



What's New in DB2 10 for z/OS for DBA

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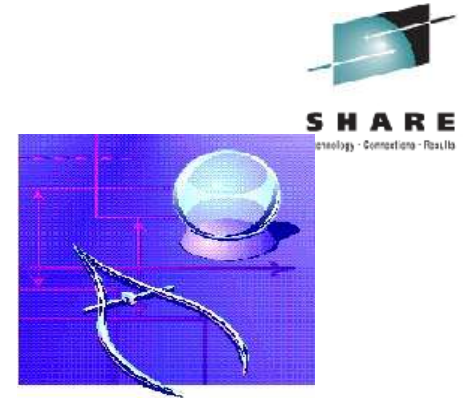
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Agenda



- 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
 - Invalidate plans/packages/dynamic statement cache when altering table space types
- x Alter 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.
- 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.

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

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 accessible 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

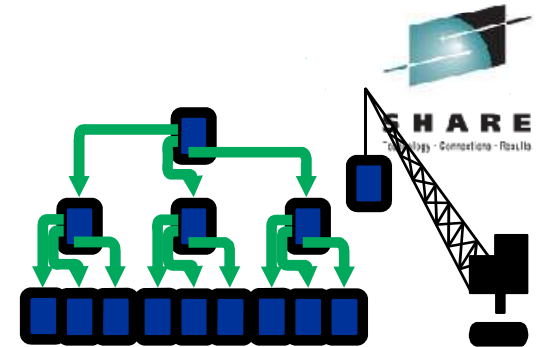
- Add non-key columns

- 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

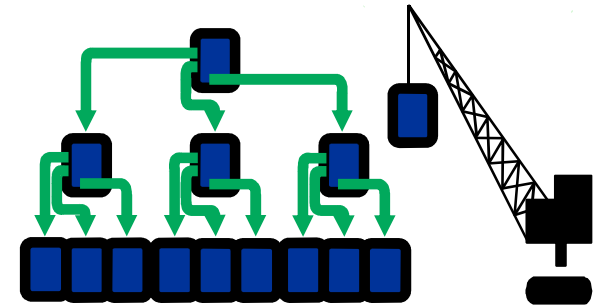
- Rebind to benefit for index-only access



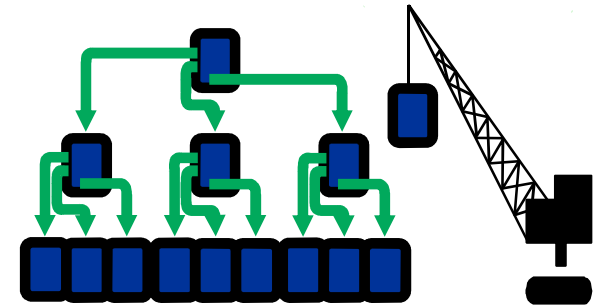
Index Improvements – V10 ...



- Improve 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

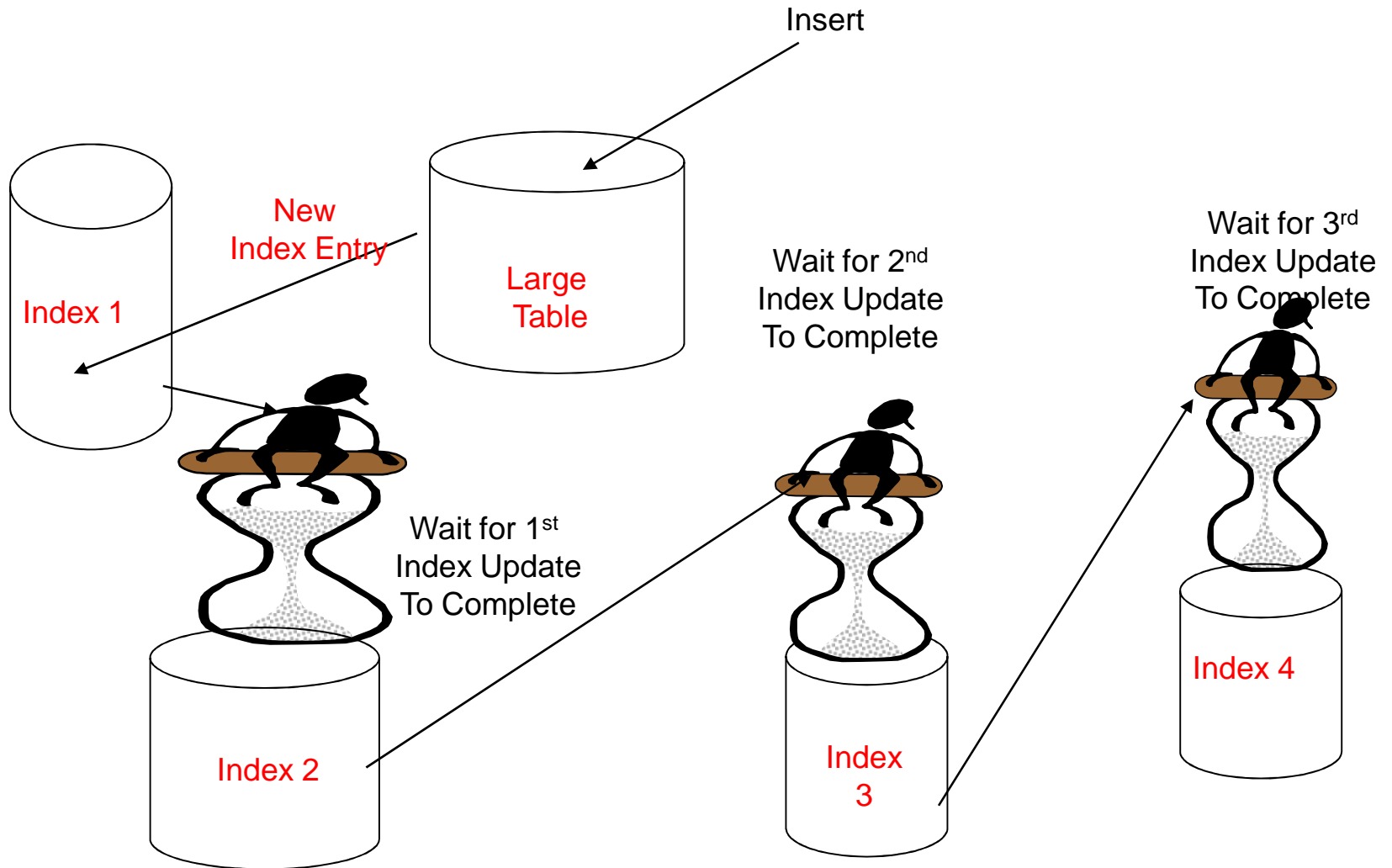


Index Improvements – V10 ...

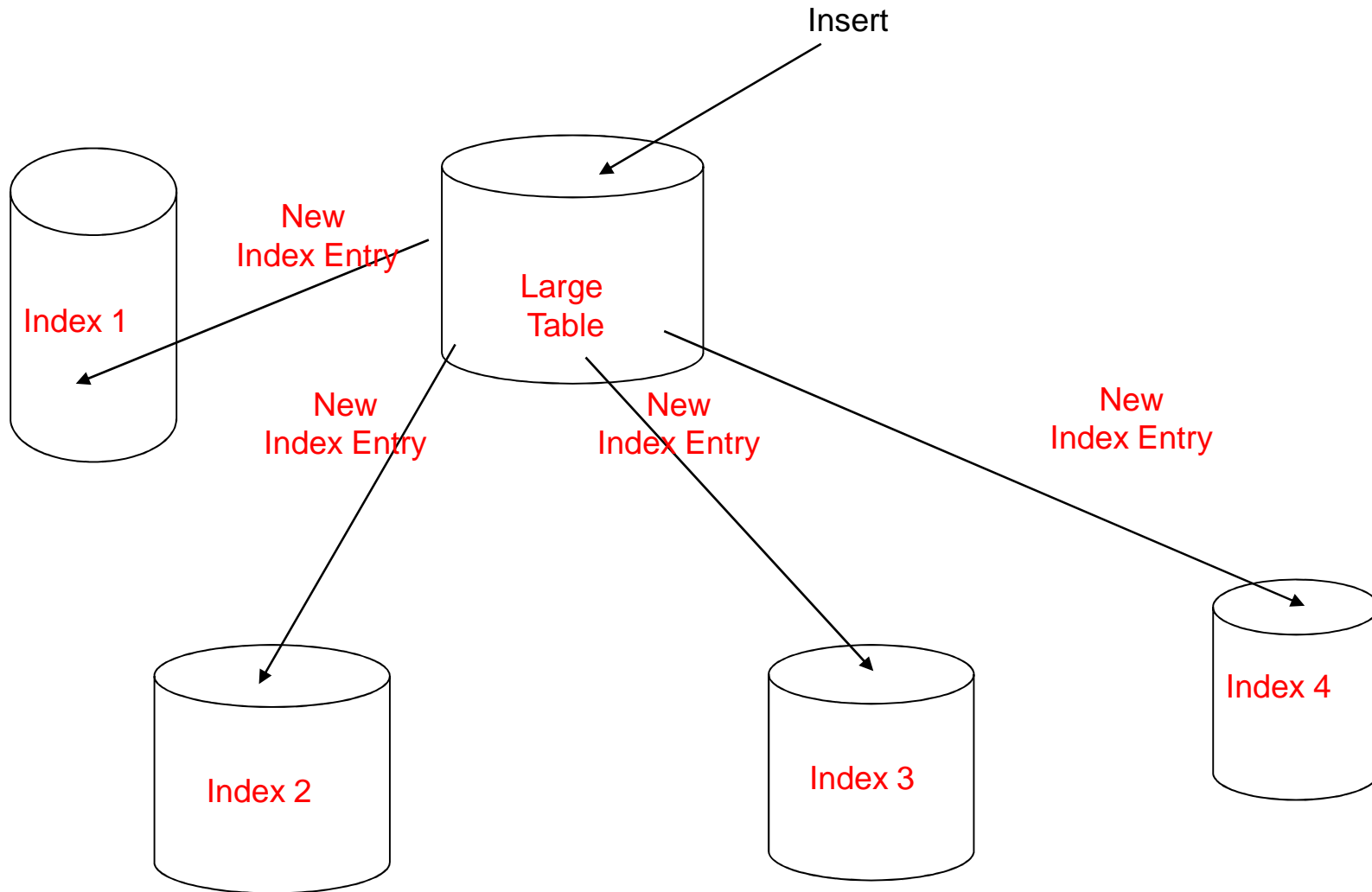


- Improve performance for Referential Integrity and nested loop join
 - Enable index look-aside and sequential detect
- CPU reduction for index access especially with NOT PADDED indexes on VARCHAR
- Remove empty pages from the index tree is no longer limited to the covering space map on delete
- New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

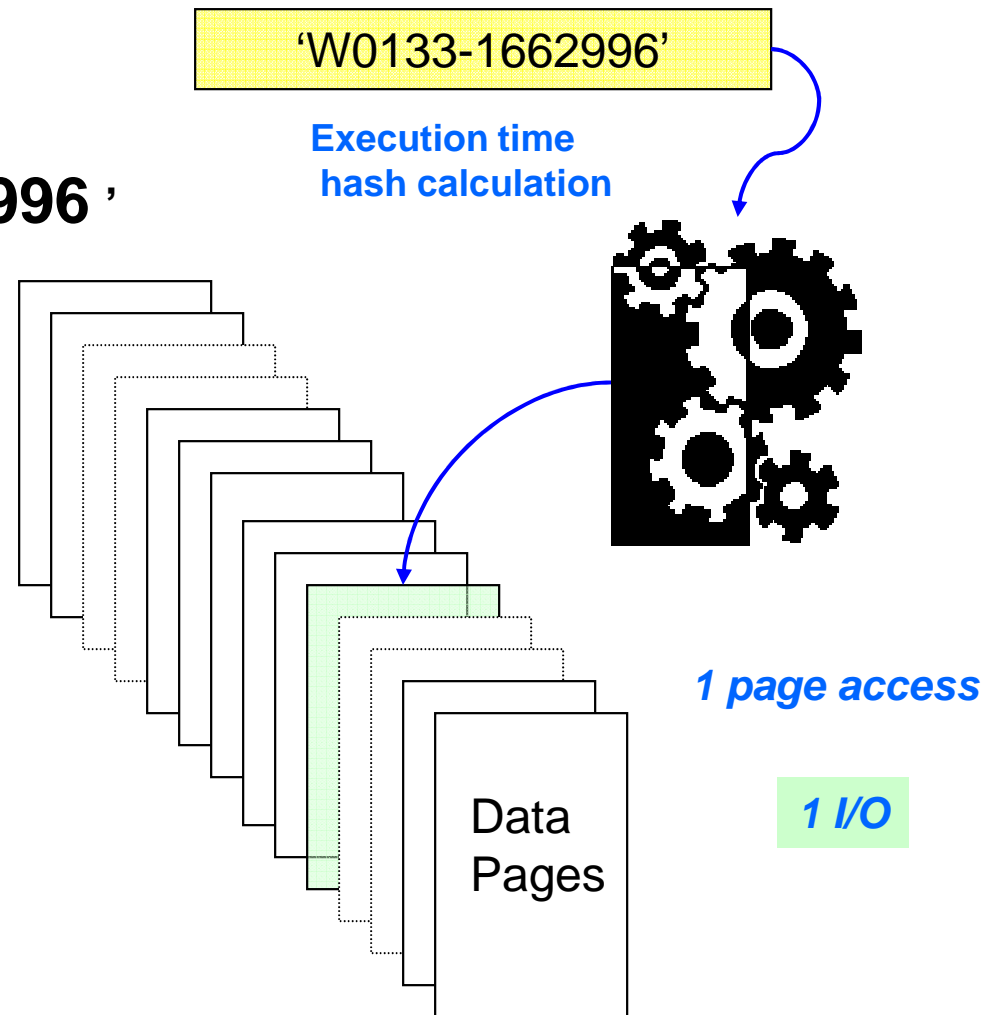
Hashed Table

```
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



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 query **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
- Improved COPY CHANGELIMIT performance
 - Use RTS, instead of scan space map pages

UNLOAD/RUNSTATS Enhancements



- Extend UNLOAD to support
 - Spanned records for LOB, instead of using FRV
 - Support UTF-16 for data, time & timestamp fields
 - Allow a char value for a graphic column in WHEN clause
- RUNSTATS enhancements
 - Sample data
 - Auto stats
- REPORT RECOVERY support for system level backups

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



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