Db2 13 Utilities

IBM Easy Tier Exploitation
Enhanced Space Level Recovery using Part Level Image Copies
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IBM Easy Tier Exploitation

FL 100

Description

– IBM Easy Tier: no-charge feature in the DS8xxx and above system storage
  - Provides a performance enhancement by shifting data placement based upon access frequency
    – Frequently accessed to onto SSDs
    – Infrequently accessed to HDDs
  - Easy Tier dynamically moves datasets to help maximize overall "application" performance across the storage system

Db2 Behavior

– REORG Utility automatically exploits Easy Tier via a utility update applied in the maintenance stream starting in Db2 12 for z/OS
  - No changes are needed by the Db2 user
  - REORG utility automatically leverages Easy Tier for placement of Target/Shadow tablespaces

Benefits:

– Improved REORG performance

– Consistent application performance across REORGs as target inherits source placement

Reference: https:/ www.ibm.com/docs/en/db2-for-zos/12?topic=release-integration-ds8870-easy-tier-multi-temperature-management.

Redpapers:

- IBM DS8000 Easy Tier (Updated for DS8000 Release 9.0) https:/ www.redbooks.ibm.com/abstracts/redp4667.html
- DS8870 Easy Tier Application https:/ www.redbooks.ibm.com/redpapers/pdfs/redp5014.pdf

Enhanced Space Level Recovery using Part-Level ICs

FL 100

Db2 TS Recovery Challenge

– When doing a recovery and using the default DSNUM ALL – for TS, IS and IXs – an error message is issued

  DSNU512**I** (DATASET LEVEL RECOVERY IS REQUIRED)

  - Frequently caused when DSNUM ALL without LISTDEF used when only copies available are partition or piece level
  - Objects with these errors are not recovered and the RECOVER ends with RC8

Changes

– RECOVER supports TS-level recovery for all UTS types even if the ICs were taken *at the part or piece level*, including UTS base tables for:
  - XML
  - Auxiliary indexspaces or indexes over XML UTS
  - LOB tablespaces
  - Auxiliary indexspaces or indexes over LOB tablespaces

– RECOVER to CURRENT or point-in-time maximizes use of part-level ICs and uses other IC datasets where part-levels not available (especially when DSNUM ALL used without a LISTDEF)

– Promotes greater use of part-level in-line copies by REORG and LOAD utilities providing greater efficiency

– New message when recovery is processed at the PART or piece level:
  - *DSNU1576I RECOVERY OF object-type object-qualifier.object-name PROCEEDS AT THE PARTITION OR PIECE LEVEL*

REPAIR WRITELOG for Compression Dictionary support

FL 100

Use Case

- Replication products read Db2 log records for source tables, then replicate the SQL INSERT, UPDATE and DELETE operations to the target tables
  - Log data is retrieved using IFCID 306
  - Compressed data requires the compression dictionary for Db2 to decompress the data
    - The current dictionary is always on the source table
    - The prior old compression dictionary may be needed by Db2 under certain circumstances to decompress data
      - » IBM Utilities (REORG/LOAD) write the old dictionary to the Db2 log (e.g. when new dictionary is built)\
      - » ISV utilities have been unable to record the OLD decompression dictionary to the Db2 log.
    - ISV Utilities could cause replication products to fail and/or force an automatic refresh of the target object.

Enhancement

REPAIR WRITELOG has New values for TYPE and SUBTYPE

- ISV products can now write old decompression dictionary log record, up to the maximum log record size supported by Db2
- REPAIR utility returns message DSNU3335I noting location of log record with old decompression dictionary
- ISV utility can then insert a record into SYSIBM.SYSCOPY noting the log record location

Enables replication products to avoid errors for log records that require the old decompression dictionary when using ISV Utilities.

REORG INDEX NOSYSUT1 – New Default

FL 500

Use Case

- The REORG utility can improve performance by eliminating the work data set by processing the index keys in memory
  - REORG will benefit when the utility leverages subtask parallelism to unload and build the index keys concurrently
  - Introduced in Db2 12 by:
    - New NOSYSUT1 syntax keyword for REORG INDEX
    - Updating the REORG_INDEX_NOSYSUT1 subsystem parameter which is online changeable
    - "PARALLEL num-subtasks" can specify degree of parallelism; however, not required as REORG INDEX determines optimal degree based on runtime resource calculation

Recommended V12 Setting: YES

Changes

- The NOSYSUT1 will always be used in Db2 13 for REORG INDEX types:
  - REORG INDEX SHRLEVEL REFERENCE
  - REORG INDEX SHRLEVEL CHANGE
- At FL500, the only setting for subsystem parameter REORG_INDEX_NOSYSUT1 is YES
- Benefit is automatic once FL500 reached – no changes to REORG utility jobs required

REORG INDEX NOSYSUT1 – New Default

FL 500

REORG INDEX syntax diagram changes

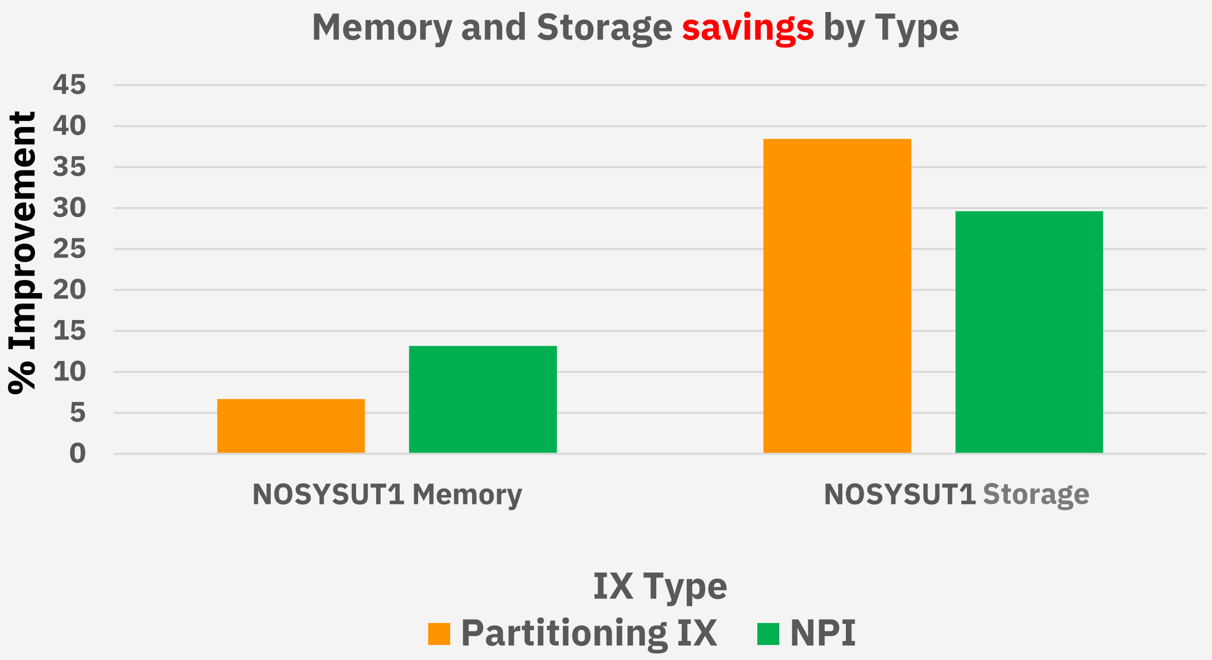
```
>--REORG INDEX----…

   |--NOSYSUT1--|
>--|------------|-----|-------------------------|---
                      |--PARALLEL num-subtasks--|
```

Multi-task and parallel information

- NOSYSUT1 will enable parallel subtasks to unload and to build the index keys in its internal processing.
- The index keys can be processed concurrently by parallel subtasks, as well as operate on different physical partitions of the target partitioned index (PI or DPSI)
- The optimal degree of parallelism based on available system resources at run time, with at least one index unload task and one index build task

- The NOSYSUT1 option is ignored if SHRLEVEL NONE is specified
- For SHRLEVEL REFERENCE or CHANGE execution, NOSYSUT1 option is always enforced.
- Should an error occur during index keys unload or build, the user needs to perform a phase-restart of the utility from the beginning of the UNLOAD phase.
  - This is only for SHRLEVEL REFERENCE since SHRLEVEL CHANGE is not re-startable until the SWITCH phase

REORG INDEX NOSYSUT1 – New Default



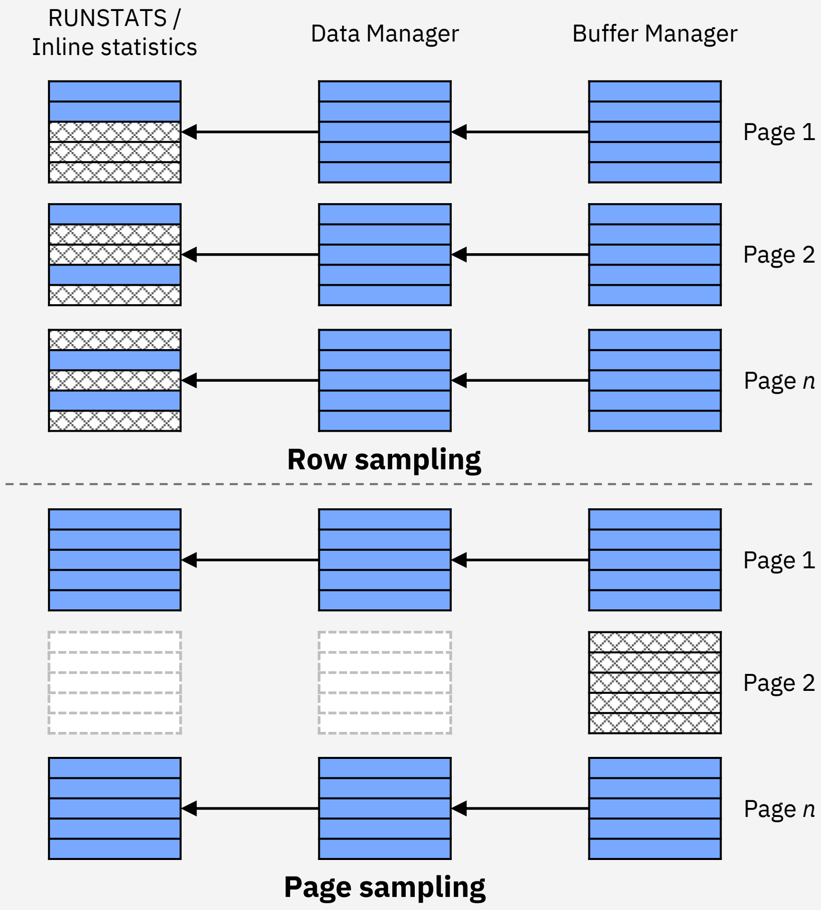
With this new enhancement performance measurements show significant improvements:

- Reductions in Memory Requirements
- Significant reductions in storage requirements
- Partitioned indexes show up to an 86% improvement in elapsed time, and CPU reduction can be even higher
- Tasks are now zIIP eligible providing reductions in non-zIIP CPU of between 50-95%

Page Sampling support for Inline Statistics

FL 500

- Db2 10 introduced page sampling for RUNSTATS to reduce CPU consumption and elapsed time
- Since Db2 12, page sampling is the default for RUNSTATS
- Db2 13 now supports page sampling for inline statistics collected by LOAD REPLACE and REORG TABLESPACE
- New keyword **TABLESAMPLE SYSTEM** added to LOAD REPLACE and REORG TABLESPACE syntax
  - AUTO: let Db2 determine the sampling rate
  - *Numeric value*: user-defined sampling rate (0 < *n* ≤ 100)
  - NONE: do not use page sampling, instead use the value specified by the SAMPLE keyword
- ZPARM STATPGSAMP introduced in V12R1M505, that sets the system-wide default for page sampling, is extended to inline statistics for V13



Utilities History Table – overview

FL 501

Motivation

- Running, monitoring and optimizing utility executions is an important part in the daily management of Db2
- Db2 does not provide an easy way to obtain utility execution history and statistics in real time
- It is required to retrieve and scan the utility job outputs to get the relevant information
- Users should be able to easily retrieve utility execution history and statistics without any additional tooling or processing

Solution

- New catalog table **SYSIBM.SYSUTILITIES**
- New ZPARM **UTILITY_HISTORY NONE | UTILITY** to control history collection for each data sharing group member
- New column **EVENTID** in SYSIBM.SYSCOPY
- Uses IFCID 25 trace record statistics (elapsed, CPU, zIIP, sort CPU, sort zIIP times)
- Multi-step implementation
  - Today: collection of utility-level information
  - Future: collection of object-level and utility phase-level information

Utilities History Table – normal flow

FL 501

```
/ DB2COPY JOB DB2ADM …
/ STEP1 EXEC DSNUPROC,UID='COPYTS' …
/ SYSIN DD *
LISTDEF COPYLIST
         INCLUDE TABLESPACE DSN8D13A.DSN8S13E
         INCLUDE TABLESPACE DSN8D13A.DSN8S13D
COPY LIST COPYLIST …
```

1 When the utility driver begins execution, a row is INSERTed

EVENTID	NAME	JOBNAME	UTILID	USERID	STARTTS	STARTLOGPOINT	CONDITION
1001	COPY	DB2COPY	COPYTS	DB2ADM	2022-04-05 13:26	…001F8C16A04…	*blank*

2 After utility-in-progress states are set, the row is UPDATEd

EVENTID	NUMOBJECTS	LISTNAME
1001	2	COPYLIST

3 When the utility terminates, the row is finally UPDATEd

EVENTID	ENDTS	ELAPSED TIME	CPU TIME	ZIIP TIME	SORT CPUTIME	SORT ZIIPTIME	RETURNCODE	CONDITION
1001	2022-04-05 13:28	418295	22910	0	0	0	0	E

Remark: The table columns and data is simplified for display purpose.

Utilities History Table – special cases

FL 501

When a utility ABENDs, the row is **not** updated. The utility is in a stopped state.

EVENTID	ENDTS	RETURNCODE	CONDITION
1002	NULL	NULL	*blank*

Issue –DIS UTIL command to determine if active or stopped

When a utility is RESTARTed, the corresponding row is UPDATEd like this:

EVENTID	RESTART	JOBNAME	USERID	GROUP_MEMBER
1002	Y	blank		DSNB

When a utility completes after RESTART, the row is finally UPDATEd like this:

EVENTID	ENDTS	ELAPSEDTIME	CPUTIME	ZIIPTIME	RETURNCODE	CONDITION
1002	2022-04-05 13:28	418295	22910	0	0 | 4 | 8	E

When a –TERM UTIL or STA DB(…) SP(…) ACCESS(FORCE) command terminates a *stopped utility*, the corresponding row is updated like this:

EVENTID	ENDTS	ELAPSEDTIME	RETURNCODE	CONDITION
1002	2022-04-05 13:28	418295	NULL	T | F

ELAPSEDTIME includes the time the utility was in stopped state

When a –TERM UTIL command is issued on an *active utility*, the corresponding row is updated like this:

EVENTID	ENDTS	ELAPSEDTIME	RETURNCODE	CONDITION
1002	2022-04-05 13:28	418295	8	T

Utilities History Table – operational aspects

FL 501

- New messages are added to the utility job output
  - **DSNU3031I** UTILITY HISTORY COLLECTION IS ACTIVE. LEVEL: UTILITY, EVENTID: *event-id-number*
  - **DSNU3032I** ERROR DURING UTILITY HISTORY COLLECTION, RETURN CODE X'*return-code'* REASON CODE X'*reason-code'*
- SQL INSERT, UPDATE and DELETE are allowed on SYSIBM.SYSUTILITIES table, e.g. for cleanup processing (example in Db2 13 and More Redbook) or tools integration
- It is recommended to use ISO(UR) when querying SYSIBM.SYSUTILITIES to avoid contention
- Users can define indexes on the table as needed to optimize query performance
- Utility history information is not collected for utilities executed on SYSIBM.SYSUTILITIES table, its index and tablespace, for RECOVER or REBUILD INDEX on catalog and directory objects, for objects in a restrictive state and when executing in preview mode

Utilities History Table – Sample queries

FL 501

- *“Show all utilities that started/stopped between midnight and 6am”*
- *“Show all utilities that ended with one or more errors (RC >=8) in the last 24 hours”*
- *“Show the top 10 CPU-consuming utility executions in the last 7 days”*
- *“Show restarted utilities in active or stopped state”*
- *“Show the most recent successful execution of REORG TABLESPACE for a specific table space or REORG INDEX for a specific index space”* (joining data in SYSUTILITIES and SYSCOPY using the EVENTID column)
- SQL and more sample queries are available in the Db2 13 for z/OS and More Redbook (SG24-8527-00)