DB2 for z/OS – Ultimate Database for Cloud, Analytics and Mobile
Industry-leading performance, security, scale and reliability

DB2 for z/OS Utilities V11 Overview
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Agenda

• Strategy
• REORG
• Statistics
• Backup & Recovery
• UNLOAD & LOAD
• Compression Dictionaries
• General Enhancements
• Deprecation
• Post GA enhancements (2014-2016)
• Summary
Strategy

- Support core function
- Reduce CPU, ET & resource consumption
- Maximize availability
- Remove constraints & limitations
- Simplify data management
Z13 Synergy

- Improved utility performance due to hardware exploitation
- 20-24% REORG performance improvement compared to z196
SWITCH phase availability – reduced application impact

- Easier drain acquisition
- Prevent new claims on all target partitions whilst waiting for drains
  - Faster drain acquisition for part-level REORG
- New DRAIN_ALLPARTS option to momentarily drain all data parts
  - Eliminates claim-drain “deadlocks” for part-level REORG with NPSIs
- Restructure SWITCH phase processing for outage reduction
  - SWITCH phase ET reduction of 91% measured when reorging 20 parts
Timing of SWITCH phase with MAXRO DEFER

- Govern timing of drain and switch for long-running REORGs without the need to schedule separate –ALTER UTILITY command
- New SWITCHTIME parameter to determine earliest point at which drain processing will be attempted

```
<table>
<thead>
<tr>
<th>SWITCHTIME=None</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>SWITCHTIME</td>
<td>timestamp</td>
</tr>
<tr>
<td></td>
<td>NEWMAXRO=integer</td>
</tr>
</tbody>
</table>
```
Physically delete empty PBG partitions

- Ability for REORG to physically delete empty PBG partitions
- New zparm REORG.Drop_PBG_PARTS
  - DISABLE – keep V10 behaviour (default)
  - ENABLE – Delete empty PBG partitions on table space-level REORG
- Considerations:
  - Cannot be specified on REORG statement
  - If PBG created using NUMPARTS or ALTER ADD partition used, REORG may prune to a lesser number of partitions
  - No PIT recovery to prior to a pruning REORG
    - No facility to resurrect deleted partitions
Automated mapping table handling

- Support mapping tables in PBG
  - Increases mapping index limit from 64Gb to 16Tb
  - Retrofitted to V9 in PM58177
- Mapping table DDL must change in 11 due to RBA/LRSN change
- Requirements to automate mapping tables
- So… New automated mapping tables in REORG
  - Automatically create new format mapping table if required
    - If mapping table specified & correct format then honour specification
    - Else if specified but incorrect format then create new in same db as original
    - Else if not specified and zparm DB specified then create in zparm DB
    - Else create in implicitly created DB
    - DROP at end of REORG or end of last REORG if multiple REORGs in job step
  - NFM requires new format mapping table, CM supports both old and new
  - No additional auth requirements necessary for creation of mapping tables
REORG without sorting data

- Increasingly REORGs are performed for reasons other than to regain clustering of data, yet no ability to avoid cost of reclustering
- Prior to DB2 11, REORG SHRLEVEL CHANGE did not support SORTDATA NO
- DB2 11 supports SORTDATA NO RECLUSTER NO SHRLEVEL CHANGE
- New RECLUSTER YES/NO option on SORTDATA NO
  - RECLUSTER NO – Do not unload data through clustering index and do not sort data records in clustering order
Partition-level inline image copy

- Faster partition-level recovery from inline image copy
- Create partition-level inline image copies if using TEMPLATE with &PA or &PART
  - No new option or keyword on REORG
  - PM93611:
    - Support substring notation with &PA as long as substring ensures uniqueness
    - Support writing to tape as long as STACK YES not specified, TAPEUNITS

$\text{RECOVER of single partition of a 20 partition table space}$
  - ET reduced by 28%
  - CPU reduced by 49%
Improved REORG LISTDEF processing

• PARALLEL YES/NO option introduced in APAR in V9
  – NO – Prevent REORG from processing multiple partitions in single REORG when input is partlevel LISTDEF
  – Zparm REORG_LIST_PROCESSING at zparm level
• Need compromise option for customers who want to take advantage of REORG parallelism but cannot afford to shadow many partitions at a time
• New option LISTPARTS n to limit # of partitions to be processed in a single REORG if input is a part-level LISTDEF
• In DB2 11, PARALLEL YES/NO is superseded by LISTPARTS
  – PARALLEL YES/NO IS deprecated but still supported in 11
REBALANCE enhancements

• Improved availability & failure prevention
• Support REORG SHRLEVEL CHANGE REBALANCE
  – Complements online ALTER of partition limit keys
• Improve resiliency with enhanced distribution algorithm & improved handling of empty partitions
• Build compression dictionary for all partitions
  – Previously, partitions that were empty at the start of REORG would not have a dictionary built, requiring a subsequent REORG to gain compression
• New SORTCLUSTER option to sort data in clustering as well as partitioning order to avoid AREO*
  – Occurred when partitioning key not a superset of clustering key
  – SORTCLUSTER YES – sort in partitioning and clustering order, avoid AREO*
  – No specification – keep existing behaviour, set AREO*
  – SORTCLUSTER NO – keep existing behaviour, but do not set AREO*
REORG of LOB data

- Support REORG of LOB data even though aux index is unavailable
  - Problem in V10 if LOB tablespace is REORP and index is RBDP
    - LOBs can’t be reorged and index can’t be rebuilt
- REORG SHRLEVEL NONE for LOBs changed to RC8 from 11 CM onwards
  - Not supported in 10 NFM, but returns RC0 with MSGDSNU126I
Improved REORG serviceability

- Need ability to use online REORG even when SYSLGRNX cannot be relied upon
- Support LOGRANGES NO option for REORG SHRLEVEL CHANGE
REORG defaults to match best practices

• Change default options:
  – DRAIN WRITERS to DRAIN ALL
  – DISCARD to DISCARD NOPAD YES
  – UNLOAD EXTERNAL to UNLOAD EXTERNAL NOPAD YES
Statistics Enhancements

- More zIIP offload for RUNSTATS distribution statistics
  - Up to 80% zIIP-eligible
- zIIP offload for inline statistics
  - Additional 30% offload to zIIP
- Enhance inline statistics for RUNSTATS avoidance
  - Inline statistics collection on NPSIs during REORG with SORTNPSI
  - Inline histogram statistics
  - Inline DSTATS
- New RUNSTATS RESET option to reset existing statistics
- Improved PROFILE usability for LISTDEF processing
  - Gather default statistics if no profile exists for table
Statistics Enhancements

• Optimizer determination of missing statistics
  – Optimizer identifies missing statistics & writes information to new catalog table DSN_STAT_FEEDBACK
  – OQWT modifies statistics profile
  – Automation Tool detects profile change & builds RUNSTATS job
  – DSNACCOX similarly enhanced to recommend RUNSTATS
• -ACCESS DATABASE … MODE(STATS) option to externalize RTS statistics
• RTS overhead reduction
Backup & Recovery Enhancements

• Faster catalog/directory recovery
  – Enhanced SYSLGRNX recording
• New VCAT name translation for RESTORE SYSTEM for system cloning
  – Support logapply when RESTORE SYSTEM used for cloning purposes
• Improved recoverability with COPY-REORG concurrency
  – Permit COPY to run concurrent with long-running REORGs
• Avoid allocating empty image copy datasets for incremental or CHANGELIMIT copies
Backup & Recovery Enhancements

- Lifted many restrictions on point-in-time recovery prior to materializing REORG
  - PIT recovery restrictions lifted for
    - LOB table spaces
    - XML table spaces
    - PBR table spaces
    - Including when immediate alters have occurred since materializing REORG
  - PIT recovery restrictions still in place
    - Table space conversion
    - PBG table spaces
    - PBG partition pruning
    - Online DROP COLUMN
- Faster index recovery with FLA support for index log records
  - APAR PI07694 for V9 and above
LOAD & UNLOAD Enhancements

- Crossloader support for XML data
- Exploit FETCH CONTINUE for processing large LOBs & XML data in Crossloader
  - Reduce vstor requirement
  - Avoid DSNU1178i errors
  - 28% CPU reduction
    - Load of 1Mb LOBs
- zIIP offload for LOAD REPLACE PART clearing of NPSIs
  - 100% offload to zIIP for LOAD REPLACE with dummy input
LOAD & UNLOAD Enhancements

- LOAD SHRLEVEL NONE PARALLEL with single input dataset
  - Parallel data conversion
  - Not supported for PBGs
  - 50% ET reduction possible on single SYSREC load
LOAD & UNLOAD Enhancements

- LOAD SHRLEVEL CHANGE PARALLEL
  - Supports non-partitioned as well as partitioned
  - Single input dataset
  - Supported for PBRs or PBGs
  - >80% ET reduction

Input
SYSREC
Read task
Conversion 1
Conversion 2
Conversion 3
Conversion 4
Part 1
Part 2
Compression Dictionaries

• Avoid decompression failures for IFI 306 readers when new compression dictionary built by REORG/LOAD
• Old compression dictionary stored on log
• New SYSCOPY record written pointing to old compression dictionary for CDC tables
• IFI 306 read automatically retrieves old compression dictionary if necessary
• Avoid need for replication target refresh when dictionary changes
• New APAR PI54885 to avoid repeated tape mounts when compression dictionary archive log dataset on tape
General Enhancements

- Greater parallelism for faster utilities
  - 11% elapsed time reduction measured for REORG, LOAD, REBUILD INDEX
- PARALLEL option for parallelism control for LOAD, REORG, REBUILD INDEX, UNLOAD, CHECK INDEX
- DISPLAY UTILITY enhancements
  - Remove serialization between -DIS UTIL and -TERM UTIL
  - Jobname, start timestamp
  - Late addition: SWITCHTIME and NEWMAXRO
- Utility impact reduction on bufferpools
  - Extend MRU for UNLOAD, REORG TABLESPACE, RUNSTATS TABLESPACE, RUNSTATS INDEX, REBUILD INDEX, CHECK INDEX, CHECK DATA
- Improved dataset cleanup in utility stored procedures
  - Previously, datasets remained allocated on utility failure, preventing cleanup
General Enhancements

- Improved TEMPLATE support for large / EF datasets and local time values
  - DSNTYPE LARGE, EXTREQ, EXTPREF
  - New EATTR option on TEMPLATE to request extended attributes
  - New TIME LOCAL|UTC option
- Enforce NUMTCB=1 for stored procedures
- DSNACCOX performance
Deprecation

- REORG SHRLEVEL NONE for LOBs changed to RC8 from 11 CM onwards
  - Not supported in 10 NFM, but returns RC0 with MSGDSNU126I
- Still supported in 11, but no longer documented:
  - REORG
    - PARALLEL YES|NO
      - Superseded by LISTPARTS
    - INDREFLIMIT
    - OFFPOSLIMIT
    - LEAFDISTLIMIT
    - UNLOAD ONLY
    - UNLOAD PAUSE
    - UNLOAD EXTERNAL
  - COPY
    - CHANGELIMIT
V11 Post GA (Oct 2013) Significant News
DB2 Sort provides high speed utility sort processing for data stored in DB2 for z/OS. It improves sort performance while optimizing overall system efficiency by exploiting the advanced facilities of the z/OS operating system and System z to provide the highest level of ROI.

DB2 Sort leverages the strengths of the System z platform, DB2 for z/OS and the DB2 Utilities Suite to drive:

- Significant savings in elapsed time and CPU during utility sort processing, especially LOAD, REBUILD INDEX and REORG
- Relief from application constraints of large volumes of data in highly-transactional workloads performing numerous insert, update and delete operations against DB2 for z/OS databases
- Efficient use of resources with dynamic adjustment of resources to avoid over-allocation while helping to maintaining optimal performance for all tasks
- Improved sort processing for other IBM products such as DB2 Utilities Enhancement Tool, DB2 High Performance Unload, DB2 Recovery Expert, DB2 Log Analysis Tool and DB2 Change Accumulation Tool
DB2 Sort 2.1 Performance Benefits

- Use of DB2 Sort 2.1 with DB2 utilities, as compared with running DB2 utilities alone, may see:
  * Reduction of Sort CPU usage
    - Up to 84.8% reduction on machines with zIIP engines
    - Up to 49.1% reduction on machines without zIIP engines
  * Reduction of Utility CPU usage
    - Up to 60.6% reduction on machines with zIIP engines
    - Up to 39.7% reduction on machines without zIIP engines
  * Reduction of Utility Elapsed Time
    - Up to 44.6% reduction on machines with zIIP engines
    - Up to 46% reduction on machines without zIIP engines

* The information contained on this slide is distributed AS IS. Performance data and results presented were determined in various controlled laboratory environments, using specific, limited test configurations, and are for reference purposes only. Tests were run against the most current versions of DB2 Sort and DB2 Utilities Suite generally available as of October 24th, 2014. Results reported for machines with zIIP engines reflect a situation where all DB2 Sort program zIIP eligible instructions are successfully dispatched to execute on available zIIP processor(s). The results that may be obtained in other operating and production environments may vary significantly. Users of the product should verify the applicable results they might achieve for their specific environment.
Post GA Apars - 2014

- Fast log apply for faster index recovery
  - PI07694 (V10 Jan 14)
- Retrofit REORG SWITCH phase performance
  - PI09303 (V10 Apr 14)
- REORG REBALANCE SHRLEVEL CHANGE
  - PI11839 (V10 Jun 14)
- LOB REORG performance
  - PI17945 (V10 Jul 14)
Post GA Apars - 2015

- TEMPLATE LOCALTIME option
  - PI29707 (V10 Feb 15)

- REORG LOG phase performance improvement
  - PI32491 (V11 Feb 15)

- Easy-tier storage support in REORG
  - PI35321 (V10 Apr 15)
  - OA46482 required for DFSMS support
  - REORG shadows inherit temperature of original page sets

- Prevent lock escalation on DB2 catalog tables
  - RUNSTATS (PI29519 V10 Feb 10/15)
  - RECOVER (PI30747 V10 Feb 10/15)
  - REORG (PI32588 V10 Mar 15)
  - QUIESCE, COPYTOCOPY, REPORT RECOVERY (PI38443 V10 Jun 15)
Post GA Apars - 2015

• LOAD RESUME BACKOUT YES option
  – Avoid leaving table in RECP on load failure
  – PI08421 (V10 Jul 15)

• LOAD utility IGNORE WHEN option
  – Ignore records that do not satisfy WHEN clause instead of treating them like discarded records
  – PI44415 & PI44675 (V11 Aug 15)

• Reduce index page p-locking in Data Sharing
  – RUNSTATS/REORG – PI46320 (V10 Oct 15)

• LOAD SHRLEVEL CHANGE PARALLEL for PBG page sets
  – PI44674 (V11 Oct 15)
Post GA Apars - 2016

- Parallel PREFORMAT partitions REORG performance
  - PI50747 (V10 Jan 16)
- Avoid repeated tape mount to retrieve compression dictionary for IFI306 reads
  - PI54885 (V11 Feb 16)
- LOAD RESUME BACKOUT YES support with DISCARDS
  - Only back out if DISCARDS limit is hit rather than on first discarded record
  - PI54658 (V10 Aug 16)
- LOAD with CONSTANT field specification
  - PI62566 (V11 Aug 16)
Summary

- Unparalleled investment in utilities
- IBM Utilities Suite is essential for exploitation of major DB2 enhancements
- Support of core DB2 function from day 1 of GA
- Expect continued delivery of enhancements on release boundary, and in maintenance stream when prudent
- Continued focus on:
  - Elimination of application impact from utilities
  - Elapsed time & CPU consumption reduction
  - Resource consumption reduction
  - Reduction in complexity & automation improvements
  - Solutions through DB2, Utilities & Tools
Thank You