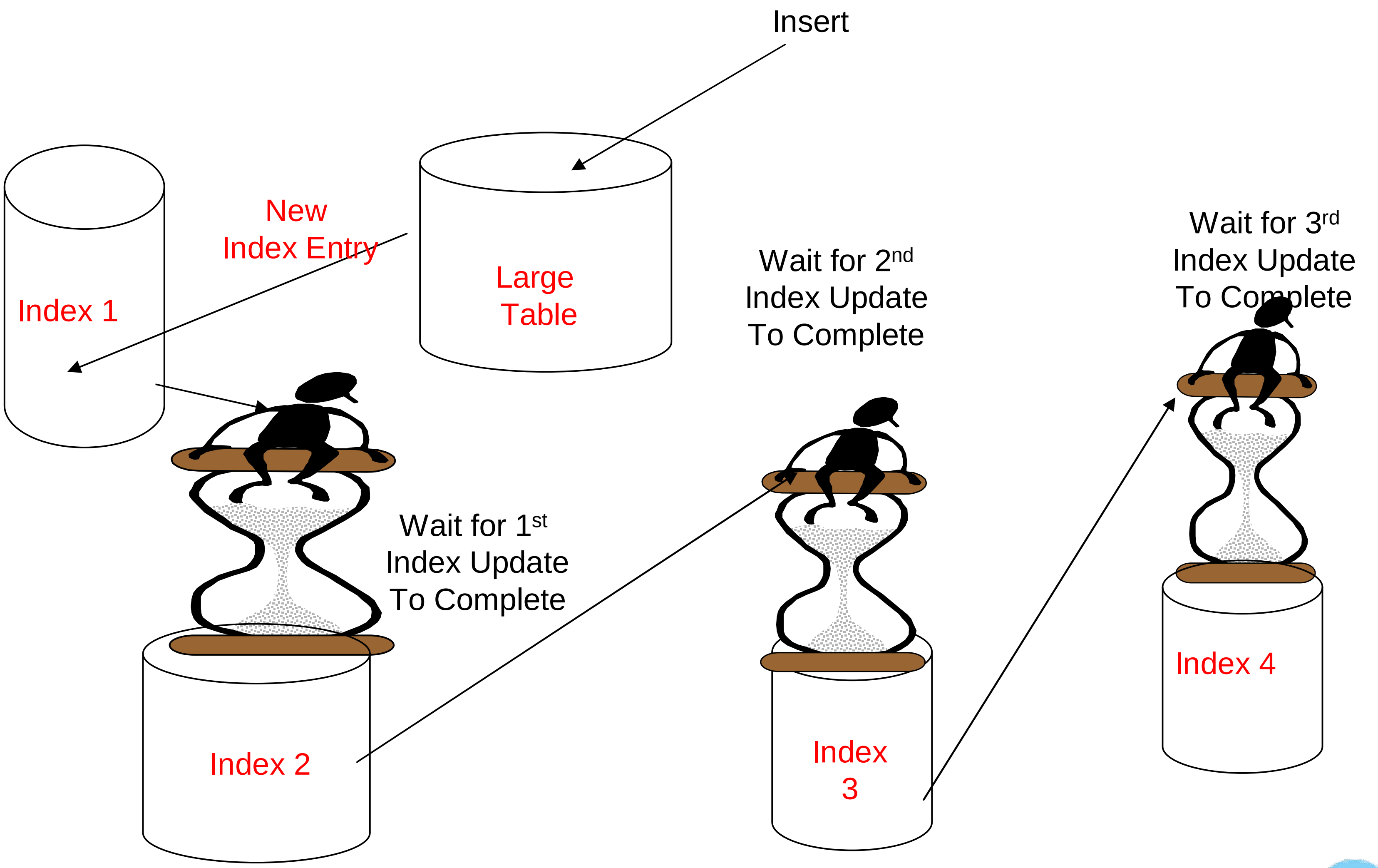
- Impove index look-aside performance
  - ➢Cache the last accessed leaf page
- Improve index split performance
  - ➢Avoid searching a free page from the first space map
- Cache the index root page in buffer pool during open
  - ➢Eliminate one GETP/RELP on each index access
- List prefetch for disorganized indexes – forward scan only
  - ➢Less need for REORG

Index Improvements – V10 …

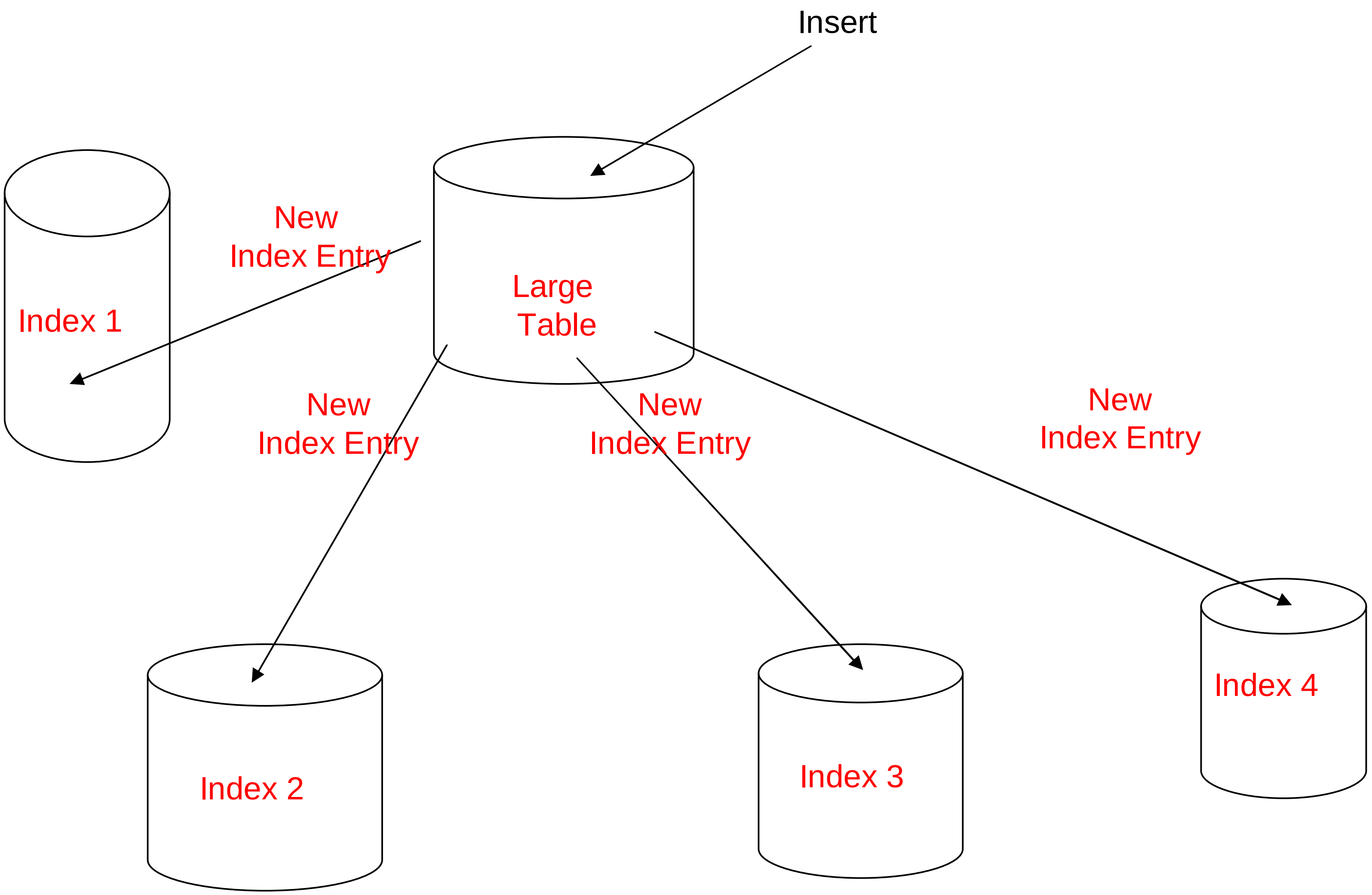


- Improve performance for Referential Integrity and nested loop join
  - ➢Enable index look-aside and sequential detect
- CPU reduction for index access especially with NOT PADDED indexes on VARCHAR
- Remove empty pages from the index tree is no longer limited to the covering space map on delete
- New IFCID 359 to monitor index split

Index Update without I/O parallelism



I/O Parallelism for Index Updates



Buffer Pool Enhancements

- Use 1MB real storage frame, instead of 4K, for PGFIX = YES Buffer Pools
  - ➢Reduce cpu overhead when accessing pages in BP
  - ➢Available only for z10 and zEnterprise
- Prefetch/Deferred Writes are running under zIIP
- Avoid BP scans in data sharing
  - ➢Switch from non-Shared to Shared and vice versa
  - ➢Data set close
  - ➢During STOP DB2
  - ➢Significantly improve performance for large BPs

Buffer Pool Enhancements …

- In-memory tables/Indexes
  - ➢A new PGSTEAL = NONE on ALTER BUFFERPOOL
  - ➢Load data into the buffer pool at data set open
    - Done by DB2 Prefetch Engines
  - ➢Ensure BP size is large enough to cache all data/index pages
  - ➢BP is managed in FIFO (First In First Out) order
    - Not managed in LRU
    - Disable all prefetch requests
  - ➢Query optimizer uses zero I/O cost for tables and indexes using this Buffer Pool
  - ➢Recommend to use AUTOSIZE(NO) which is the default
  - ➢Recommend to set CLOSE = NO for tables/indexes

Currently Committed Locking Option

- A new Bind/Prepare option – Currently Committed versus Wait for Outcome
  - ➢Applicable only for UTS table space
  - ➢Support both Row and Page level locking
- Applies to iso(cs) cd(no) to avoid lock wait for uncommitted insert/delete
- Applies to iso(rs) to avoid lock wait for uncommitted insert
- Still need to wait for uncommitted updated rows
- Pseudo delete data rows will always be done for UTS
  - – Space can be reused after commit

Auto-Compress

- Extend insert to build compression dictionary
  - ➢Applies to COMPRESS YES tables without a dictionary
  - ➢Start to compress rows without a REORG or LOAD
  - ➢Applicable for inserts due to online LOAD and MERGE SQL statement
- Dictionary is built by an asynchronous DB2 task
  - ➢Trigger based on DATASIZE in RTS catalog table
  - ➢Use iso(ur) to perform table scan existing data rows
- Use the default SYSTEMPAGES YES option to taken image copies
  - ➢ UNLOAD utility needs to have the dictionary before processing any data rows

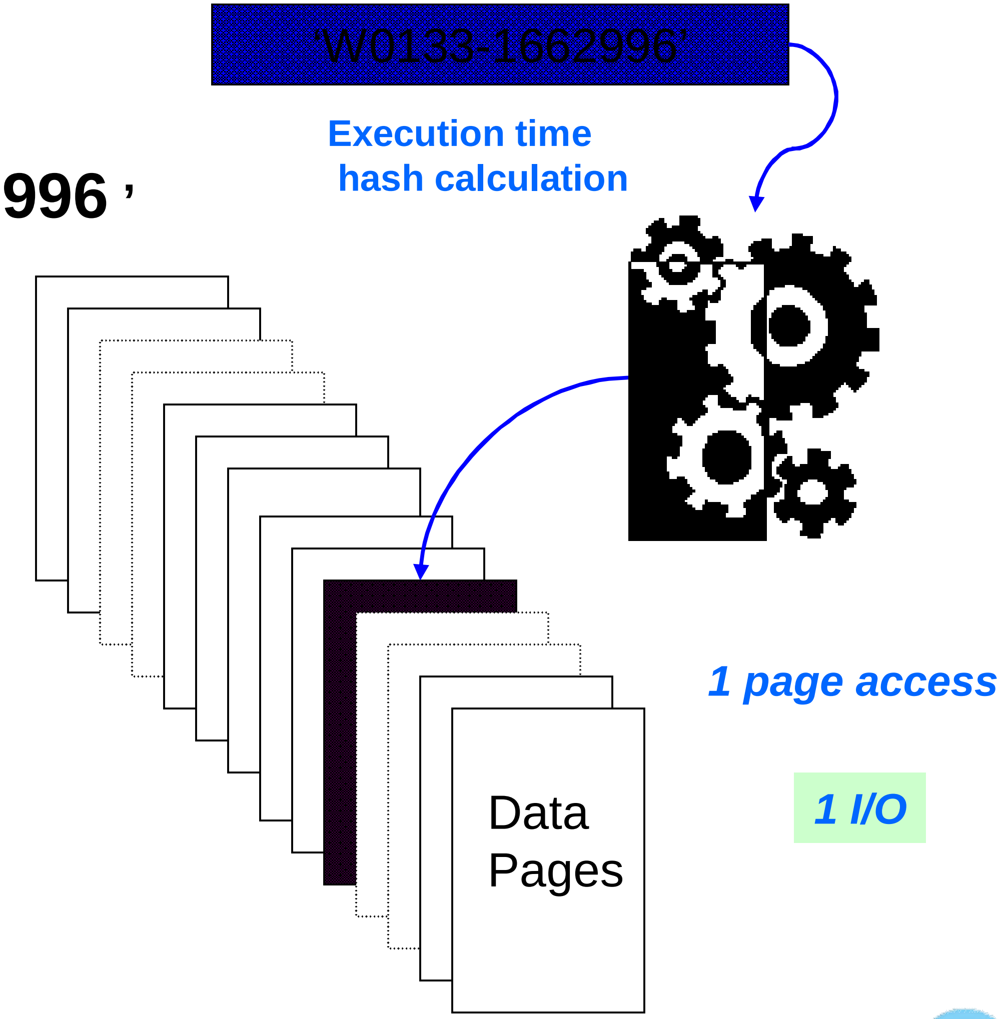
Hashed Table

SELECT * …WHERE
ITEMNO = 'W0133-1662996 '

Locate the data row
by hashing the key value.

-The hash Key must be unique
-Reduced page visits
-Reduced CPU & elapsed time
-Possibly eliminate an index

-Tradeoff: extra space used



'W0133-1662996'

Execution time
hash calculation

Data
Pages

1 page access

1 I/O

Hashed Table Access

- **Tables**
  - Hash access is good for tables:
    - With **a unique key**
    - Queried by applications (such as OLTP) needing **single row access via the unique key or IN predicates**
    - With **known approximate size**

- **Applications**
  - Hash access path will be chosen when:
    - The SELECT statement includes an **equal predicate on all hash key columns or IN-List**
    - DB2 APS determines via hash availability and the specific q **if hash access is suitable**

- **Syntax**
  - CREATE TABLE … ORGANIZE BY HASH UNIQUE (itemno) HASH SPACE 2G
  - **ALTER PBR/PBG into Hash**
    - **Table is not accessible through hash or Insert until REORG**

Universal Table Space Enhancements

- Member Cluster support for UTS
  - ALTER support – deferred alter with REORG
- ALTER to add new partitions to PBG
- Ability to create multiple partitions on create of PBG
  - Allow to use DSN1COPY to copy data
- PBR is the default for new ranged partitioned tables
  - Need to specify SEGSIZE 0 to create classic ranged partitioned tables
  - A ZPARM option which allows to change the default

Workfile Enhancements

- The workfile record size can be up to 64K bytes
  - Spanned workfile record to support JOINs and large SORTs
  - The sort key length can be up to 32K bytes
- PBG can be used for workfile table space
  - The maximum size can go beyond 64GB
  - MAXPARTITIONS can be used to limit the size
  - ALTER can't be done for
- Extend the usage of In-memory workfile
  - Allow simple search predicates

New RTS data in DB2 10

- REORGSCANACCESS
  - Number of queries use table scans
- REORGHASHACCESS
  - Number of queries use hash access
- REORGINDEXACCESS
  - Number of queries use this index to access data
- NPAGES – number of index pages that contains only pseudo deleted keys
  - Unused SYSINDEXSPACESTATS column in V9
- DRIVETYPE – HDD or SSD (Solid State Drive)

Logging Enhancements

- Reduce Log Write Latch (LC19) contention
  - ➢ Eliminate CPU spin loop to generate an unique LRSN within a data sharing member – V9
  - ➢ LRSN will only need to be unique for updates against the same data/index page – V9
  - ➢ Allow multiple rows inserted into the same data page with the same LRSN – V10
- Parallel log force for dual active logs
- Option to take system checkpoint based on time or logs, whichever occurs first
- Online to add new active log data sets via
  - – SET LOG NEWLOG(dsn) COPY(1 or 2)
  - – Recommend to format the data set with DSNJLOGF

Online REORG Enhancements

- Allow REORG SHRLEVEL REFERENCE after ALTER of limitkey
  - Involved partitions will still be marked in REORG pending
  - Helps to avoid data recovery when REORG failed
- SHRLEVEL(CHANGE) for LOBs
- Allow disjoint partition ranges – available in V9
- New AUX keyword for REORG to include LOB
  - Permit movement of rows between partitions
  - Allows DISCARD to delete LOB
- Option to cancel blocking threads
- Messages to estimate length of REORG phases and time to completion

Copy/Recover Enhancements

- Consistent COPY with Shrlevel Change
  - Will not quiesce applications
  - Need data set level FlashCopy capability
- Extend COPY, LOAD, and REORG to take backups using data set level FlashCopy
- Data set level FlashCopy backups as input to
  - RECOVER, COPY, DSN1COPY, DSN1PRNT
- Extend RECOVER to support a point-in-time recovery via rollback using logs

Other Miscellaneous Enhancements

- Major changes in catalog and directory
  - Use Row level Locking
    - Improve concurrency: BIND, DDL, utilities
  - Remove links from catalog tables
    - Many more table spaces
  - LOB columns for long strings
  - DB2/SMS-managed (not user-defined)
- Allow REPAIR utility to set an index part in rebuild pending
  - REBUILD INDEX PART after rows are inserted
- Eliminate the UTSERIAL lock for utilities

Summary

- Universal Table Space
  - Online to alter page size, DSSIZE, …
  - A new option to allow queries to access committed data without waiting for locks
- Index Enhancements
  - Online to alter page size,
  - Parallel index updates to improve insert performance
- Online to alter table space types
- Extend LOAD/REORG/COPY/RECOVER to support data set level FlashCopy
- More online REORG enhancements

Thank
You