DB2 10 for z/OS Technical Overview

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Information Management software

DB2 10 for z/OS

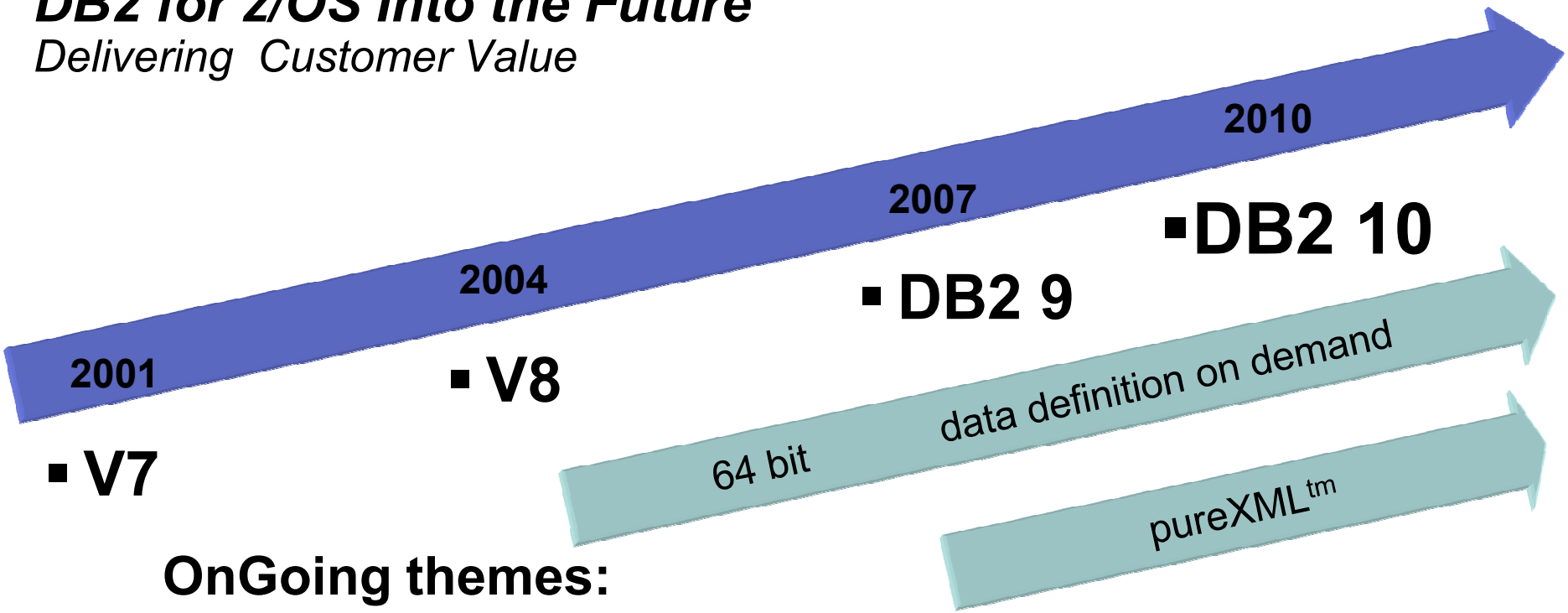
- The next release of DB2 for z/OS
- Satisfies major technical requirements across all of the themes
- Major focus areas include:
  - Scalability and performance
  - Catalog contention reduction
  - DBA productivity
  - New SQL functionality
  - Query performance and manageability
  - Ease of migration

DB2 for z/OS Technical Strategy

- Application enablement
  - Applications can easily connect to DB2 from anywhere
  - Advanced SQL, XML capability, application portability
- Extend the lead in availability, scalability and performance.
  - Parallel Sysplex: the best scale-out solution in the industry
  - Tight integration between DB2 and the System z hardware and z/OS operating system
  - Advanced solutions for compliance with data security and privacy regulations
  - Workload consolidation: System z is the ultimate consolidation platform
  - Eliminate all causes of outages
- Reduce cost of ownership
  - DB technology that can handle large workloads with fewer people
  - Advanced autonomics to make the system more self-managing and self-tuning
  - Storage and cpu optimization, including specialty engines
- Improved data warehousing capabilities

DB2 for z/OS Into the Future

Delivering Customer Value



OnGoing themes:

Performance Scalability
Reliability Availability Serviceability
Security Productivity
Application Development
SQL XML SOA

DB2 10 for z/OS At a Glance

Addressing Corporate Data Goals

Application Enablement	• pureXML enhancements • Temporal queries • Last Committed reads • Timestamp with timezone • SQL improvements that simplify porting
RAS, Performance, Scalability, Security	• Wide range of performance improvements • More online schema changes • Catalog restructure for improved concurrency • Row and Column access control • Hash access to data • New DBA privileges with finer granularity
Simplification, Reduced TCO	• Full 64-bit SQL runtime (5x – 10x more threads) • Auto stats • Data compression on the fly • Query stability enhancements • Reduced need for REORG • Utilities enhancements
Dynamic Warehousing	• Moving sum, moving average • Many query optimization improvements • Query parallelism improvements • Advanced query acceleration

Application Enablement, Portability

- Allow non-NULL default values for inline LOBs
- Loading and unloading tables with LOBs
  - LOBs in input/output files with other non-LOB data
- ‘Last committed’ locking semantics
- Implicit casting
- Timestamp with timezone
- Greater timestamp precision

Application Enablement, Portability …

- SQLPL in Scalar UDFs
- 64-bit ODBC Support (APAR PK83072 for DB2 9)
- Special null indicator to indicate value not supplied or default
- DRDA support of Unicode for system code points
- Instance based statement hints
- Allow caching of dynamic SQL statements with literals
- Data dependent paging
  - When only a specific portion of the result set is required
  - Improved SQL paging with efficient access to desired portions based on size or on data values

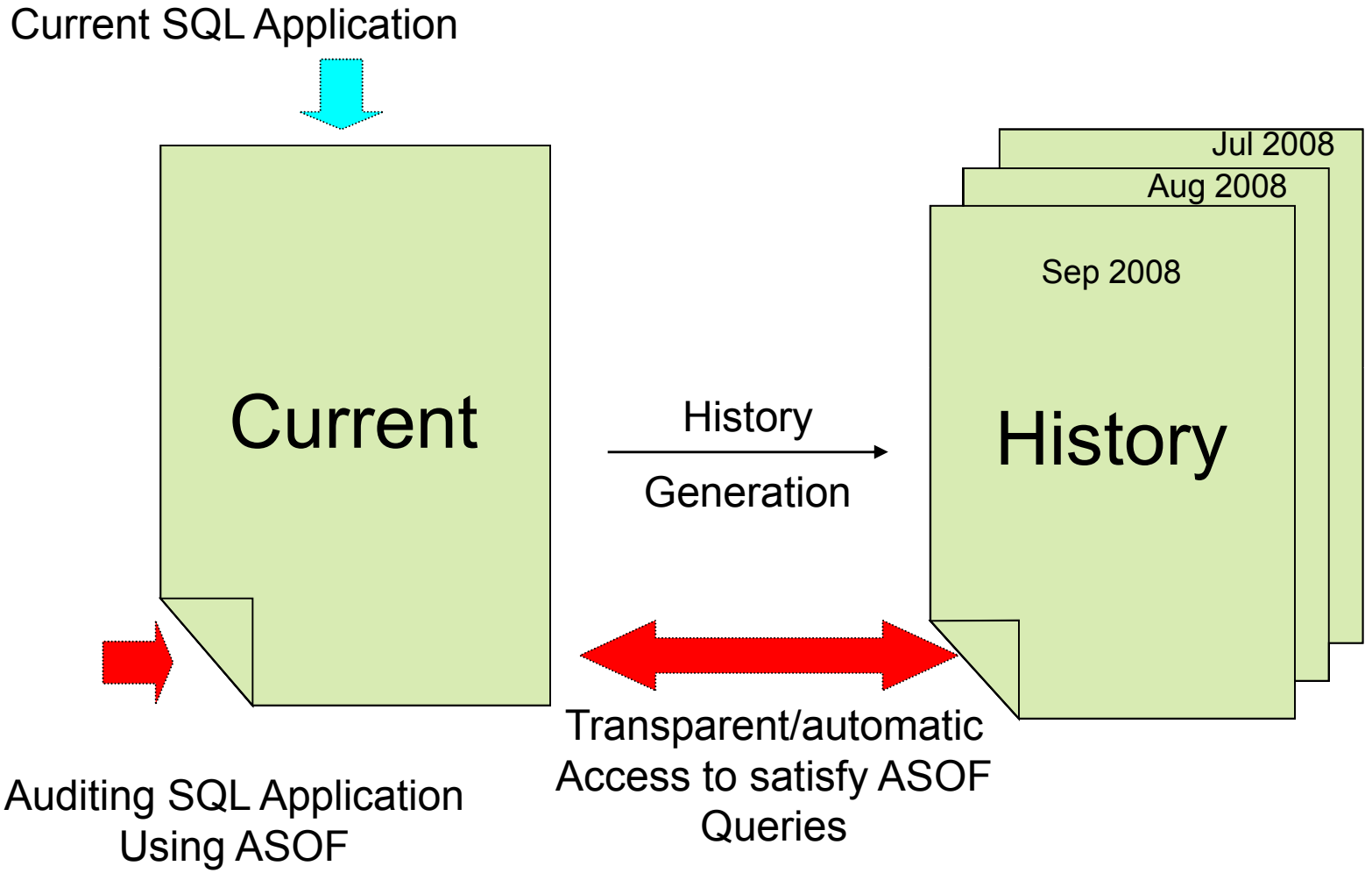
pureXML Enhancements

- XML schema validation in the engine for improved usability, performance
- Binary XML exchange format for improved performance
- XML multi-versioning for more robust XML queries
- Allow easy update of sub-parts of an XML document
- Stored proc, UDF enhanced support for XML

Temporal Data - Summary of Proposal

- Business Time (Effective Dates, Valid Time)
  - Every row has a pair of time stamps set by Application
    - Start time: when the business deems the row valid
    - End Time: when the business deems row validity ends
  - Query over current, any prior, present or future period in business time
  - Useful for tracking of business events over time, app logic greatly simplified
- System Time (Assertion Dates, Knowledge Dates, Transaction Time)
  - Every row has another pair of time stamps set by DBMS
    - Start time: when the row was inserted in the DBMS
    - End Time: when the row was modified/deleted
    - Modified rows start time is the modification time
  - Query at current or any prior period in system time
  - Useful for auditing, compliance
- Bi-temporal
  - Inclusion of both System Time and Business Time in row

Current and History



Temporal UPDATE example (business time)

Simple table definition (Policy#, start, end, coverage)

Table has 1 row of (123,'01/01/2001', '12/31/2001', 1000)

```
UPDATE policy p
   FOR BUSINESS_TIME FROM DATE('03/01/2001') TO DATE('03/31/2001')
   SET coverage = 2000;
```

Result of the update statement is 3 rows:

(123,'01/01/2001','03/01/2001',1000)
(123,'03/01/2001','03/31/2001',2000)
(123,'03/31/2001','12/31/2001',1000)

Availability

- More online schema changes for tablespaces, tables and indexes
  Online REORG instead of DROP/CREATE or REBUILD INDEX
  Alterations are manifested with REORG, unless noted otherwise
  - Page size for table spaces and indexes
  - DSSIZE for table spaces
  - SEGSIZE
  - MEMBER CLUSTER
  - Convert single table segmented into UTS PBG
  - Convert single table simple into UTS PBG
  - Convert classic partitioned tablespace into UTS PBR
  - Convert UTS PBR to UTS PBG
  - Convert PBG to hash (immediate, but RBDP index)
  - Ability to drop pending changes
- Online REORG for LOBs, other Online REORG / utility improvements
- Online add active log

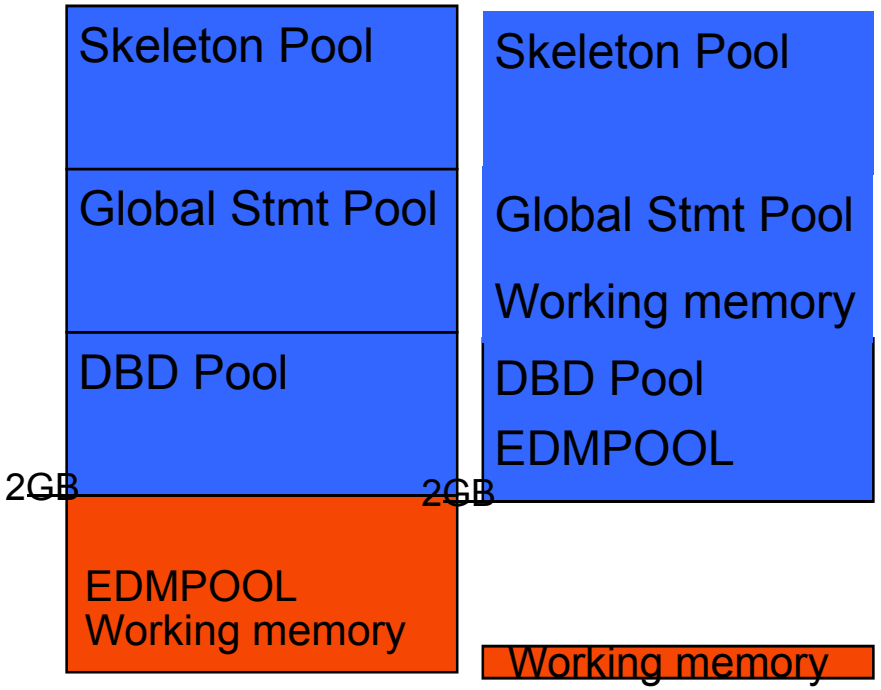
DB2 10 Performance, Scalability Objectives

- Provide significant Scalability and Performance improvements
  - Will be an important “feature” for DB2 10
  - Synergistic operation with latest System z hardware
    - High n-way scalability
    - Large real memory exploitation
    - Hardware level optimization
  - Improve transaction times
  - Lower CPU usage for both large and small DB2 subsystems
- Virtual storage is most common constraint for large customers
  - Can limit the number of concurrent threads for a single member/subsystem
- Increasing the number of concurrent threads will expose the next tier of constraints, which should also be addressed

DB2 10: 64 bit Evolution (Virtual Storage Relief)

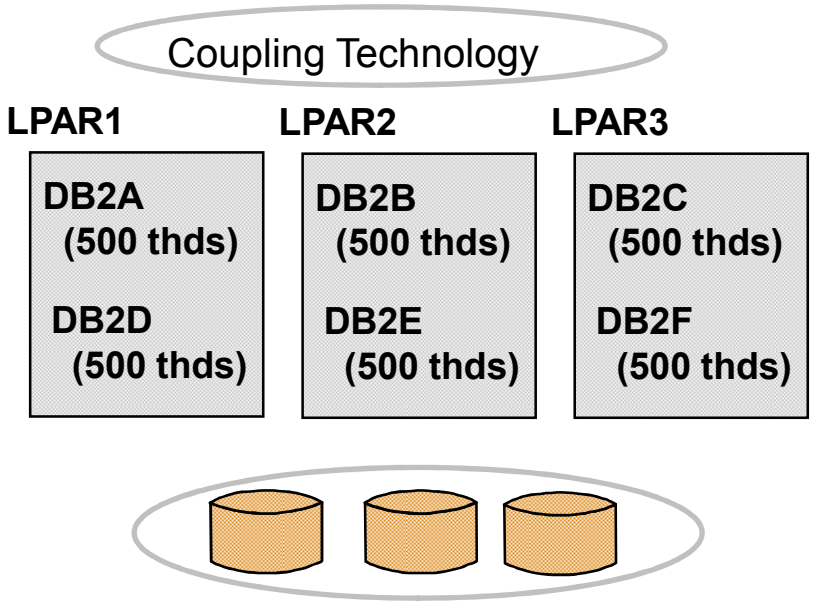
Scalability: Virtual storage constraint is still an important issue for many DB2 customers.

- DB2 9 helped (~ 10% – 15%)
- DB2 10 expects to move 90%
  - More concurrent work
  - Reduce need to monitor
  - Consolidate LPARs
  - Reduced cost
  - Easier to manage
  - Easier to grow



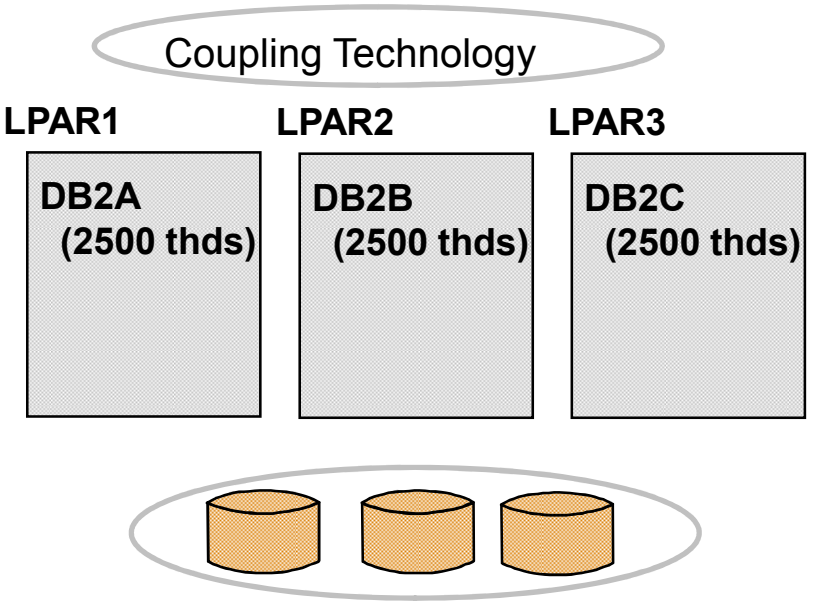
Running a Large Number of Threads

Today



- Data sharing and sysplex allows for efficient scale-out of DB2 images
- Sometimes multiple DB2s / LPAR

DB2 10



- More threads per DB2 image
- More efficient use of large n-ways
- SSI constraints are relieved
- Easier growth, lower costs, easier management
- Data sharing required for continuous availability and XXL scale

Other System Scaling Improvements

- Other bottlenecks can emerge in extremely heavy workloads
  - several improvements planned to reduce latching and other system serialization contention
  - new option to for readers to avoid waiting for updaters
  - eliminate UTSERIAL lock contention for utilities
  - Exploitation of 64-bit common storage to avoid ECSA constraints
- Concurrent DDL/BIND/Prepare processes can hit contention with one another
  - restructure parts of the DB2 catalog to avoid the contention
- SPT01 64GB limit can be a constraint, especially if “plan stability” support is enabled
  - relieve 64GB limit for SPT01

Performance

- Hash access path
- Parallel index update at insert
- Faster single row retrievals
- Inline LOBs
- LOB streaming between DDF and rest of DB2
  - Faster fetch and insert, lower virtual storage consumption
- DEFINE NO for LOBs (and XML)
- Enabling MEMBER CLUSTER for UTS
- Efficient caching of dynamic SQL statements with literals

Performance

- Buffer pool enhancements
  - Utilize z10 1MB page size
  - “Fully in memory” option
- Internal performance optimizations
  - Improved cpu cache performance
  - Exploit new h/w instructions
  - Streamlined DDF, RDS, DM, Index Mgr. performance-critical paths
- Exploitation of SSD

Query Performance and Manageability

- Safe query optimization: assess “reliability” of access path choices
- More Access path stability
- IN list performance*
- RID pool overflow to workfiles*
- Index include columns*
- Workfile spanned records, PBG support, and in-memory enhancements
- Auto Stats
- Instance based statement hints
- Single index access for complex OR predicates*
  - commonly used for cursor scrolling
- Query parallelism improvements*
- Index list prefetch to reduce need for index REORG

Optimization Stability and Control

Provide an unprecedented level of stability of query performance achieved by stabilizing access paths:

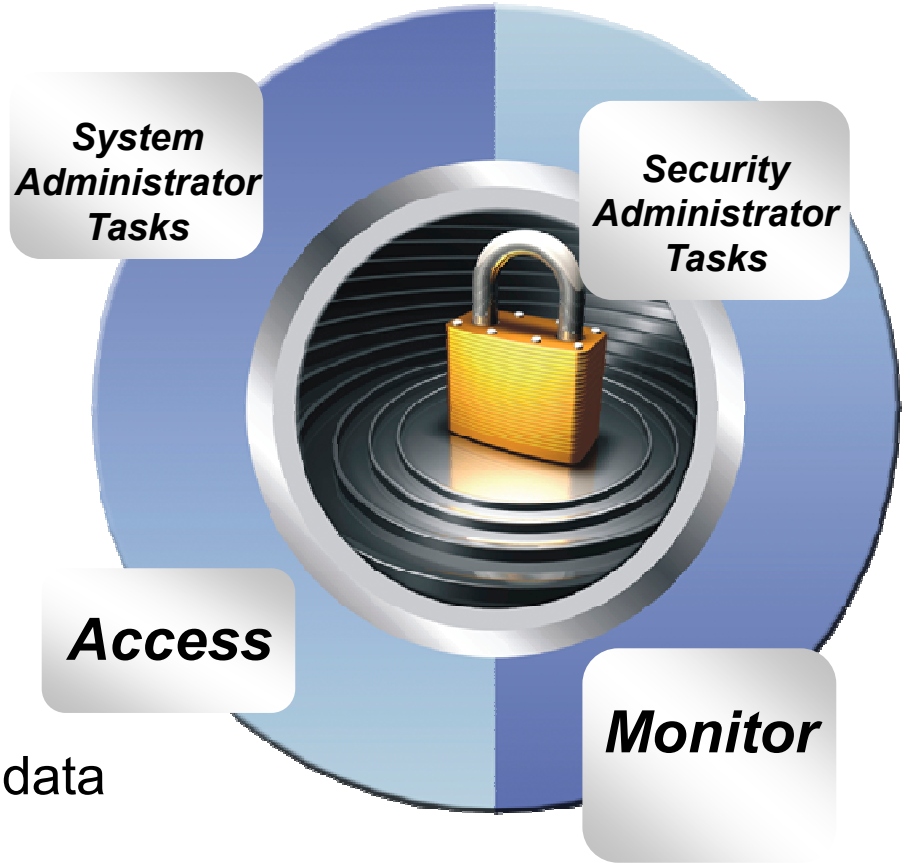
- Static SQL
  - Relief from REBIND regressions
- Dynamic SQL
  - Remove the unpredictability of PREPARE
  - Extend Static SQL benefits to Dynamic SQL

Support

- Access path repository
- Versioning
- “Fallback”
- “Lockdown”
- Manual overrides. Hints: easily influence access paths without changing apps
- Per-statement BIND options

DB2 10: Business Security & Compliance Needs

- Protect sensitive data from privileged users
  - SYSADM without data access
- Separate authority to perform security related tasks
- Allow EXPLAIN without execute privilege or ability to access data
- Audit privileged users

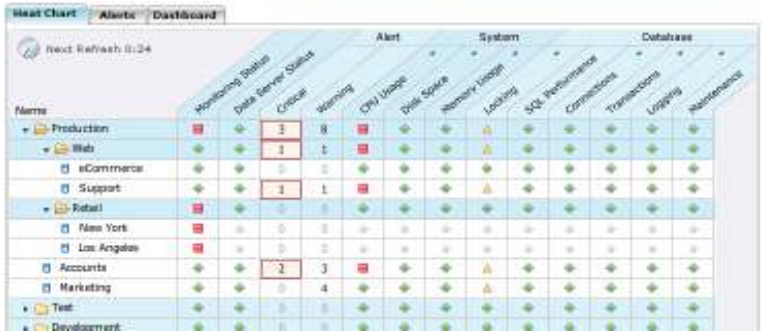


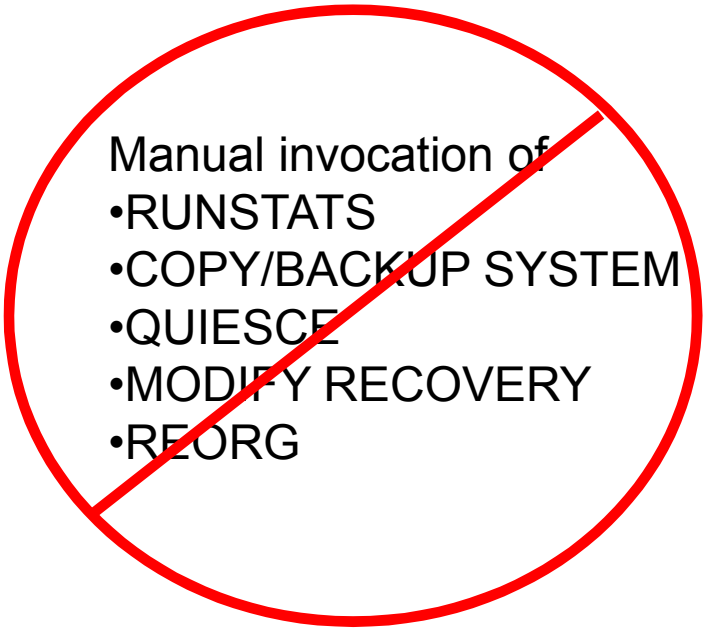
- "As of" query, temporal or versioned data
- Fine grained access control
  - Allow masking of value
  - Restrict user access to individual cells

Use disk encryption

DB2 10: Productivity – Doing More with Less!

- Auto statistics collection
- Compress 'on the fly'
  - Avoid need to run utility
- Timeout / deadlock diagnostics:
  - Identify SQL statements
- Automatic config of IBM supplied UDFs and SPs
- Access path stability
- Reduced need for REORG
  - Build compression dictionary on the fly
  - Index list prefetch enhancements
- Allow tailored names for DSNHDECP





Autonomics and DBA Productivity…

- Checkpoint intervals based on both time and # log records
- Run ‘must complete’ backout under pre-emptable SRB
- Identify unused packages

DB2 10 Utilities Enhancements

- REORG SHRLEVEL(CHANGE) for LOBs
- Online REORG enhancements
  - SHRLEVEL(CHANGE) support for all catalog/directory objects
  - Option to cancel blocking threads
  - Faster SWITCH phase
  - Allow disjoint partition ranges
  - Permit movement of rows between partitions when LOB columns exist
    - Allows REBALANCE or shrinking of PBG even though LOB columns exist
    - Allows DISCARD to delete associated LOB values
  - Messages to estimate length of REORG phases and time to completion

DB2 10 more utilities enhancements

- Support of spanned records for UNLOAD of LOB data
  - Currently unload of LOBs >32K must use FRVs
  - This allows inlining of LOBs with base row in unload dataset
  - Provides portability of data
- Performance enhancement for FRV processing with PDS datasets
  - UNLOAD 33% elapsed time reduction
  - LOAD 84% elapsed time reduction
- Extend support for UTF-16
  - Date, time & timestamp fields currently unloaded in UTF-8
  - Cannot specify a char value for a graphic column in WHEN clause

DB2 10: More Utility Improvements

- Improved COPY CHANGELIMIT performance
  - Use RTS instead of SM page scans
- Dataset level FlashCopy option
- FlashCopy backups with consistency and no application outage
- FlashCopy backups as input to:
  - RECOVER (fast restore phase)
  - UNLOAD
  - COPYTOCOPY, DSN1COPY
- RECOVER “back to” log point
- REPORT RECOVERY support for system level backups
- MODIFY RECOVERY improved performance
- RUNSTATS enhancements to support auto stats

Data Warehousing

- Moving Sum, Moving Average
- Enhanced query parallelism technology for improved performance
  - Remove query parallelism restrictions
- In-memory techniques for faster query performance
- Advanced query acceleration techniques

Key details about DB2 10

- CM, ENFM, NFM is planned
- Probable Prerequisites
  - z/OS V1.10
  - SMS managed, DB2 managed for DB2 catalog
  - DB2 9 for z/OS in NFM
  - z890, z990, z9 and above (no z800, z900)
- Eliminated:
  - Private protocol → DRDA (new help in DSNTP2DP)
  - Old plans and packages V5 or before → REBIND
  - Plans containing DBRMs → packages
  - ACQUIRE(ALLOCATE) → ACQUIRE(USE)
  - XML Extender → XML type
  - DB2 MQ XML user-defined functions and stored procedures → XML functions
  - DB2 Management Clients feature (DB2 Administration Server, Control Center, & Development Center) → IBM Data Studio application & administration services
  - msys for Setup DB2 Customization Center → install panels
  - BookManager use for DB2 publications → Info Center, pdf

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