S206: DB2 10 for z/OS Performance and Scalability

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22–24 May, 2012
Oslo, Norway
Performance and Scalability

- Many opportunities for price/performance (cost) improvements
  - Major theme of this release
  - Most welcome to our customers

- Customers intimidated by the marketing noise about improved performance
  - Expectation of their CIO
  - For some of their workloads not seeing improvements in CPU and elapsed time
  - Conversely see big improvements for certain workloads
  - Small workloads can skew expectations on savings
  - Some measurements and quotes are insanely positive
    - Should be ignored
  - How to extrapolate and estimate for production mixed workload?
    - Estimation with accuracy and high confidence not practical
    - Benchmarking effort would be required

- Very important to correctly level set customer performance expectations
- Customers should not spend any performance benefits until they see them
Assumes no major access path regressions

On Day 1 in production in CM without any changes (e.g., no rebind, no use of 1MB page size) there may be customers who see zero % improvement and even some will see degradation
  - Why? SPROCs disabled, puffing of run time structures for migrated packages from V8 or V9, etc

To maximise the performance improvements must:
  - REBIND static SQL packages
  - Use PGFIX=YES bufferpools with sufficient 1MB real storage page frames to 100% fully back the requirement from PGFIX=YES bufferpools

Seeing 0-10% improvement after REBIND and use of 1MB real storage frames

Need to look at total CPU resource consumption picture across
  - Acctg Class 2 TCB Time (Accounting Trace)
  - DB2 System Address spaces (Statistics Trace)
Customers should expect to see some increase in real storage consumption (10-30%)
  - Must also factor in MAXSPACE requirement for DB2 dumps (approx 16GB)
    • Avoid very long dump capture times and bad system performance
    • Critical for V10 serviceability
Performance and Scalability ...

- The 0-10% CPU reduction is based on the DB2 portion of a given application workload
- Customer value driven on how sub-capacity workload licensing works
  - Based on 4-hour rolling average MSU utilisation
  - Highest rolling average figure for each month used to calculate software charges for all MLC products (IBM and non-IBM)
  - Provided DB2 forms a significant component of the total MSU usage during peak period, any MSU savings will translate directly to MLC savings
  - Typically this is the online day - mid morning and mid afternoon
  - So for example - this may be driven by CICS-DB2 workload where the DB2 portion of the workload only represents 40-60% of the total path length
  - So the 0-10% may represent only 0 to 6% (i.e., needs to be discounted)
  - Investigate how much CPU is used in the 4-hour period for DB2 work (SQL)
  - Evaluate V10 price bands under WLC pricing vs. V10 MSU savings
  - Factor in the impact on overall z/OS software stack cost reduction
    z/OS, CICS, MQ
Performance and Scalability ...

- Sub capacity pricing

Chart courtesy of Cristian Molaro, taken from White Paper: Getting the financial benefits of DB2 10 for z/OS
Opportunities for additional price/performance improvements driven by DBM1 31-bit VSCR supported by additional real storage include

- More use of persistent threads with selective use of RELEASE(DEALLOCATE)
  - High Performance DBATs
  - CICS Protected ENTRY Threads
  - CICS Unprotected ENTRY Threads with queuing
  - Typical savings 0-10%, may be more
- Increasing MAXKEEPD to improve Local Dynamic Statement Cache hit ratio and reduce the number of short prepares
- Sysplex/Data sharing Group consolidation
  - So for example, 8-way to 4-way
  - Reduced cost of data sharing

Very important to correctly level set customer performance expectations

Customers should not spend any performance benefits until they see them
## Performance and Scalability...

<table>
<thead>
<tr>
<th>Workload</th>
<th>Customer Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>CICS online transactions</td>
<td>Approx. 7% CPU reduction in DB2 10 CM after REBIND, additional reduction when 1MB page frames are used for selective buffer pools</td>
</tr>
<tr>
<td>CICS online transactions</td>
<td>Approx. 10% CPU reduction from DB2 9</td>
</tr>
<tr>
<td>CICS online transactions</td>
<td>Approx. 5% CPU reduction from DB2 V8</td>
</tr>
<tr>
<td>CICS online transactions</td>
<td>10+% CPU increase</td>
</tr>
<tr>
<td>Distributed Concurrent Insert</td>
<td>50% DB2 elapsed time reduction, 15% chargeable CPU reduction after enabling high performance DBAT</td>
</tr>
<tr>
<td>Data sharing heavy concurrent insert</td>
<td>38% CPU reduction</td>
</tr>
<tr>
<td>Queries</td>
<td>Average CPU reduction 28% from V8 to DB2 10 NFM</td>
</tr>
<tr>
<td>Batch</td>
<td>Overall 20-25% CPU reduction after rebind packages</td>
</tr>
</tbody>
</table>
### Performance and Scalability

<table>
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<tr>
<td>Multi row insert (data sharing)</td>
<td>33% CPU reduction from V9, 4x improvement from V8 due to LRSN spin reduction</td>
</tr>
<tr>
<td>Parallel Index Update</td>
<td>30-40% Elapsed time improvement with class 2 CPU time reduction</td>
</tr>
<tr>
<td>Inline LOB</td>
<td>SELECT LOB shows 80% CPU reduction</td>
</tr>
<tr>
<td>Include Index</td>
<td>17% CPU reduction in insert after using INCLUDE INDEX</td>
</tr>
</tbody>
</table>
| Hash Access                      | 20-30% CPU reduction in random access  
16% CPU reduction comparing Hash Access and Index-data access.  
5% CPU reduction comparing Hash against Index only access  
Further improvements delivered late in the beta program. |
• Measurements of IBM Relational Warehouse Workload (IRWW) with data sharing
  – Base: DB2 9 NFM REBIND with PLANMGMT EXTENDED
  – DB2 9 NFM → DB2 10 CM without REBIND showed 1.3% CPU reduction
  – DB2 10 CM REBIND with same access path showed 4.8% CPU reduction
  – DB2 10 NFM brought 5.1% CPU reduction
  – DB2 10 CM or NFM with RELEASE DEALLOCATE 12.6% CPU reduction from DB2 9
- Query performance enhancements
  - No REBIND required for
    - Index list prefetch
    - INSERT index read I/O parallelism
    - Workfile spanned records
    - SQLPL performance
    - High performance DBATs
    - Inline LOBs
Query performance enhancements …

- **REBIND** required for
  - Use of RELEASE(DEALLOCATE)
  - Early evaluation of residual predicates
  - IN-list improvements (new access method)
  - SQL pagination (new access method)
  - Query parallelism improvements
  - Index include columns
  - More aggressive view/table expression merge
  - Predicate evaluation enhancements
  - RID list overflow improvements

- Execute **RUNSTATS** before **REBIND**
  - When coming from V8, to collect improved index statistics including CLUSTERRATIOF
  - When coming from V9, if do not already include the KEYCARD option of RUNSTATS
Potential for access path regression when using OPTIMIZE FOR 1 ROW

- Used by customers as a hint to discourage use of sort or list prefetch
- Sometimes applied as an installation SQL coding standard
- DB2 access path selection has always been cost based
- V10 ‘hammer’ change
  - Excludes the ‘sort’ access plan candidates
  - Remaining ‘sort avoidance’ access plans compete on cost – lowest cost wins
  - If no ‘sort avoidance’ access plans, then ‘sort’ access plans remain and compete on cost
- Seeing increasing evidence of access path regression when multiple candidate indexes available e.g.,
  - DB2 using alternate index with lower MATCHCOLS value because there is no sort
- Solutions
  - Change application to code OPTIMIZE FOR 2 ROWS
  - Alter an existing index or create a new index that would support both sort avoidance and index matching (if predicates allow)
  - APAR PM56845 now open to provide option for OPTIMIZE FOR 1 ROW to allow sort access plans
Performance and Scalability ...

- Increase in DB2 system address space CPU resource consumption
  - DBM1 SRB
    - More use of prefetch
      - Row level sequential detection and progressive prefetch
      - INSERT index read I/O parallelism
      - Index list prefetch when disorganised index
      - After BIND, more use of list prefetch
    - zIIP offload for prefetch and deferred write
      - Seeing 50-70% zIIP offload achieved
  - DBM1 TCB
    - Closing of high use CLOSE=YES datasets when hitting DSMAX because of stale list
    - See APAR PM56725 for this issue
  - MSTR TCB
    - Increase related to real storage monitoring which was introduced (APAR PM24723)
    - DB2 is calling a z/OS RSM service for COUNTPAGES function which serialised the frame access with spin loop
    - CPU increase especially when multiple DB2 subsystems running on the same LPAR
    - See z/OS APAR OA37821 and corresponding DB2 APAR PM49816 for this issue
Bufferpool Page Classification
- Sequential, dynamic, and list prefetch are all treated the same
  - Pages are marked *sequential* at the time they are prefetched
- In V8
  - These pages were reclassified as *random* when subsequently touched via getpage
- In V9 and V10
  - None of them will be re-classified to *random* on a getpage

CF utilisation issue
- Root cause is the way GBP data in the CF is deleted in V10
- CF DELETE call option being invoked by V10 deletes both data and directory entries in one CF call
  - But the code path used with name class mask requires more internal CFCC serialisation and can take longer
    - Results in significantly more re-drives of the DELETE requests observed with V10
    - Increased volume of re-drives causes the significant increase in CF utilisation
- See APAR PM51467 for this issue
DB2 10 and z196 synergy

- Taking the general case, performance improvement from V9 to V10 observed on z10 processor should be in same range on z196 processor as long as they are measured on the same number of processors
  - Expectation is still in the 5-10% range
- Apart from MIPs improvement, z196 provides
  - Higher cache hit ratio thus better scalability as number of processors per LPAR increases (more than 16 processors per LPAR)
- V10 performance on z196
  - Scales better with more processors per LPAR than z10
  - Can run with higher number of concurrent threads
- IBM measurement shows 20% ITR improvement from V9 (with a few benchmark specials) compared to V10 on z196 80-way with IRWW-like workload
  - Measurement is extreme case
  - Will only apply to very high end customers
  - Not a general message
- Why does V10 run better on z196
  - Latch contention reductions, 1MB real storage page frame size, general path length
Use of 1MB size real storage page frames on z10 and z196

- Long term bufferpool page fix was introduced in V8 to reduce CPU
  - Many customers reluctant to use PGFIX=YES
  - Potential for real storage shortage because running too close to the edge of the amount of real storage provisioned
  - Customers do understand the value, but it only applies for a few hours each day
  - But page fix is a long term decision
  - In most cases requires DB2 recycle to change attribute
  - 75% cost reduction on real storage on z196 (USD1.5K vs. USD6K)
Use of 1MB size real storage page frames on z10 and z196 …
- Potential for reduced for CPU through less TLB misses
- CPU reduction based on customer experience 0 to 6%
- Buffer pools must be defined as PGFIX=YES to use 1MB size page frames
- Must have sufficient total real storage to fully back the total DB2 requirement
- Involves partitioning real storage into 4KB and 1MB size page frames
  - Specified by LFAREA xx% in IEASYSnn parmlib member and only changeable by IPL
  - 1MB size page frames are non-pageable
  - If 1MB size page frames are overcommitted, DB2 will use 4KB size page frames
  - Recommendation to add 5-10% to the size to allow for some growth and tuning
- Must have both enough 4KB and enough 1MB size page frames
- Do not use 1MB size real storage frames until running smoothly on V10
- Make sure any critical z/OS maintenance is applied before using 1MB size real storage page frames
Use of 1MB size real storage page frames on z10 and z196 ...

- Useful commands
  - DB2 -DISPLAY BUFFERPOOL(BP1) SERVICE=4
    - Useful command to find out how many 1MB size page frames are being used
    - Especially useful when running multiple DB2 subsystems on the same LPAR
    - See DSNB999I message
  - MVS DISPLAY VIRTSTOR,LFAREA
    - Show total LFAREA, allocation split across 4KB and 1MB size frames, what is available
    - See IAR019I message
• Exceptions where CPU regression for very light OLTP transactions
  – Skinny packages with few simple SQL
  – Package allocation cost overrides benefit from SQL optimizations in V10
  – APAR PM31614 may solve this by improving package allocation performance
  – Good candidate for the use of persistent threads with RELEASE(DEALLOCATE) and will help compensate
Performance and Scalability ...

- DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time

16 ExaByte = $2^{64}$

2 GigaByte = $2^{31}$

DBM1 address space

IRLM locks

- Castout bfrs
- Compression
- Global DSC
- DBD Cache
- Ridpool
- Sortpool

DDF ctrl-blks

- SK-CT/PT
- Castout bfrs
- Compression
- Global DSC
- DBD Cache
- Ridpool
- Sortpool

CT/PT
- Thread

EDMPool
- Thread
- DSMAX

All

Dataspace

CTHREAD + MAXDBAT = 2000

practical limit

$\sim$ a few hundreds

CTHREAD + MAXDBAT = 20000

DSMAX

$\sim$ a few thousands

Real storage
DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time
  – Available in CM
  – Requirement to REBIND static SQL packages to accrue maximum benefit
  – Very good results achieved (up to 90% VSCR)
  – Have high degree of confidence that problem addressed
    Real world proposition: 500 -> 2500-3000 threads plus
  – Limiting factors now on vertical scalability (# number of threads, thread storage footprint)
    • Amount of real storage provisioned on the LPAR
    • Log latch (LC19) contention
    • ESQA/ECSA (31-bit) storage
- DBM1 31-bit Thread Storage V9 vs. V10 – Initially but corrected prior to GA
- DBM1 31-bit Thread Storage V9 vs. V10 – as at GA after Fix
Performance and Scalability ...

- **DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time**
  - Major customer opportunities here for 31-bit VSCR and improved price/performance
    - Potential to reduce legacy OLTP transaction CPU cost through use of
      - More CICS protected ENTRY (persistent) threads
      - More use of RELEASE(DEALLOCATE) with next/existing persistent threads
    - Potential to reduce CPU for DRDA transactions by using High Performance DBAT
      - Must be using CMTSTAT=INACTIVE so that threads can be pooled and reused
      - Packages must be bound with RELEASE(DEALLOCATE) to get reuse for same connection
      - MODIFY DDF PKGREL(BNDOPT) must also be in effect
      - Do not overuse RELEASE(DEALLOCATE) on packages
        - Will drive up the MAXDBAT requirement
    - Potential to reduce CPU when using KEEPDYNAMIC(YES) e.g., SAP
      - Increase MAXKEEPD to improve Local Dynamic Cache Hit Ratio and reduce the number of short prepares

- Must provision **additional real storage** to back the requirement for each opportunity
• DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time
  – More persistent threads with RELEASE(DEALLOCATE) is also trade off with BIND/REBIND and DDL concurrency
  – For RELEASE(DEALLOCATE) some locks are held beyond commit until thread termination
    • Mass delete locks (SQL DELETE without WHERE clause)
    • Gross level lock acquired on behalf of a SQL LOCK TABLE
    • Note: no longer a problem for gross level lock acquired by lock escalation
  – CICS-DB2 accounting for cost of thread create and terminate, or avoidance thereof
    • CICS uses the L8 TCB to access DB2 irrespective of whether the application is thread safe or not
    • Thread create and terminate cost will clock against the L8 TCB and will be in the CICS SMF Type 110 record
    • Note: prior to OTE did not capture the thread create in the SMF Type 110
DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time

- High Performance DBATs (Hi-Perf DBATs) is a new type of distributed thread
  - Must be using CMTSTAT=INACTIVE so that threads can be pooled and reused
  - Packages must be bound with RELEASE(DEALLOCATE) to get reuse for same connection and -MODIFY DDF PKGREL(BNDOPT) must also be in effect
  - When a DBAT can be pooled after end of client's UOW
    - Now DBAT and client connection will remain active together
      - Still cut an accounting record and end the enclave
    - After the Hi-Perf DBAT has been reused 200 times
      - DBAT will be purged and client connection will then go inactive
    - All the interactions with the client will still be the same in that if the client is part of a sysplex workload balancing setup, it will still receive indications that the connection can be multiplexed amongst many client connections
    - IDTHTOIN will not apply if the if the Hi-Perf DBAT is waiting for the next client UOW
    - If Hi-Perf DBAT has not received new work for POOLINAC time
      - DBAT will be purged and the connection will go inactive
    - If # of Hi-Perf DBATs exceed 50% of MAXDBAT threshold
      - DBATs will be pooled at commit and package resources copied/allocated as RELEASE(COMMIT)
    - Hi-Perf DBATs can be purged to allow DDL, BIND, and utilities to break in
      - Via -MODIFY DDF PKGREL(COMMIT)
• DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time
  – High Performance DBATs (Hi-Perf DBATs) should be carefully
    • Want to have some high performance applications running on LUW application servers
      connected to DB2 10 for z/OS running with High Performance DBATs and others not
    • Standard ODBC and JDBC packages supplied with drivers/connect packages should be bound
      twice into two different package collections e.g.,
      – The CS package in collection1 will be bound with RELEASE(DEALLOCATE) so that the applications
        using that package will be eligible to use high performance DBATs
      – The CS package in collection2 (e.g., NULLID) would be bound with RELEASE(COMMIT) and would not
        use high performance DBATs
    • For JDBC applications
      – Set the currentPackageSet property in the respective datasource
    • For .NET and ODBC / CLI applications
      – Set CurrentPackageSet parameter in the db2dsdriver.cfg configuration
DBM1 31-bit Virtual Storage Constraint Relief with 64-bit SQL run time

- Potential to reduce the number of DB2 subsystems in data sharing group
  - First step is to collapse multiple DB2 members running on the same LPAR
  - May then be able to reduce the number of LPARs/DB2 members
  - Consider the increase in logging rate per DB2 member
    - Possible aggravation of LC19 contention despite V10 improvement
  - Consider the increase in SMF data volume per LPAR
    - Can enable DB2 compression of SMF data to reduce SMF data volume
      - Experience is that Accounting records compress 70-80%
      - Tiny CPU overhead at ~1%
    - Re-consider use of accounting roll up for DDF and RRSAF workload (default)
      - Compromises performance PD/PSI as lose information on outlying transactions
      - Significant enhancements to package level accounting so it is now useful
  - Consider the increased DUMPSRV and MAXSPACE requirement
- Re-emphasise the continued value of data sharing to differentiate the platform
  - Support avoidance of planned outages
  - Avoid humongous single points of failure
  - Minimum of 4-way for true continuous availability
Performance and Scalability ...

- 64-bit virtual storage
  - Three large areas allocated at IPL time
    - Common 6GB (z/OS default)
      - Addressable by all authorized programs on the LPAR
      - IFC for accounting
    - Private 1TB
      - Buffer pools
      - XML and LOB are huge users, RTS blocks, TRACE buffers,
      - some RID blocks, IFC work buffers and few other misc system pools
    - Shared (Private) 128GB
      - Addressable by all authorized products which have registered their interest to z/OS using the unique object token created when the memory object is created
      - V9 introduced 64-bit shared private storage but it was used in limited fashion
      - Almost all the DB2 storage in V10 is now 64-bit shared private
  - DB2 is only "reserving" virtual storage, it does not mean it is being used
    - It costs nothing to reserve virtual storage i.e., addressing range
    - Having a fixed size areas is a lazy design but it makes it easier for serialization
    - Needs to be backed by real storage when it is allocated within the reference area
Performance and Scalability ...

- 31-bit and 64-bit virtual storage contraction
  - CONTSTOR=YES and MINSTOR=YES
    - These existing system parameters drive the contraction of 31-bit storage pools and the best fit allocation of 31-bit storage respectively
    - Not applicable to 64-bit storage
    - Not as critical as before V10
    - Assuming generous DBM1 31-bit VSCR in V10, set CONSTOR=MINSTOR=NO
  - 64-bit thread pools are contracted under control of
    - Commit count
    - New Real Storage Management DISCARD function (see follow on slides)
Real storage

- Need to carefully plan, provision and monitor real storage consumption
- Prior to V10 a hidden zparm SPRMRSMX (‘real storage kill switch’) existed
  - SPRMRSMX prevents a runaway DB2 subsystem from taking the LPAR down
    - Should be used when there is more than one DB2 subsystem running on the same LPAR
    - Aim is to prevent multiple outages being caused by a single DB2 subsystem outage
    - Should be set to 1.5x to 2x normal DB2 subsystem usage
    - Kills the DB2 subsystem when SPRMRSMX value reached
  - With V10, will need to factor in 64-bit shared and common use to establish new footprint
- Problems with introduction of V10
  - Unable to monitor the REAL and AUX storage frames used for 64-bit shared storage
    - V9 not really an issue, as limited use of 64-bit shared
    - But now V10 makes extensive use of 64-bit shared
  - LPAR level instrumentation buckets for REAL and AUX storage use
    - If more than one DB2 subsystem on the same LPAR then the numbers reported are inaccurate
    - Only able to get reliable numbers if only one subsystem like DB2 on the LPAR uses 64-bit shared
  - Lack of ENF 55 condition monitoring
    - 50% of AUX used
Real storage …

DB2 APAR PM24723 is very important

- Monitoring issue is addressed and new extensions to IFCID 225 provided
  - Pre-req is new MVS APAR OA35885 which provides a new callable service to RSM to provide REAL and AUX used for addressing range for shared objects
  - SPRMRSMX hidden zparm now becomes an opaque parameter REALSTORAGE_MAX
- Introduces DISCARD mode to contract storage usage to protect against excessive paging and use of AUX
  - New zparm REALSTORAGE_MANAGEMENT controls when DB2 frees storage frames back to z/OS
    - ON -> Discard unused frames all the time - discard stack, thread storage, keep footprint small
    - OFF -> Do not discard unused frames unless things are getting out of hand
    - AUTO (default) -> Detect whether paging is imminent and reduce the frame counts to avoid system paging
  - With AUTO, DB2 monitors paging rates, switches between ON/OFF and decides when to discard frames based on
    - 80% of SPRMRSMX reached
    - 50% of AUX (ENF55 condition) used
    - Hitting AVQLOW (available real storage frame)
  - New messages (DSNV516I, 517I) for when paging rate thresholds cause DB2 to free real frames
- Strong recommendation to apply PTF for APAR PM24723 before going into business production and to run with REALSTORAGE_MANAGEMENT=AUTO
Monitoring Virtual and Release Storage

- SPREADSHEETDD support in OMPE has not been enhanced to support V10
  - OMPE are working on a 'generic' spreadsheet generator
  - Outstanding requirement to also include serviceability fields
- MEMU2 and MEMUSAGE already enhanced for V10 and available on the DB2 for z/OS Exchange community website on IBM My developerWorks
  2. (From DB2 for z/OS Exchange (http://www.ibm.com/developerworks/software/exchange/db2zos), click on 'View and download examples'. The file is tagged with 'memu2'.
  3. To access MEMU2 directly (but note that if you want to be kept informed of updates and new versions, you need to log on to developerWorks rather than download the file anonymously...)

V8/V9

V10
High INSERT performance

- Significant improvements for UTS
  - Now support for MEMBER CLUSTER
  - Changes to space search algorithm (like classic partitioned)
- Goal was for UTS to be equal or better than classic partitioned (PTS)
  - Not there yet, but much closer
  - Very workload dependent
  - Some good, some worse
  - Still trade off between space vs. throughput and reduced contention
  - Work still to do on UTS PBR/PBG with RLL and sequential insert
- High INSERT performance …
  - Reduced LRSN spin for inserts to the same page
    • Works well for MRI and INSERT within loop in a data sharing environment
  - Optimization for ‘pocket’ sequential insert works well
    • Index manager picks the candidate RID during sequential insert (next lowest key rid)
    • Higher chance to find the space and avoiding a space search
  - Parallel index IO works very well when activated for random key inserts
    • >= 3 indexes
    • Prefetch and deferred write offload to zIIP to compensate
High Insert Workload Description

- 2-way data sharing
- Database schema
  - 3 tables with total of 6 indexes (4 unique, 2 non-unique indexes, 2 secondary indexes)
  - Table space types: Classic Partitioned, Classic Segmented, UTS (PBR, PBG)
- SQL
  - INSERTs contain 5, 9 and 46 columns of integer, bigint, char, varchar, decimal and timestamp data type
- Application implemented in Java
- Sequential inserts into empty tables
  - 240 concurrent threads
  - Multi-row inserts (100)
- Random inserts into populated tables
  - 200 concurrent threads
  - Single-row inserts
DB2 10 Range Defined Table Spaces

Random Inserts

Throughput

<table>
<thead>
<tr>
<th>PTS</th>
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<th>PBR</th>
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<td>PLL</td>
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Sequential Inserts

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DB2 10 Non-range Defined Table Spaces

**Random Inserts**

**Throughput**
- SEG
- PBG
- PBG/MC

**CPU Time**
- SEG
- PBG
- PBG/MC

**Sequential Inserts**

**Throughput**
- SEG
- PBG
- PBG/MC

**CPU Time**
- SEG
- PBG
- PBG/MC
- Accounting Trace Class 3 enhancement – separate counters
  - IRLM Lock/Latch waits
  - DB2 Latch waits
- Data sharing
  - Faster DB2 shut down by avoiding local buffer pool scan per GBP-dependent object
  - Avoiding scan of XXXL local Buffer pool when
    - Pageset/partition transitions into GBP-dependency
    - Pageset/partition transitions out of GBP-dependency
- Inline LOBs work very well if you hit the sweet spot
  - Potential for significant CPU and elapsed time improvement with the right inline value
  - Trade off in setting the right inline value
    - Avoiding access to auxiliary tablespace
    - Increasing base row size with fewer rows per page
    - May have to increased page size
  - Inline portion can be compressed
  - Significant space savings with small LOBs (<1000 bytes)
Performance and Scalability ...

- Compress on INSERT
  - Compression ratios almost as good compared with running REORG later

- Active log writes
  - Prior to V10, log writes are done serially when re-writing partial CIs
  - Determined that destructive writes due to IO errors no longer occur
  - Now all log write IOs are done in parallel
  - Elapsed time improvements

- Limited value of Currently Committed locking semantics
  - SQL UPDATE not supported
Questions
Thank You