

IBM System z Technology Summit



DB2 10 – The Secrets of Scalability



Agenda

- **Introduction**
- **The Need for Scalability**
- **DB2 10 Scalability Enhancements**
 - Virtual storage constraint relief
 - Latch contention reduction
 - Catalog concurrency enhancements
 - SMF compression
 - Other scalability enhancements
 - Concurrency
 - Index Enhancement
 - Multirow Operations
 - LOBs
 - Hash Organization
 - Optimization
 - Additional zIIP Exploitation
- **Summary & Questions**

The Need for Scalability

- **IT volumes continue to increase**
 - More applications
 - More data
 - More transactions

- **Performance is ever more important**
 - Customers need to support workload growth without a drop-off in performance

- **Availability is ever more important**
 - Pressure to reduce both planned and unplanned outages

- **End result: each DB2 environment is being asked to work harder, with less downtime**

- **Every DB2 release attempts to push back these boundaries, but major progress has been made in DB2 10**

DB2 10 Scalability Enhancements

Savings ... right out of the box

IBM DB2 10 for z/OS delivers faster queries and reduced cost with optimized technology

Simple

Cuts costs

Innovative

Proven

Secure

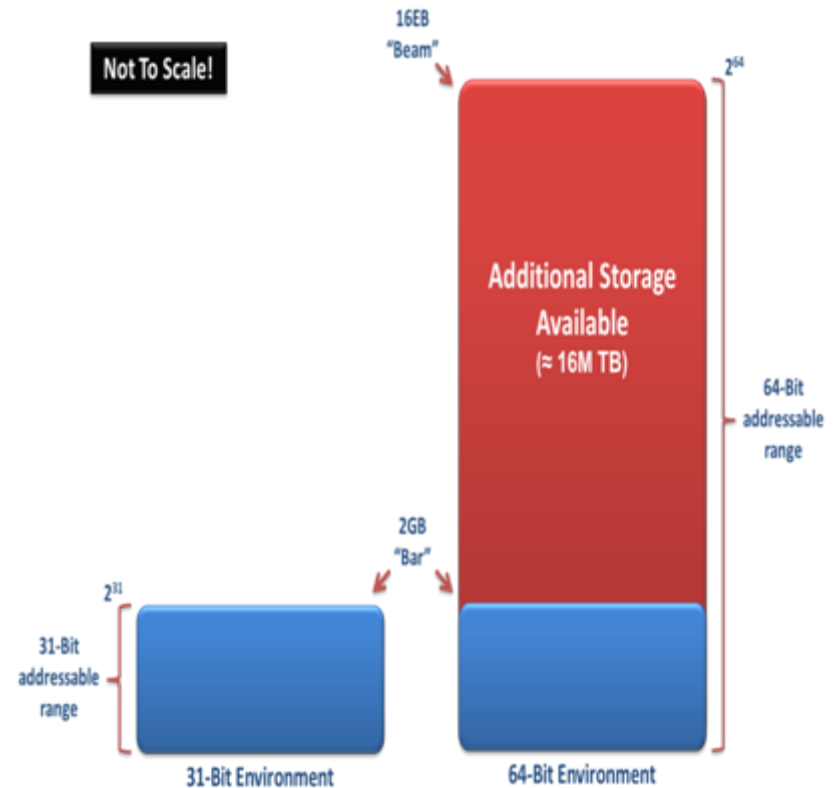


Top New Features

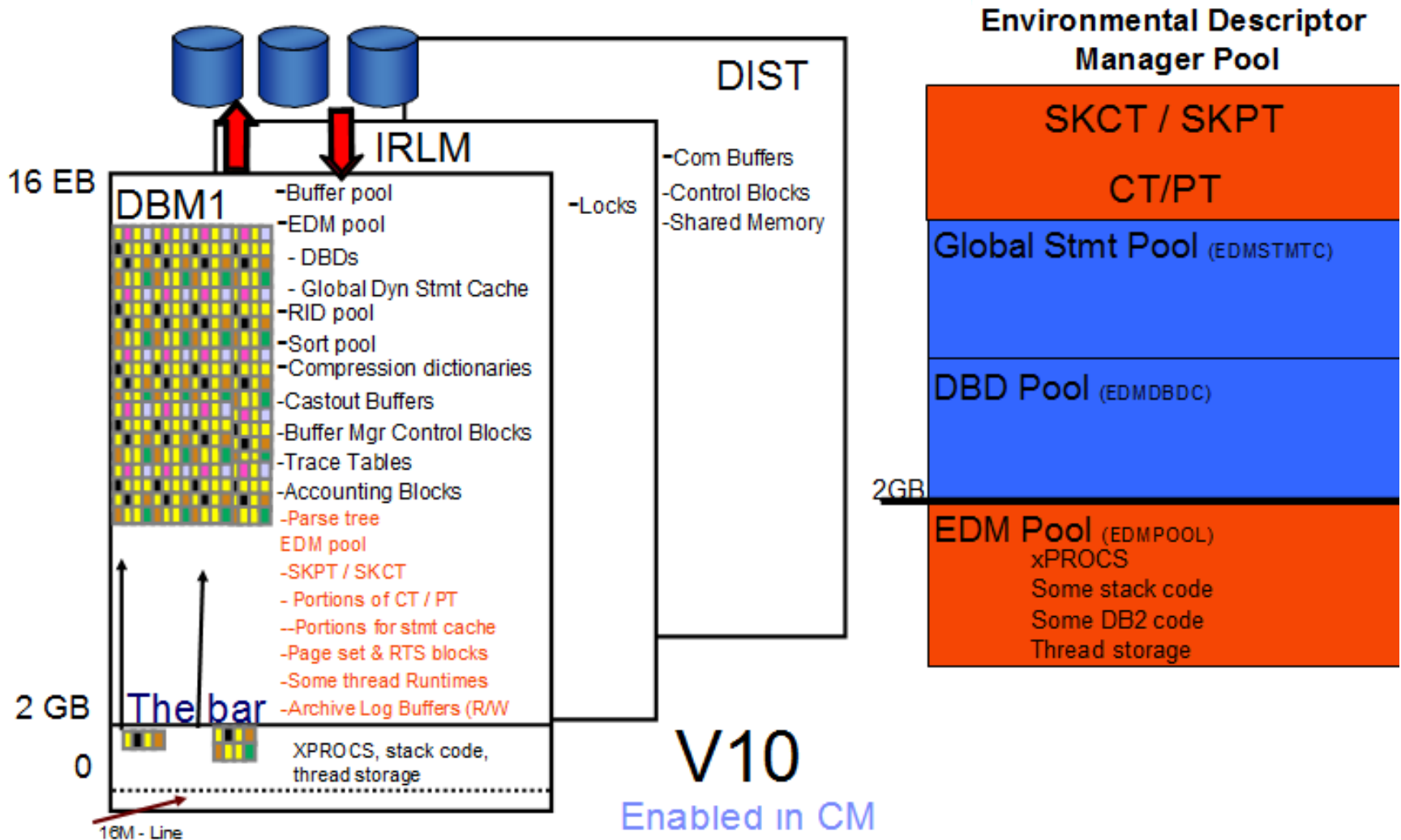
- CPU/Performance Improvements
- Virtual Storage Enhancements
- Security Extensions
- Improved Catalog Concurrency
- Temporal Data
- Access Path Management
- pureXML enhancements
- Currently Committed semantics
- Automated statistics
- Dynamic schema change enhancements
- In-memory object support
- Optimiser enhancements
- MEMBER CLUSTER for UTS
- Backup and recovery enhancements
- Enhanced audit
- Include additional index columns
- Enhanced SQL OLAP functions
- Skip Migration
- And many more....

Virtual Storage Enhancements

- **V8 began a major project to transform DB2 into a 64-bit RDBMS**
 - Laid the groundwork and provided some scalability improvements but a lot of DBM1 objects remained below the 2GB bar
- **DB2 9 improved things a little, but only by another 10-15% for most customers**
 - Practical limit of 300-500 threads per DB2 subsystem
- **DB2 10 moves 80-90% of the remaining objects above the bar, resulting in 5-10x improvement in threads per subsystem (CM)**



64 bit Evolution (Virtual Storage Relief)

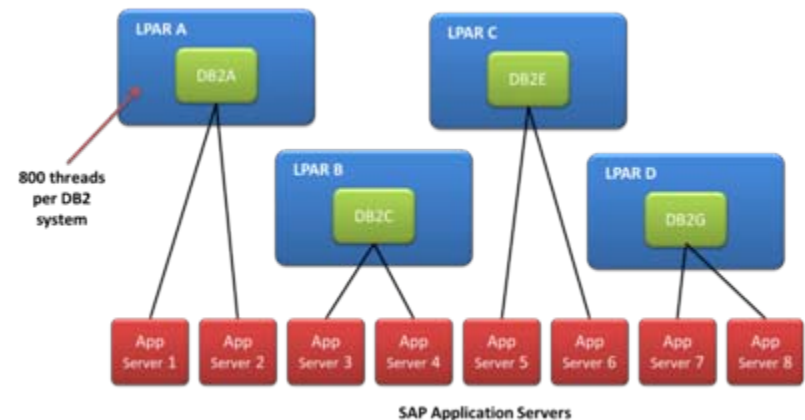
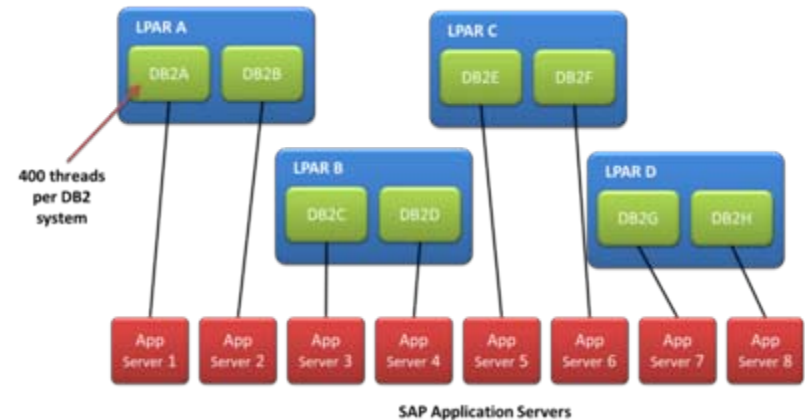


Virtual Storage Enhancements

- **Possibility for less DB2 subsystems (and possibly less LPARs) in a data sharing environment**

- Lower data sharing overhead
- Less systems to manage / maintain
- Delete of data sharing member is coming! See:

- PM31003
- PM31009
- PM54873

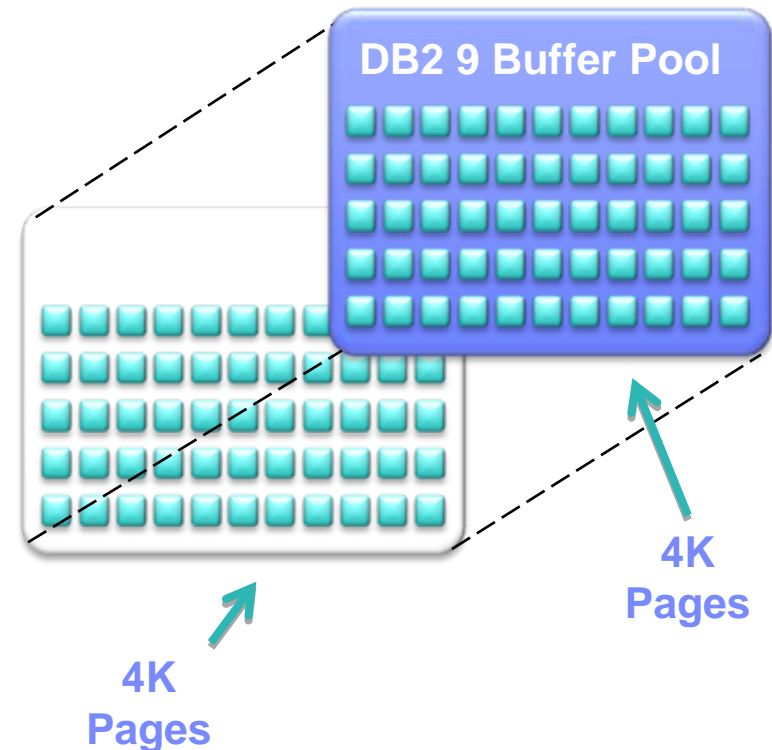


Virtual Storage Enhancements

- **More space for performance critical storage objects such as dynamic statement cache**
- **Potential to reduce legacy OLTP CPU cost through**
 - More use of CICS protected entry threads
 - More use of RELEASE(DEALLOCATE) with persistent threads (with trade-off on concurrency)
 - DB2 10 High-Performance DBATs
 - **-MODIFY DDF PKGREL(BINDOPT | COMMIT)**
- **Other limiting factors on vertical scalability still remain**
 - Real storage
 - Plan on additional 10-30% real memory following migration
 - ESQA/ECSA (31-bit) storage
 - Active log write

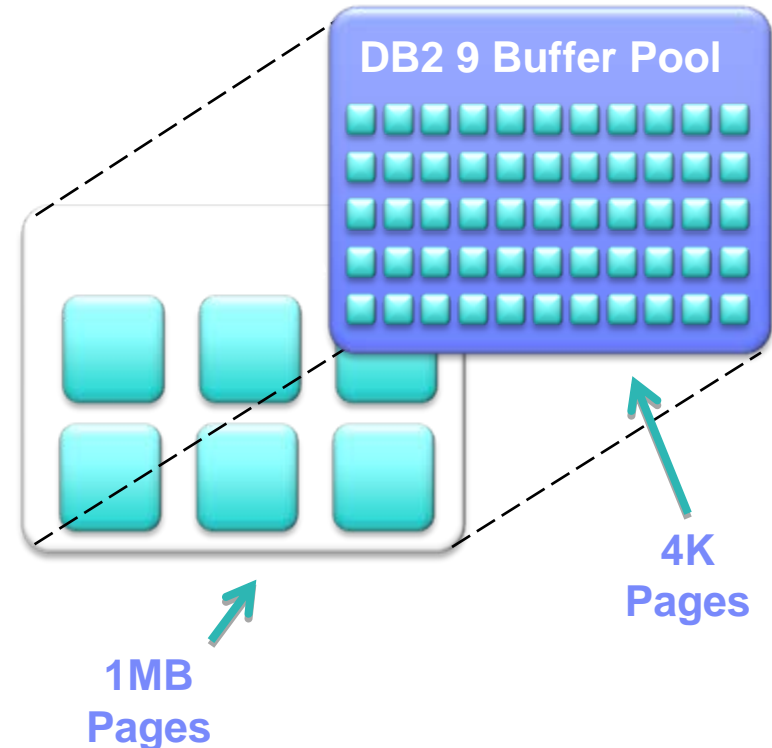
Real Storage Enhancements

- For prior releases, z/OS always managed DB2 bufferpool pages as 4K frames
- Move to 64-bit architecture made much larger buffer pools viable
 - Bufferpools can use many millions of pages
 - Increased z/OS overheads for page management



Real Storage Enhancements

- **DB2 10 introduces support for 1MB pages to reduce z/OS page management overheads**
 - Needs z10 or newer z196 server
 - Needs bufferpool to be defined with PGFIX=YES
 - Buffer Pool intensity can help determine
 - $\text{PGREADS} + \text{PGWRITES} / \# \text{ of Pages}$
 - z/OS Sysprogs must partition real storage between 1K and 1MB frames (LFAREA in IESYSnn / PARMLIB)
- **Customer testing during beta program showed CPU reductions of 0-6% with this feature enabled**



Storage Enhancements

- **Remains critical to ensure that there is no paging in DB2 address spaces**
- **Focus changes from virtual memory constraints & monitoring to real memory constraints & monitoring**
 - See (PM24723) for real storage monitoring and contraction enhancements – advised not to go into production without this!
- **Ensure use of PGFIX=YES to exploit 1MB real storage frames**
 - Many customers still haven't exploited this feature in their DB2 8 and DB2 9 systems – significant CPU savings!
 - Support for 1MB non page-fixed bufferpools in future release
- **Ensure you are up to date on z/OS maintenance before using 1MB pages**
 - OA31116, OA33702, OA33529, check for others.

Latch contention reduction

- **Latch: DB2 mechanism for controlling concurrent events or the use of system resources**
 - Reported in accounting and statistics traces
 - Latch wait time can be significant for high-volume environments
- **DB2 10 reduces latch contention for a large number of situations, including:**
 - LC12: Global Transaction ID serialization
 - LC14: Buffer Manager serialization
 - LC19: Log write in both data sharing and non data sharing
 - LC24: EDM thread storage serialization
 - LC24: Buffer Manager serialization
 - LC27: WLM serialization latch for stored procedures and UDF
 - LC32: Storage Manager serialization
 - IRLM: IRLM hash contention
 - CML: z/OS Cross Memory Local suspend lock
 - UTSERIAL: Utility serialization lock for SYSLGRNG (removed in NFM)

Catalog Concurrency

- **Contention on DB2 catalog is a major ongoing pain for most large DB2 customers**
- **DB2 10 introduces UTS PBG format for catalog tablespaces in NFM**
 - Internal hashes and links are removed during ENFM processing
 - Use of row-level locking and reordered row format
 - Use of new currently committed semantics and other lock avoidance techniques
 - SMS pre-reqs for migration
- **Greatly improves access to catalog/directory**
 - REORG SHRLEVEL(CHANGE) for complete catalog/directory
 - BIND concurrency much improved, but more work required in future releases – especially with heavy parallel DDL against different databases

Catalog Contention Issues

- **Be prepared for some short-term degradation on entry to CM for single-thread BIND/REBIND processes, until you get to NFM**
 - PLANMGMT=EXTENDED the default, so multiple copies of access plan kept in catalog
 - New indexes are defined, in preparation for hash links to be removed in NFM
 - No concurrency improvement until catalog restructure in ENFM
 - Redbook testing showed REBIND elapsed time increases CPU increases of 50-70%

SMF compression

- **High transaction volume usually means high SMF volume, which can become a limiting factor**
- **Some customers forced to switch off useful accounting data, or resort to SMF rollup (via ACCUMACC ZPARM)**
- **New SMF compression feature can provide increased throughput due to I/O efficiency improvement**
 - Uses z/OS compression service to deliver approx. 60%-90% compression for 1% CPU cost

SMF compression

- Enabled via new SMFCOMP DSNZPARM (member scope)
- All data after SMF header is compressed
- Needs vendor support to allow compressed SMF records to be processed
- New sample DSNTSMFD application to uncompress SMF data (via PM27872)
- Can be used in conjunction with accounting rollup to achieve up to 99% reduction

Other scalability enhancements

▪ Others enhancements in DB2 10

- SPT01 restructured: split into several pieces with LOBs used for larger package sections
 - Inlined BLOB with PM27811 for performance
 - Reported in **–DIS GROUP DETAIL**
- Workfile enhancements: support for spanned records to increase maximum record length, better use of in-memory workfiles, use of PBG tablespaces
- Support for Extended Address Volumes: EAVs theoretically allow up to 221TB per volume (223GB in z/OS 1.10)
- Decrease dataset allocation/deallocation times: using new function in z/OS 1.12 DB2 startup/shutdown times can be improved

Other scalability enhancements

▪ Concurrency

- Access Currently Committed
 - With UPDATE / DELETE workloads
- XML storage restructure (Multi-Versioned Format)

▪ Index Enhancements

- Parallel Index Maintenance
 - For tables with 3 or more indexes
 - Measures 50% ET reduction during the beta
 - Table with 6 indexes, during 2000 INSERTs
- INCLUDE Columns
 - Added columns to unique indexes
 - Not part of the unique constraint
 - Enhance index only access
 - Eliminate some indexes
- Sequential INSERT improvements in DB2 9 & 10

Other scalability enhancements

- **Multirow Operations for Data Sharing**
 - LRSN changes for Multirow Insert
- **LOBs**
 - Streaming & INLINE(ing)
- **Hash Organization**
 - Use caution in determining the right table candidates
 - Significant savings given the correct workload
 - Performance Redbook reports 13 – 37% CPU savings, slightly less if the application was getting index only access
- **Optimization / Operation**
 - Literal Replacement
 - Dynamic Index List Prefetch for disorganized indexes

Other scalability enhancements

▪ Additional zIIP Exploitation

– Buffer operations

- Prefetch
- Deferred Write

– RUNSTATS

- Simple statements

– DB2 9 added

- Native SQL Procedures called remotely
- zIIP exploitation for DFSort for Utilities
- XML Serialization / Parsing

Summary

- **DB2 10 delivers some very significant enhancements for increasing throughput, supporting more users and reducing planned downtime**
 - Many of these enhancements available in Conversion Mode (CM)
- **Remember that sufficient real storage is needed to back any increase in virtual**
- **If you are still on DB2 V8, remember that support ends in April 2012**
 - DB2 9 EOS announced for June 2014

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- DB2 for z/OS Best Practices
- IDUG: The Worldwide DB2 User Community
- My developerWorks Exchange
- World of DB2

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- lexluthor
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- mik212

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DB2 for z/OS best practices

Best practices
Make your job easier, achieve your business goals more efficiently, learn techniques that work with other customers, and gain valuable knowledge directly from the experts.

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↓ Configuring
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↓ Developing
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Introduction
These best practices present advice on the optimal way to use IBM® DB2® for z/OS® to satisfy key business data processing needs. These presentations and articles are authored by leading experts in IBM's development and consulting teams.
Please send any feedback or suggestions for future DB2 for z/OS best practice topics to db2zinfo@us.ibm.com.

Planning
• [DB2 10 for z/OS: Helping you improve operational efficiencies and gain competitive advantage](#) (IBM, April 2010) by Roger Miller and David Beulke (David Beulke & Associates)
Competitive pressures are common across most enterprise shops. These pressures give rise to challenges such as lowering operating costs through CPU cycle reductions while still building a strong foundation for SOA and XML initiatives, productivity improvements, and

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