The future runs on System z

DB2 utilities: Maximize performance and minimize resource consumption
Agenda

- Availability
- Performance
- Features & function
- Summary
Availability

- Ensure utilities are non-disruptive
- Introduction of shadow page set technology
- Introduction of claim & drain processing
- Exploitation of ISO(UR) processing
- SHRLEVEL NONE
- SHRLEVEL REFERENCE
- SHRLEVEL CHANGE
Availability – what has changed recently?

- **Online create or rebuild of non-unique indexes**
  - REBUILD INDEX SHRLEVEL CHANGE

- **Eliminate outage for partition-level REORGs**
  - Eliminate BUILD2 phase
  - New restriction on concurrent part level REORGs

- **REORG avoidance for data compression**
  - LOAD COPYDICTIONARY
  - PK63324 & PK63325 (V9)

- **Online data consistency checking and repair**
  - CHECK DATA SHRLEVEL CHANGE
  - CHECK LOB SHRLEVEL CHANGE
  - REPAIR LOCATE… SHRLEVEL CHANGE
Availability – what has changed recently?

- Run data consistency checks without impacting BACKUP SYSTEM or disk mirroring
  - PK41711 (V9)

- Avoid CHKP after PIT recovery of RI set in V9
  - PK80304 (V9)
Availability – what has changed recently?

- Replace data with virtually no outage
  - CLONEs effectively provide LOAD REPLACE SHRLEVEL CHANGE
  - UTS only

- Read LOB data during REORG
  - REORG SHRLEVEL REFERENCE for LOBs

- RECOVER to point in time with consistency
  - Avoid need for QUIESCEs
Performance

- **Elapsed time**
  - DB2 enhancements
  - z/OS & architecture improvements
  - Parallelism

- **CPU cost**
  - DB2 enhancements
  - z/OS & architecture improvements
  - zIIP
Performance – what has changed recently?

- **Faster REORGs**
  - Parallel unload of partitions
  - Parallel reload of partitions
  - Parallel log apply
    - Greater likelihood of REORG keeping up with logging rates
- **Faster CHECK INDEX SHRLEVEL REFERENCE**
  - Parallel index processing
- **Up to 40% faster COPY & RECOVER RESTORE phase to/from tape**
  - Support Large Block Interface for image copies to tape
- **Reduced impact on applications when running COPY**
  - COPY uses MRU for buffers to improve BP hit ratio for online applications
- **Reduced impact on applications when running LOAD & REORG**
  - Auto-invalidate of cached dynamic statements on completion of LOAD & REORG
  - PK47083 (V8 & V9)
Performance – what has changed recently?

- **Greater utility parallelism with SORTNUM elimination**
  - PK45916 (V8), PK41899 (V9)
  - Major improvement in utility sort processing
  - Simpler, more efficient, more reliant on RTS

- **SORTBLD performance improvement**
  - PK60956 (V8 & V9)
  - Up to 20X performance improvement in SORTBLD for indexes with small SECQTY

- **LOAD & REORG performance improvement**
  - PK61759 (V8 & V9)
  - 10% CPU & elapsed time improvement in RELOAD phase
  - 10% CPU reduction in SORT phase

- **COPY performance improvement**
  - PK74993 (V9)
  - 20% elapsed time improvement for copy of multiple small datasets to tape
Performance – what has changed recently?

- **Crossloader performance improvement for CCSID data conversion**
  - PK76860 (V8 & V9)

- **LOAD/UNLOAD LOB file reference variable performance**
  - PK75216 (V9)
  - PDS only, not HFS
  - 56% ET reduction on UNLOAD, 93% ET reduction on LOAD

- **UNLOAD performance for multi-table table spaces**
  - UTILINIT phase – use DBD rather than catalog lookup
  - PK77313 (V8 & V9)
  - In one case 1.5 hours -> 11 secs

- **COPY performance with large LISTDEF lists**
  - PK78865 (V8 & V9)
  - Reduce writes to SYSUTILX
Performance – what has changed recently?

- **REORG PART of empty partition performance**
  - Avoid NPI scan
  - PK67154 (V8 & V9)
  - Sample SORTBLD phase: 98% CPU reduction, 70% ET reduction

- **COPY of partitioned tablespace with many parts**
  - PK81232 (V9)
  - Correct CPU regression in V9 - up to 80% CPU reduction

- **COPY SHRLEVEL CHANGE performance improvement for LOBs**
  - PK83096 (V9)

- **LOAD and UNLOAD to/from virtual file**
  - USS named pipe support with templates
  - PK70269 (V8 & V9)
Performance – what has changed recently?

- **DSN1COPY performance**
  - Improved VSAM buffer allocation for page sets with cylinder allocation
  - Up to 20% ET improvement
  - PK78516 (V8 & V9)

- **RUNSTATS histogram statistics**
  - Improved query optimization for non-uniform distribution
  - Example - 1, 3, 3, 4, 4, 6, 7, 8, 9, 10, 12, 15 (sequenced), cut into 3 quantiles

<table>
<thead>
<tr>
<th>Seq No</th>
<th>Low Value</th>
<th>High Value</th>
<th>Cardinality</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>5/12</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>9</td>
<td>4</td>
<td>4/12</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>15</td>
<td>3</td>
<td>3/12</td>
</tr>
</tbody>
</table>
Performance – what has changed recently?

- **CPU cost reduction in V9**
  - 10-20% for COPY & RECOVER
  - 5-30% for LOAD, REORG, REBUILD INDEX
  - 20-60% for CHECK INDEX
  - 35% for LOAD partition
  - 30-40% for RUNSTATS INDEX
  - 40-50% for REORG INDEX
  - 70% for LOAD REPLACE partition with dummy input

- **zIIP enablement for utility index processing in V8**
Performance – what has changed recently?

- In spite of CPU reduction in V9, there is continued focus on CPU consumption for utilities
- Sort can consume ~60% of total utility CPU time
- DB2 in concert with DFSORT will provide zIIP offload of DB2 utility memory-object fixed-length record sort processing
- Requirements:
  - DB2 APAR PK85889 (V8 or V9)
  - DFSORT APAR PK85856
  - z/OS 1.10
- PTFs can be applied independently of each other
- Exploitation is automatic
Features & function

- More powerful utilities for greater flexibility…
- … yet simpler utilities for reduced complexity
- New utilities & more options
  - COPYTOCOPY
  - BACKUP SYSTEM & RESTORE SYSTEM
  - LISTDEF
  - TEMPLATE
  - File Reference Variables
  - …
- Intelligent defaults
- Autonomics
- Synergy with Information Management Tools
Features & function – what has changed recently?

- **BACKUP SYSTEM & RESTORE SYSTEM enhancements**
  - Support for tape
  - Support for incremental FlashCopy

- **Object-level recovery from system-level backup**

- **RECOVER to any point in time with consistency**

- **SORTNUM elimination**
  - Simplified utility invocation

- **Remove restriction on REORG of >254 compressed parts**
  - ZPARM restricts LOAD in V9 – restriction removed in X

- **Better information for DPROPR/QRep or other IFI 306 readers**
  - Write diag log record at utility termination so IFCID 306 readers can trigger refresh
  - PK78558 (V9)
Features & function – what has changed recently?

- **MODIFY RECOVERY** simplification & safety

- **Template switching for COPY utility**
  - E.g. copy to disk if small, to tape if large

```
TEMPLATE LRG DSN &DB..&TS..D&DA..T&TI. UNIT=TAPE
TEMPLATE SML DSN &DB..&TS..D&DA..T&TI. UNIT=SYSALLDA LIMIT(20 CYL, LRG)
COPY TABLESPACE SMALL.TS COPYDDN(SML)
COPY TABLESPACE LARGE.TS COPYDDN(SML)
```
Features & function – what has changed recently?

- Permit use of ALIASes for LOAD, RUNSTATS and UNLOAD
  - PK77061 (V9)

- New DSNACCOX stored procedure to gather statistics from catalog and make utility recommendations
  - See PK44133
  - DSNACCOR still supported

- More information
  - All utility messages in job output have julian date & timestamp
  - -DISPLAY UTILITY enhanced to show progress of logapply

```
DSNU116I csect-name RECOVER LOGAPPLY PHASE DETAILS:
  STARTING TIME = timestamp
  START RBA = ss START LRSN = rr
  END RBA = ee END LRSN = nn
  LAST COMMITTED RBA = cc LAST COMMITTED LRSN = ll
  ELAPSED TIME = hh:mm:ss
```
What’s coming?

- Remove usability restrictions for REORG
  - LOBs
  - PBG
  - Catalog/directory SHRLEVEL CHANGE REORG
  - Rebalance of partitioned page sets with LOB columns
  - Disparate parts

- **REORG avoidance**

- Remove UTSERIAL lock for greater utility concurrency

- RTS enhancements & greater reliance upon RTS

- Intelligent & autonomic statistics gathering

- BACKUP SYSTEM / RESTORE SYSTEM enhancements
What’s coming?

- FlashCopy exploitation
- Faster & better COPY processing
  - Incremental, CHANGELIMIT, FlashCopy
- LOAD & UNLOAD enhancements
  - Improved LOB/XML processing
  - Performance options
- CHECK utility enhancements
  - XML, availability, data correction,…
- Faster point in time recovery
- ... and more
Summary

- Continued delivery of performance improvements & features of real value
- Tolerance, support & exploitation of new features from day 1
- Ensure utilities are non-disruptive
  - Eliminate outages
  - Improve performance
  - Reduce resource cost
- Reduce complexity & improve automation
Thank You