IBM

DB2 for z/OS Trends and Directions

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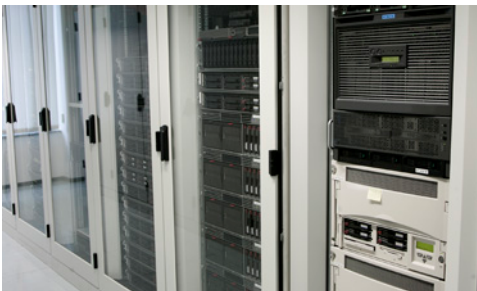
Pressures Faced by Data Centers Today

78% of CIOs
want to improve the way they use
and manage their data

70 cents per dollar
is spent operating / maintaining current IT
infrastructures rather than adding new
capabilities

7 out of 10 companies
in the Global 1000 will need to modify their
data centers to meet increased power and
cooling requirements

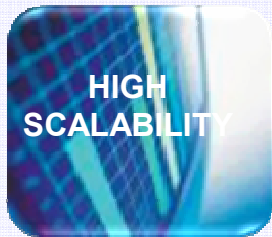# We Need Smarter Systems & Software for Enterprise Computing

To address today's business challenges – and - tomorrow's business opportunities and demands…

- Link and optimize multiple systems to work as a single, integrated service delivery platform

- Scale, without adding complexity, to meet the growing demands on the IT infrastructure

- Simplify data center management

- Transform IT into an engine for business innovation and growth

Customers Select DB2 for z/OS to Address their Critical Business Needs – Today and Tomorrow

High business growth

HIGH SCALABILITY

Continuous business operations

HIGH AVAILABILITY RELIABILITY

Flexibility and speed to respond

EXTREME VIRTUALIZATION

REAL TIME ANALYTICS

Reduce business risk

SECURITY

Reduce costs

EFFICIENCY

COST SAVINGS

Secure Cloud Services

CLOUD

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DB2 for z/OS: Outside-In Development Approach

- **Principals**
  - Buyers and Decision Makers
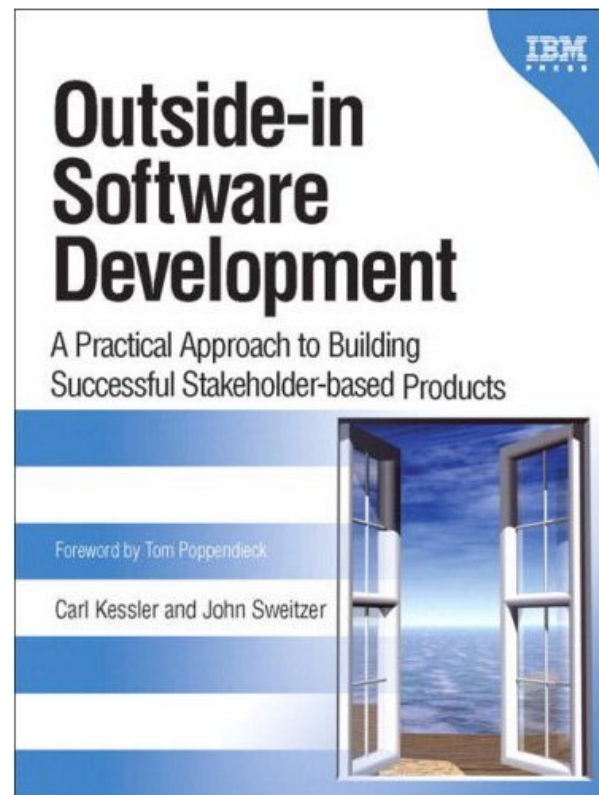 - CIOs, CTOs, & Sr. Business Mgmt

- **Insiders**
  - Inside interest in product aspects
  - IBM Execs; Product Managers; et.al.

- **Partners**
  - ISVs and Business Partners
  - SAP, DB2 Tools, BMC, etc.

- **End Users**
  - People who use the product to get their job done
  - DBAs and Application Programmers

Book cover: **Outside-in Software Development** — A Practical Approach to Building Successful Stakeholder-based Products. Foreword by Tom Poppendieck. Carl Kessler and John Sweitzer. IBM PRESS.

DB2 for z/OS Technical Strategy

- **Reduce cost of ownership**
  - Database technology that can handle large workloads with fewer people
  - Storage and cpu optimization, including specialty engines
  - Advanced autonomics to make the system more self-managing and self-tuning
  - TCO reductions through DB2 for z/OS Tools

- **Extend our 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

- **Application enablement**
  - Apps can easily connect to DB2 from anywhere
  - Advanced SQL, XML capability, application portability

DB2 for z/OS
The most robust and cost effective data server

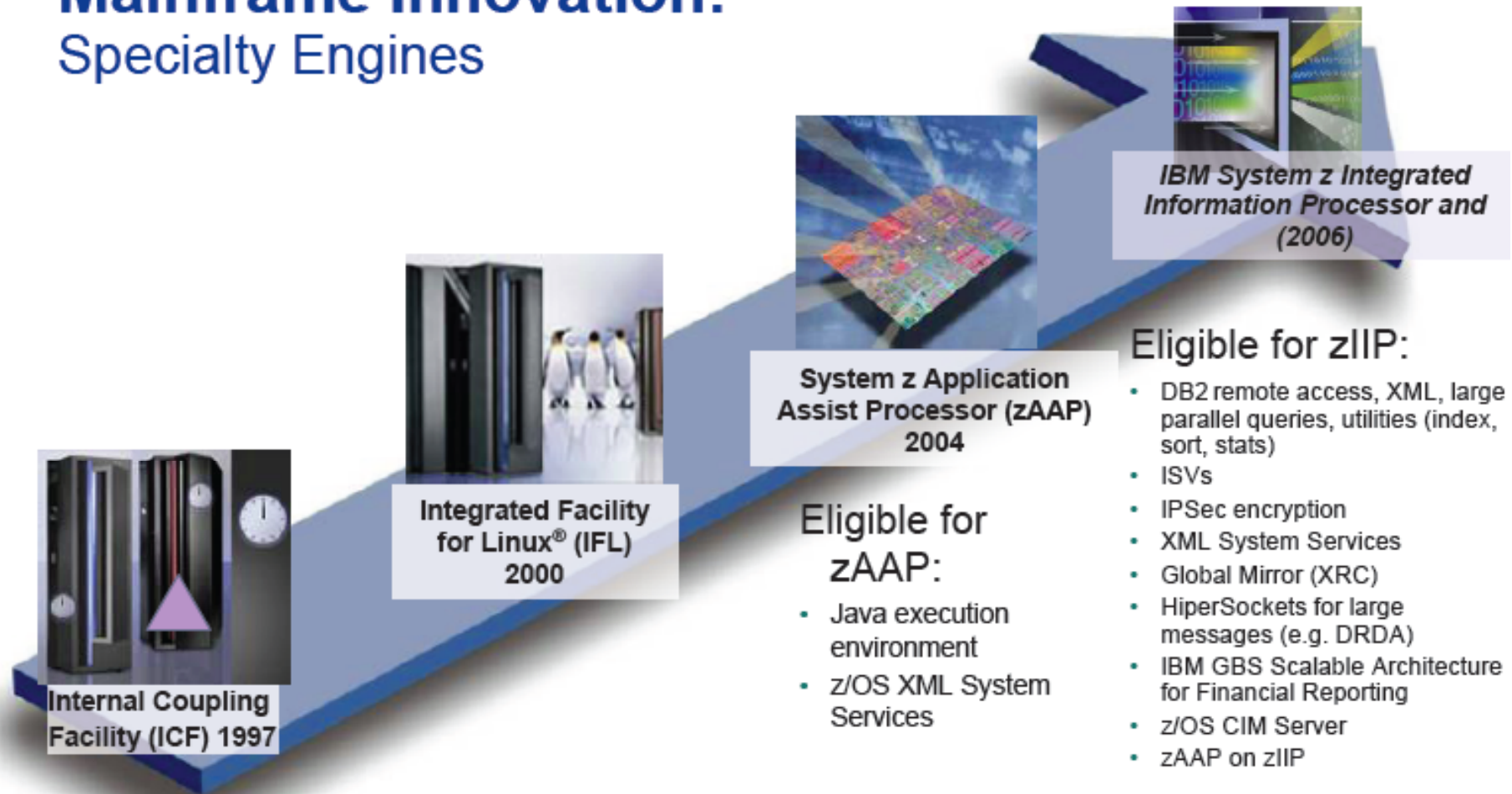|	DB2	DB2 9	DB2 10
Efficiency	• Deep synergy with System z • HW Compression • Consolidation	• Up to 20% utility CPU savings • Compress indexes, save 50% disk • More CPU on specialty engines	• Save up to 5-10% CPU batch & transactions out-of-the-box (rebind) • On-the-fly data Compression • Temporal data support • Skip-level migration
Resilience	• Unmatched availability • Unparalleled security • Industry leading reliability	• Flexible context and role security • Expanded online schema changes • Volume level backup & recovery	• Ten times more concurrent users • More online schema changes • More granular access control
Growth	• Near-linear scalability • Optimized for SOA • Flexible development • Warehousing capabilities	• Seamless integration of XML and relational • Improved SQL • Native SQL PL • Partition by growth • OLAP expressions	• Enhanced query parallelism • Advanced query acceleration • Query optimizations • More SQL compatibility • Improved pureXML and SQL PL

DB2 Deep Synergy with System z

Key integration points include:

– Data sharing (availability and scale out)

– zIIP and other specialty engines

– Unicode conversion

– Encrypted communication and data

– Hardware data compression & encryption

– Cross-memory, memory protection keys

– Sorting

– Multi-core, large N-way

– 64-bit addressing and large memory

– z/OS Workload Manager

– z/OS Security Server (RACF)

– z/OS RRS integrated commit coordinator

– System z10 1 MB page size, decimal float

– Solid state disks

– zEnterprise 196, z114, zBX, z10, …

**DB2 9 for z/OS
Performance Topics**

Redbooks

Mainframe Innovation:
Specialty Engines

IBM System z Integrated Information Processor and (2006)

System z Application Assist Processor (zAAP) 2004

Integrated Facility for Linux® (IFL) 2000

Internal Coupling Facility (ICF) 1997

Eligible for zIIP:

- DB2 remote access, XML, large parallel queries, utilities (index, sort, stats)
- ISVs
- IPSec encryption
- XML System Services
- Global Mirror (XRC)
- HiperSockets for large messages (e.g. DRDA)
- IBM GBS Scalable Architecture for Financial Reporting
- z/OS CIM Server
- zAAP on zIIP

Eligible for zAAP:

- Java execution environment
- z/OS XML System Services

* Statements represent the current intention of IBM. IBM development plans are subject to change or withdrawal without further notice.

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DB2 and IBM zIIP Add Value to Database Work

Portions of the following DB2 9 & DB2 10 workloads may benefit from zIIP or zAAP

- ➤ **DRDA over TCP/IP connections**
  - ▪ **DB2 9 for zOS remote native SQL procedures**
  - ▪ **DB2 9 XML parsing, DB2 schema validation**
  - ▪ **DB2 10 increased portion of DRDA redirected to zIIPS – up 60%**
    - – Improved performance via reduced processor switching

- ➤ **Requests that use parallel queries**
  - ▪ **Higher percentage of DB2 9 parallel queries are zIIP eligible**
  - ▪ **More DB2 10 queries are eligible enabling more parallelism**

- ➤ **DB2 utilities LOAD, REORG and REBUILD functions used to maintain index structures and sort**
  - ▪ **DB2 10 RUNSTATS – options other than column group, inline**

- ➤ **DB2 10 buffer pool prefetch and deferred write**

Hardware Trends for DB2 for Leverage

- **Drive toward multi core, slowing growth in processor frequency**
  - Higher n-ways, more parallelism bring potential latching bottlenecks, memory cache thrashing, …
  - S/W techniques for single threaded performance growth
  - Clustered systems for massive scale out and continuous availability

- **Specialty engines (price / performance)**

- **Hybrid systems, accelerators**
  - Use cores that are more specialized to their purpose
  - New performance opportunities
  - New programming paradigms (e.g. OpenCL)

- **Memory hierarchy design**
  - Higher CPU frequencies, n-ways make cache utilization a critical factor
  - Translation lookaside buffer design, large System z page sizes

- **Solid state disk (and other disk related improvements)**
  - Performance, energy consumption, reliability benefits of HDD

System zEnterprise Benefits for DB2
Taking System z to the next level

- **Faster CPUs, more CPUs, more memory → better DB2 performance and scalability**

- **Compression hardware expected to increase DB2 data compression performance**

- **Cache optimization, 192M L4 Cache expected to benefit DB2 work**

- **Hybrid architecture query performance acceleration with IBM Smart Analytics Optimizer**

- **Excellent synergy with DB2 10 → significant cost reduction and scalability increase**
  - CPU reductions
  - Remove key single system scaling inhibitors: virtual storage, latching, catalog, utilities, …
  - Translation Lookaside Buffer changes expected to improve performance for 1MB page sizes
  - Buffer pool management

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IBM zEnterprise Provides a New Dimension in Cloud Computing

The world's fastest and most scalable system:
IBM zEnterprise™ 196 (z196)

Unified management for a smarter system:
IBM zEnterprise Unified Resource Manager (zManager)

Scale out to a trillion instructions per second:
IBM zEnterprise BladeCenter® Extension (zBX)

Broad Network Access

Very large number of end user access from multiple sources including mobile devices

Rapid Elasticity

A new dimension of Scale. Most efficient platform for Large-scale Linux consolidation

Resource Pooling

1000s of virtualized systems across a heterogeneous resource pool

Measured Service

Meter, monitor, and track workloads for chargebacks and capacity expectations

On Demand Self-Service

Automate provisioning and service requests reducing provisioning cycles from weeks to minutes

IBM Smart Analytics Optimizer

Capitalizing on the best of both worlds – System z and Netezza

- **What is It?**

  - The IBM Smart Analytics Optimizer is a workload optimized, appliance add-on, that enables the integration of business insights into operational processes to drive winning strategies

  - Accelerates select queries, with unprecedented response times

- **How is it different?**

  - **Performance:** unprecedented response times to enable 'train of thought' analyses frequently blocked by poor query performance

  - **Integration:** connects to DB2 through deep integration providing transparency to all applications

  - **Self-managed workloads:** queries are executed in the most efficient way

  - **Transparency:** applications connected to DB2 are entirely unaware of the Optimizer

  - **Simplified administration:** appliance hands-free operations, eliminating many database turning tasks

Breakthrough technology enabling new opportunities

IBM Smart Analytics Optimizer V2

- **Next generation Smart Analytics Optimizer**
  - Capitalizing on Netezza technology
  - Access through and is highly integrated with DB2 for z/OS
  - Enhances expandability
  - More robust query execution
  - Lowers cost
  - Removes past restrictions

- **Beta target to begin 3Q 2011**

- **Investment protection – the full value of IBM Smart Analytics Optimizer V1 will be applied to IBM Smart Analytics Optimizer V2**

DB2 for z/OS Field Update

- **DB2 V8:**
  - V8 Withdrawal from Marketing:
    - Announced: December 2, 2008
    - Effective: September 8, 2009
  - V8 End of Service:
    - Announced: August 3, 2010
    - **Effective: April 30, 2012**
  - 25% of Top 100
  - 32% of Top 200

- **DB2 9 and DB2 10:**
  - GA dates: DB2 9:   March 16, 2007

                     DB2 10:   October 22, 2010

  - 72% of Top 100
  - 65% of Top 200
  - More than 50% of worldwide customers on DB2 9

- **Quality of DB2 9 (compared to V8):**
  - Lower overall PMR volume
  - Less Severity 1 APARs
  - Lower PE rate

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DB2 9 for z/OS

SOA Enablement	• pureXML • Optimistic locking for WebSphere • LOB performance, usability
Dynamic Warehousing	• Many SQL improvements • Dynamic index ANDing • Histogram statistics • New built-in OLAP expressions • Optimization Service Center
Simplification, Reduced TCO	• Index compression • Partition By Growth tables • Cloned tables • Volume based backup / recovery
Workload Consolidation	• More online schema changes • Online REBUILD INDEX • Trusted context and ROLEs • Parallel Sysplex clustering improvements

DB2 9 Reduced TCO and Administration Requirements

- **DB2 9 further reduces cost of ownership and System z-specific skill needs**

- **Improved productivity with increased consistency with DB2 family and other relational databases**

- **Cost reductions through processing reductions, use of zIIP, disk compression and improved memory use**

IDC: Since 2000, Labor Costs Have Exceeded the Cost of All Servers … and are Still Growing

Spending (USB$) —■— Installed Base (M Units)

■ **New server spending (USM$) 3% CAGR**

□ **Cost of mgmt. & admin. 10% CAGR**

BALDOR
MOTORS • DRIVES • GENERATORS
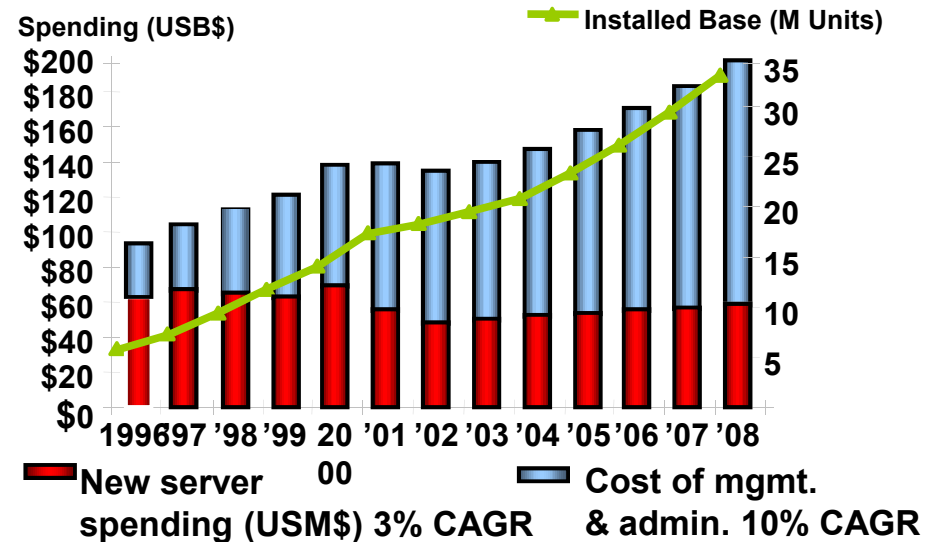
Decreasing cost of IT?

After consolidating SAP & DB2 on System z, IT expenses as a percentage of sales decreased from over 2% of sales to .9%!

DB2 9 for z/OS Performance Improvements

- **CPU reductions in utilities: LOAD, REORG, …**
  - Online REORG with no BUILD2 phase
- **LOB performance, function, scalability**
- **SQL and optimization improvements, inserts**
- **Use zIIP more**
  - Remote native SQL Procedure Language
  - Increased parallel work
- **Improved varying length performance**
- **Sequential disk access**

Most consumable DB2 9 improvements

Very little to no action:

- Utility CPU reductions
- Logging improvements
- Improved index page split
- Larger prefetch, write & preformat quantities
- LOB performance
- DDF VSCR
- Optimization Service Center & Opt. Expert

Requires some work:

- Changed online REORG
- Improved RUNSTATS
- Optimization improvements, EDMPOOL VSCR
- REOPT(AUTO) dynamic SQL
- Reordered row format
- Index: larger page sizes, compression, index on expression
- LOB lock avoidance

Business Partners: Many enhancements

- SHRLEVEL(REFERENCE) for REORG of LOB table spaces
- Online RENAME COLUMN
- Online RENAME INDEX
- Online CHECK DATA and CHECK LOB
- Faster REORG by intra-REORG parallelism
- More online REORG by eliminating BUILD2 phase
- LOB Lock reduction
- Skipping locked rows option
- Online REBUILD INDEX
- Change SCHEMA & VCAT
- Tape support for BACKUP and RESTORE SYSTEM utilities
- Recovery of individual tablespaces and indexes from volume-level backups
- Enhanced STOGROUP definition
- Utility TEMPLATE switching
- Conditional restart: automatic search for appropriate checkpoint
- CLONE Table: fast replacement of one table with another
- Buffer management by WLM

- Global query optimization
- Generalizing sparse index and in-memory data caching method
- Optimization Service Center
- Autonomic reoptimization
- Logging enhancements
- LOBs Network Flow Optimization
- Faster operations for variable-length rows
- NOT LOGGED table spaces
- Index on expressions
- Universal Table spaces
- Partition-by-growth table spaces
- APPEND option at insert
- Autonomic index page split
- Index page sizes 8K, 16K, 32K
- Support for optimistic locking
- Faster and more automatic DB2 restart
- MODIFY RECOVERY enhancements
- RLF improvements for remote application servers such as SAP
- Preserving consistency when recovering individual objects to a prior point in time

- DECIMAL FLOAT, BIGINT
- VARBINARY, BINARY
- TRUNCATE TABLE statement
- MERGE statement
- FETCH CONTINUE
- ORDER BY and FETCH FIRST n ROWS in sub-select and full-select
- ORDER OF extension to ORDER BY
- Various scalar functions
- XML support in DB2 engine
- Native SQL Stored Procedures, able to use zIIP
- SELECT FROM UPDATE/DELETE/MERGE
- Enhanced CURRENT SCHEMA
- IPv6 support
- Unified Debugger
- Network Trusted Context
- Database ROLEs
- Automatic creation of database objects
- Modify early code without requiring an IPL
- Utilities CPU reduction
- Temporary space consolidation
- . . .

DB2 9 Availability & Scalability Improvements

New features enhance availability & scalability of the DB2 9 environment manage your 7x24 infrastructure easily

- **New and improved DB2 capabilities**
  - Improved INSERT performance
  - New universal table space
  - Partition by growth
  - Not logged table space
  - Online schema change enhancements
  - Clone tables
  - Data sharing enhancements
- **More online utilities**
  - Online Reorg enhancements
  - Online Check Data, Check LOB
  - Online Rebuild Index
- **Memory improvements 64 bit++**

Land Registry
Cymraeg

UK government Land Registry runs DB2 for z/OS to maintain the world's largest known transaction processing (OLTP) database – 23.1 TB! [1]

1 - Winter Corporation's "2005 Top Ten" awards - http://www.wintercorp.com/index.html

Migration to DB2 9 for z/OS is easier

- **Migration process enhancements: ENFM speed, CM***
- **Much less performance regression:**
  - Earlier improvements
  - Plan stability & tools for avoiding access path issues
- **CCSIDs and old product issues resolved in V8**
- **Simpler virtual storage considerations**
- **Less impact from incompatible changes**
- **Earlier deliveries from vendors**

DB2 10 for z/OS

- **GA'ed October 2010**

- **Completed Largest Beta Ever**

  - Fastest license uptake 23 WW customers

  - +10 Extended Beta

  - Over 80 vendors

- **Fastest uptake out of the gate**

  - As of May 2011, over 120 customer orders … 3X that of prior release

  - More than 4X the number of licenses

  - About 25% are migrating from V8

  - Every core beta customer is continuing with migration plans

- **First customer already in production**

  - Migrated from V8 to V10

  - Quality/stability looking good

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What Customers want from DB2

✓ **Reduce CPU time 5% - 10%**

✓ **Increased ability to scale up**

✓ **Easier security compliance and audit**

✓ **Improved productivity**
  ✓ Temporal and more enhanced SQL & XML
  ✓ Administration, scaling and performance
  ✓ Move from DB2 9 or V8

✓ **Ready for production, stable and available**

✓ **Customer references**

Information Management
Draft Document for Review February 25, 2011 11:01 am

IBM
SG24-7942-00

DB2 10 for z/OS
Performance Topics

Triton
CONSULTING

DB2 10 for z/OS
A Smarter Database for a Smarter Planet

Online
reorganization

These and more addressed by DB2 10!

DB2 10

Customers seeing reduced costs, simplified workloads through proven technology

| Reduced Costs	Simplified Workloads	Proven Technology
"Based on the performance metrics from our controlled test environment, we see a significant amount of CPU and Elapsed time savings. This release has many features that will help bring down our operating costs." Morgan Stanley DB2 Team	"With DB2 10 able to handle 5-10 times as many threads as the previous version, the upgrade will immediately give the bank some much-needed room for future workload growth while simultaneously reducing their data sharing overhead." Paulo Sahadi - Senior Production Manager, Information Management Division at Banco do Brasil	"Every single SQL statement we have tested has been better or the same as our current optimal paths – we have yet to see any significant access path regression. We had to spend a lot of time tuning SQL with DB2 9, but we expect that to disappear when we upgrade to DB2 10." Philipp Nowak, BMW DB2 Product Manager
"We are particularly interested in the performance improvements due to the potential CPU reductions that we realized during our DB2 10 Beta testing. Our early testing has shown out-of-the-box processing cost reductions of between 5% - 10% and for some workloads as high as 30%. Potential cost savings of this magnitude cannot be ignored given today's business climate." Large Global Bank	*"We are really thrilled about "Temporal Data" feature – this feature has the potential to **significantly reduce overheads**. We have estimated that 80% of our existing temporal applications could have used "the DB2 10 temporal features" instead of application code - this feature will drastically save developer time, testing time – and even more importantly make applications easier to understand so improve business efficiency and effectiveness."* Frank Petersen – System Programmer Bankdata	The new audit capabilities in DB2 10 will allow tables to be audited as soon as they are created, which is an obvious benefit for the business and will reduce costs and simplify our processes" Guenter Schinkel -Postbank Systems AG

For more customer references visit
http://www.ibm.com/software/data/db2/zos/testimonials.html

DB2 10 Performance

- **Most customers can see a 5% - 10% out-of-the-box CPU reduction (transactions and batch) after rebind**
- **Some workloads and customer situations can see a CPU reduction of up to 20%**
- **Synergistic operation with latest System z hardware**

Sample: Preliminary 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

Average %CPU improvements version to version
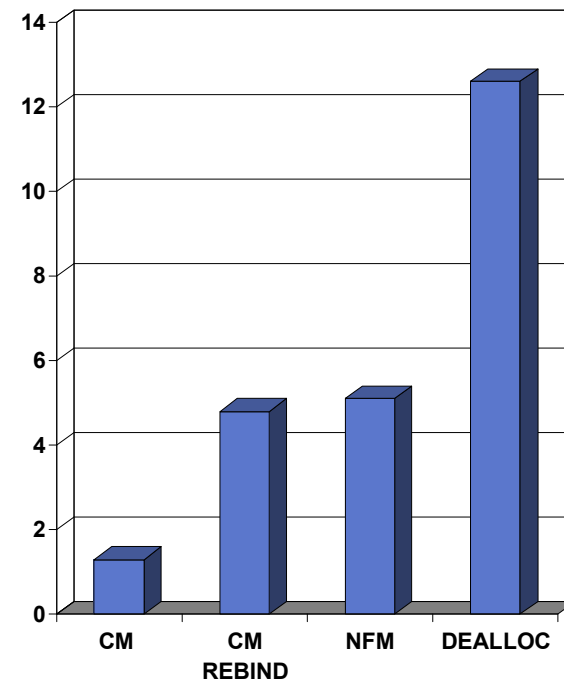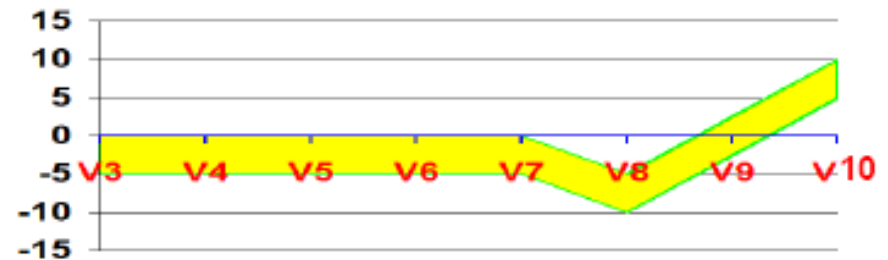
CPU Percent reduced from DB2 9

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Performance Enhancements

▪ **Requiring few changes (CM)**

- SQL runtime improved efficiency
- Address space, memory changes to 64 bit, some REBINDs
- Faster single row retrievals via open / fetch / close chaining
- Distributed thread reuse High Performance DBATs
- JCC Type2 and ODBC for z/OS performance improvements
- Parallel index I/O at insert
- Workfile in-memory enhancements
- Index list prefetch
- Solid state disk tracking in real time statistics
- Buffer pool enhancements
  - Utilize 1MB page frames on z10 or z196
  - "Fully in memory" option (ALTER BUFFERPOOL)

▪ **Requiring REBIND (CM)**

- Most access path enhancements
- Further SQL runtime improvements
- Use of RELEASE(DEALLOCATE)
- SQL paging performance enhancements
  - Single index access for complex OR predicates
- IN list performance
  - Optijized Stage 1 processing (single or multiple IN lists)
  - Matching index scan on multiple IN lists
- Safe query optimization
- Query parallelism improvements
- More Stage 2 predicates can be pushed down to Stage 1
- More aggressive merge of views and table expressions
  - Avoid materialization of views
- If migrating from V8, get new RUNSTATS before mass rebind

(cont) Performance Enhancements

- **Requiring NFM**
    - DB2 catalog concurrency and productivity
    - Compress on insert
    - Most utility enhancements
    - LOB streaming between DDF and rest of DB2
    - SQL procedure language performance improvements
    - Workfile spanned records, partition by growth
    - Access to currently committed data
    - Insert improvement for univeral table spaces
    - LRSN spin avoidance for inserts to the same page
    - Efficient caching of dynamic SQL statements with literals

- **Requiring NFM + DBA work**
    - Hash access path
    - Index include columns
    - Inline LOBs
        - Index on expression now possible for LOB columns
        - Important for spatial performance
        - LOAD/UNLOAD performance improvements
        - LOB compression for inline portion
    - DEFINE NO for LOB and XML columns
    - MEMBER CLUSTER for universal table space
    - Alter to universal table space, page size, data set size, segment size
    - Online reorg for all catalog and directory table spaces

Virtual Storage Improvements

- **DBM1 below 2GB**
  - 75-90% less usage in DB2 10 compared to DB2 9
  - Some working storage (stack, xproc storage) stays below 2GB

- **Larger number of threads**
  - Possible data sharing member consolidation

- **Improve CPU with storage**
  - More release deallocate
  - Larger MAXKEEPD values for KEEPDYNAMIC=YES

DB2 10

Global DSC	CT/PT
DBD	
Local DSC	SKCT SKPT
Thread / Stack	

Thread / Stack/ working

75-90% less usage
DBM1 below

IBM. Reliable Global
Announcing DB2 10 for z/OS
Savings…right out of the box
Market Leader Secure
Trustworthy Innovative
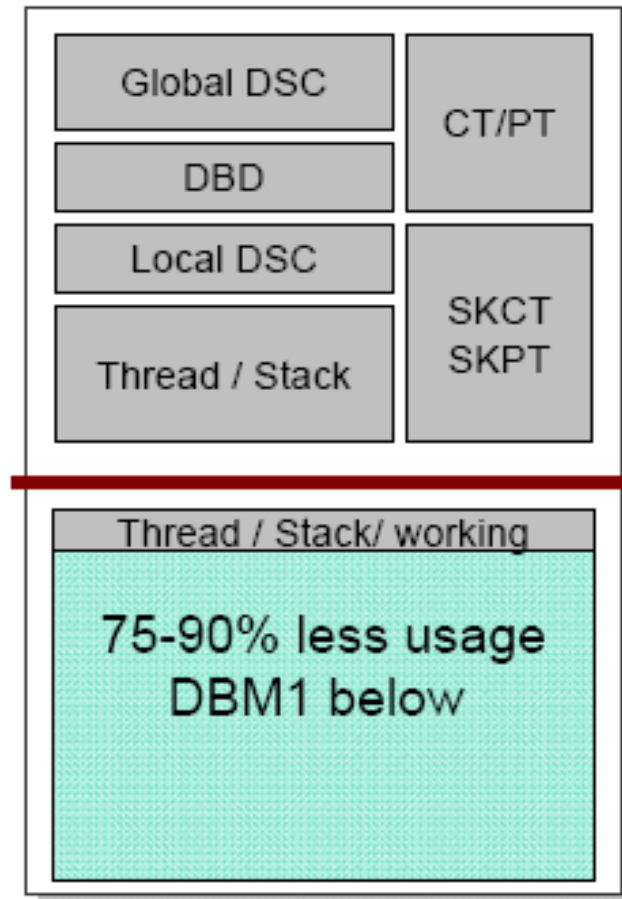
Business Security & Compliance

- **Protect sensitive data from privileged users and improve productivity**
  - SECADM & DBADM without data access
  - Usability: DBADM for all DB
  - Revoke without cascade

- **Separate authorities to perform security related tasks, e.g. security administrator, EXPLAIN, performance monitoring and management**

- **Audit privileged users**

- **Row and column access control**
  - Allow masking of value
  - Restrict user access to individual cells

System Administrator Tasks

Security Administrator Tasks

Database Administrator Tasks

Access

Monitor

Audit

Productivity – Doing More with Less!

- **Easier scaling, simpler memory management**

- **Reduce contention, more online processing**

- **Reduced need for REORG**
  - Build compression dictionary on the fly
  - Index list prefetch enhancements
  - Row-level sequential detection

- **Configure IBM UDFs and stored procedures**

- **Statement level monitoring**

- **New DSNTIJXZ job to update migration input datasets with current zparm values**

- **DDF thread management enhancements**

Manual invocation of
- RUNSTATS
- COPY/BACKUP SYSTEM
- QUIESCE
- MODIFY RECOVERY
- REORG

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Query Enhancements

- **Query processing enhancements**
  - Improved caching of dynamic SQL with literals
  - Safe query optimization
  - Aggressive view merge
  - IN list processing
  - SQL pagination
  - Parallelism enhancements
  - Index include columns

- **Access path stability**
  - Relief from package REBIND regression

- **Optimization techniques**
  - Remove parallelism restrictions; more even parallel distribution
  - Scalability: memory and latching relief allows more parallelism
  - Optimization validation with Real Time Statistics
  - In-memory techniques for faster query performance
  - Multiple IN-List matching
  - IN-List predicate transitive closure

- **RID overflow to workfile**
  - Mitigate increased workfile usage by increasing RID pool size
  - MAXTEMPS_RID zparm for maximum WF usage for each RID list

- **Sort performance enhancements**
  - Avoid workfile usage for small sorts
  - Hash support for large sorts

- **Query parallelism enhancements**
  - Removing parallelism restrictions
    - Allow parallelism if a parallel group contains a work file
    - Support parallelism with multi-row fetch
  - Parallelism effectiveness
    - dynamic record range partitioning
    - Straw model parallelism

Application Enablement and Portability

- **Bi-temporal data (data versioning)**

- **pureXML enhancements**

- **Large object improvements**
  - Allow non-NULL default values for inline LOBs
  - Load and unload tables with LOBs

- **SQL enhancements**
  - Currently committed locking semantics
  - Implicit casting or loose typing
  - Timestamp with time zone
  - Variable timestamp precision – seconds to picoseconds
  - Moving Sum, Moving Average
  - SQLPL performance improvements

DB2 10's Temporal Data

IBM Innovation – 1st in the industry with standard bi-temporal support!

DB2's temporal data capabilities enable customers to implement time-aware applications/queries that analyze/manage past, current and future events with minimal effort. Achieve audit and compliance initiatives, correct human errors and ensure the integrity of data over time

➢**System time** – relates to the time when the data was put into the system; Start and end timestamp values maintained by DB2
  - *e.g. When an insurance policy is modified or a loan created*
  - Enable regulatory compliance and auditing

➢**Application time (aka 'Business time')** – relates to the business transaction or business-relevant time period of the data; Start and end values maintained by the application
  - *e.g. Effective dates for the terms of an insurance policy*
  - Ease the tracking of business events over time
  - Application logic greatly simplified

➢**Bi-temporal** – both System time and Business time exists in a single table

➢**Inclusive-exclusive** for modeling time periods
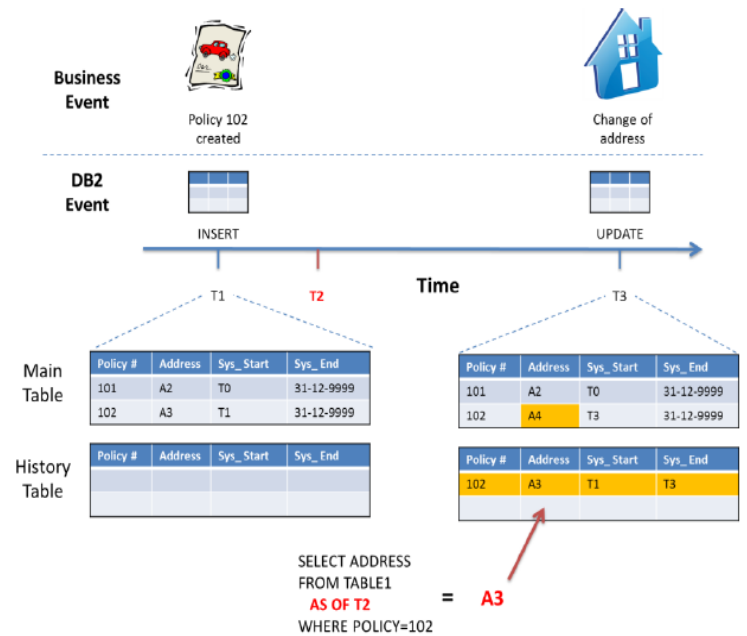
Graphic from Triton Consulting

Global cross-industry applicability
Benefits includes application simplification, faster adherence to compliances and savings of time/effort

pureXML Improved Performance and Usability

- **XML schema validation in the engine for improved usability and performance**

- **Binary XML exchange format improves performance**

- **XML multi-versioning for more robust XML queries**

- **Allow easy update of XML document nodes**

- **Stored procedure, UDF, Trigger enhanced support**

- **XML index matching with date/timestamp**

- **CHECK DATA utility checks XML**

DB2 10 for z/OS' Skip-Level Migration

V7 → V8 → DB2 9 → DB2 10

Introducing DB2 10 for z/OS

Announce Oct 19, 2010
GA Oct 22, 2010

- **Option to move from V8 to DB2 10**
  – Help V8 customers catch up and reposition themselves to stay current as subsequent releases becomes available
  – Support for DB2 for z/OS V8 will formally end April 30, 2012

- **Migration, fallback and data sharing coexistence fully supported**
  – Mix of DB2 9 and 10 -OR- DB2 V8 and 10
  – Migration checklist provided

- **DB2 10 Upgrade Timing based upon many factors including: GA, v8 end of service, other software, ability to test early software, and more…**
  – Organizations needing to complete their V8 upgrade to DB2 10 should begin planning their V8 upgrade immediately if they plan to complete their V10 upgrade before V8 support is withdrawn in April 2012

Skip Migration Overview V8 → 10
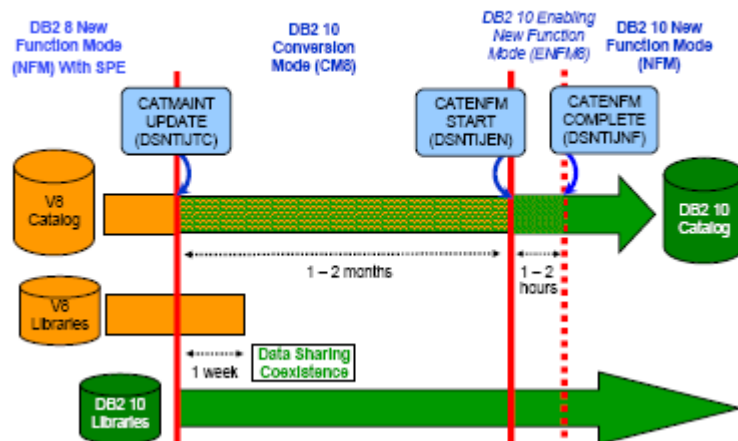
Normal Migration Overview DB2 9 → DB2 10
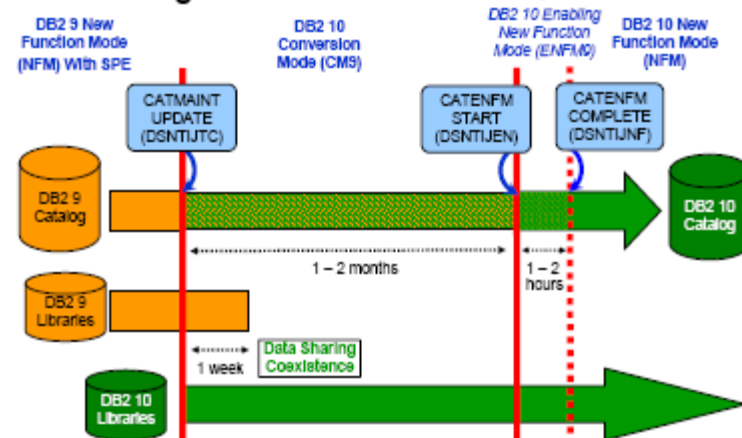
Migration and Planning

- **Early customer adopters of V10 migrating from either V8 or V9 should make plans and take extra care to mitigate against the risk of instability**

  – Perform application regression and stress testing to keep 'fires' away from production
  – Need to be more aggressive on planned continual application of preventative service
    - Will have to stay a lot more current than 2 full 'major' drops a year
    - Regular full 'major' maintenance drops including HIPERs/PEs essential required for the first year or so
      - Maybe 4 'major' drops in the first year
    - Can move to 2 'major' and 2 'minor' maintenance drops as the release passes the early adopter curve
    - Exploit CST/RSU recommended maintenance as opposed to the PUT route
      - Recommended maintenance after successful testing for a least one month
      - Testing performed over and above that performed by DB2 Development
      - CST testing still does not replace customer regression/stress testing
  – Must be prepared to tolerate hit some 'bumps in the road'
  – Customer who are not prepared to take mitigating actions and have no tolerance for 'bumps in the road' should not be early adopters
    - V8 customers should migrate to V9 quickly as it is relatively stable

Preview of DB2 XI for z/OS
Continuing on the success of DB2 10

Reduce costs – save money, save time	• Businesses and IT are being challenged to do more with existing (or decreased) budget and staff
Simple to use, manage and migrate	• Ensure fast ROI and fewer unique skills
Unmatched availability, reliability & security	• Highly secure 24x7 access to core business data is more important than ever. Rising SLA requirements bring new challenges
Integrated support for new workloads	• Real-time business analytics, WPS, Cognos, SPSS, Content, MDM, Portal and more

Savings and benefits directly out of the box!

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DB2 XI

Subject to change until GA – refer to the disclaimer at the beginning of this presentation

- **Continuous Availability Improvements (Reliability, Availability, Serviceability)**
  - Continue to extend the lead in these areas
  - Parallel Sysplex – the best scale-out solution in the industry
  - Continue tight integration between DB2 and System z hardware and z/OS operating system
  - Advanced solutions for data security and privacy regulation compliances
  - Workload consolidation – System z is the ultimate consolidation platform
  - Continue storage and CPU optimizations including specialty engines

- **Performance and Scalability**
  - Continue improvements for OLTP workloads
  - Continue improvements for data sharing
  - High INSERT workloads
  - Continue query performance improvements

- **Autonomics and Ease of Management**
  - Database technology to handle larger workloads without increasing staff
  - Clear, intuitive and easy to use interfaces
  - Advanced autonomics to improve system self-management and self-tuning
  - Utilities enhancements

- **Application Enablement**
  - Application connectivity to DB2 from anywhere
  - Continue application portability and DB2 family compatibility
  - Advanced SQL, XML capabilities
  - Advanced data warehousing and analytics capabilities
  - Continue ISV enablement

TCO pervasive across all DB2 XI

Strengthening the DB2 for z/OS team in Asia Pacific and Europe

- **Significant investment in building regional support skills for DB2 for z/OS products**
  - Training provided directly by Silicon Valley Lab team (L2 and Development)
  - Enablement of full coverage across all DB2 for z components

- **DB2 Technical support**
  - "Follow The Sun" dedicated technical support organization

- **DB2 Advocate Program**
  - Assignment of a lab advocate to champion client issues and requirements back into the lab

Academic Initiative Offerings

- Access to IBM hardware and software

- Course materials and textbooks

- Ongoing Faculty skills development (seminars and workshops)

- Roundtables

- Certification and Mastery offerings and discounts

- Curriculum assistance (Examples of majors, concentrations, and certificate programs)

- zSkills Help Desk

- Tutorials, articles and Redbooks

- Forums, technical webcasts, forums and newsletters

- Student portal

- Student Opportunity System

- Contests

- System z Job Board

Membership in the IBM Academic Initiative is free and open to individual faculty members.

Apply at *ibm.com/university/academicinitiative*

- Worldwide program
- Supports many IBM Brands and technologies
- Encourages open standards, open source

Mainframe computing is set for a rebirth – Sept 2009 CIO
"you cannot think seriously about your longer-term IT architecture without thinking equally seriously about what today's mainframe environment has to offer"

Member Schools Worldwide in System z Academic Initiative

- **Participation continues to increase**
  - **814** membership schools
  - Reaching students in over 61 countries

- **WW demographics**
  - 45% North America
  - 24% Europe, Middle East, and Africa
  - 16% Latin America
  - 15% Asia/Pacific

- **Wide variety of schools in the program**
  - Different level of participation

- **All programs are unique**
  - Designed to provide flexibility to the school to meet their requirements and capabilities

Chart showing growth: 24 (YE2003), 70 (YE2004), 213 (YE2005), 294 (YE2006), 408 (YE2007), 537 (YE2008), 643 (YE2009), 814 (YE2010)

System z Job Board

http://www.systemzjobs.com

Connects IBM clients, partners and businesses with students and professionals seeking System z job opportunities

Typical Utilization for Servers
Windows: 5-10%   Unix: 10-20%   **System z: 85-100%**

System z can help **reduce** your floor space
up to **75%-85%** in the data center

Thank You

System z can lower your total cost of ownership, requiring **as little as 30%**
of the power of a distributed server farm running equivalent workloads

The cost of storage is typically **three times more** in
distributed environments

DB2 9 and DB2 10 Resources

- **Website** http://www.ibm.com/software/data/db2/zos/db2-10/
  - Case Studies, Customer statements
  - Demos: DB2 10 for z/OS, QMF 10
  - Brochures: DB2 10 for z/OS Highlights, QMF 10 What's New

- **Presentations**
  - DB2 10's new functions – ftp://public.dhe.ibm.com/software/data/db2/zos/presentations/v10-new-function/
  - Overviews - ftp://public.dhe.ibm.com/software/data/db2/zos/presentations/overview
  - Migration - ftp://public.dhe.ibm.com/software/data/db2/zos/presentations/migration

- **Books**
  - DB2 10 for z/OS Technical Overview http://www.redbooks.ibm.com/abstracts/sg247892.html
  - DB2 10 for z/OS Performance Topics – *coming soon* http://www.redbooks.ibm.com/abstracts/sg247942.html
  - Extremely pureXML in DB2 10 for z/OS http://www.redbooks.ibm.com/abstracts/sg247915.html
  - DB2 10 for z/OS Book ftp://public.dhe.ibm.com/common/ssi/ecm/en/imm14075usen/IMM14075USEN.PDF
  - DB2 10 Security – *coming*
  - DB2 9 Technical Overview http://www.redbooks.ibm.com/abstracts/sg247330.html
  - DB2 9 Performance Topics http://www.redbooks.ibm.com/abstracts/sg247473.html
  - DB2 9 Stored Procedures http://www.redbooks.ibm.com/abstracts/sg247604.html
  - DB2 9 Resource Serialization and Concurrency Control http://www.redbooks.ibm.com/abstracts/sg244725.html
  - DB2 9 Distributed Functions http://www.redbooks.ibm.com/abstracts/sg246952.html
  - DB2 9 Utilities http://www.redbooks.ibm.com/abstracts/sg246289.html
  - DB2 and Storage Management http://www.redbooks.ibm.com/abstracts/sg247823.html
  - Index Compression with DB2 9 for z/OS http://www.redbooks.ibm.com/abstracts/redp4345.html
  - Enterprise Data Warehousing with DB2 9 for z/OS http://www.redbooks.ibm.com/abstracts/sg247637.html
  - 50 TB Data Warehouse Benchmark on IBM System z http://www.redbooks.ibm.com/abstracts/sg247674.html
  - LOBs with DB2 for z/OS http://www.redbooks.ibm.com/abstracts/sg247270.html
  - Deploying SOA Solutions http://www.redbooks.ibm.com/abstracts/sg247663.html
  - Data Sharing in a Nutshell http://www.redbooks.ibm.com/abstracts/sg247322.html

DB2 10 Resources ...

- **(cont) Books**
  - Securing DB2 and Implementing MLS on z/OS http://www.redbooks.ibm.com/abstracts/sg246480.html
  - DB2 9 for z/OS Data Sharing: Distributed Load Balancing and Fault Tolerant http://www.redbooks.ibm.com/abstracts/redp4449.html
  - DB2 9 for z/OS Packages Revisited http://www.redbooks.ibm.com/abstracts/sg247688.html
  - Ready to Access DB2 for z/OS Data on Solid-State Drives http://www.redbooks.ibm.com/abstracts/redp4537.html
  - DB2 9 for z/OS: Buffer Pool Monitoring and Tuning http://www.redbooks.ibm.com/abstracts/redp4604.html
  - Securing and Auditing Data on DB2 for z/OS http://www.redbooks.ibm.com/abstracts/sg247720.html

- **Whitepapers**
  - Business Value Whitepaper – Julian Stuhler, Triton Consulting: "DB2 10 for z/OS: A Smarter Database for a Smarter Planet" *http://public.dhe.ibm.com/software/data/sw-library/db2/analystreports/tritonconsulting-db210forzos-smarterdatabase.pdf*
  - A Matter of Time: Temporal Data Management *http://public.dhe.ibm.com/software/data/sw-library/db2/papers/A_Matter_of_Time_-_DB2_zOS_Temporal_Tables_-_White_Paper_v1.4.1.pdf*
  - Why DB2 for z/OS is Better than Oracle RAC https://www14.software.ibm.com/webapp/iwm/web/signup.do?lang=en_US&source=sw-infomgt&S_PKG=db2z-better-thank-oracle-rac-wp
  - zJournal article by Willy Favero http://www.mainframezone.com/z-journal

DB2 10 Resources …

- <u>**SAP Whitepapers**</u>
  - **SAP article on DB2 10** *(published by SAP)* http://www.sdn.sap.com/irj/sdn/db2
  - **SAP Best Practice Guide for Migrating to DB2 10 for z/OS** *(published by SAP)* https://websmp207.sap-ag.de/~sapidb/011000358700001414122010E
  - **(Updated) Business Continuity Guide for Running SAP on System z – based on DB2 10 for z/OS, DB2 Connect 9.7 FP3a, SAP NetWeaver 7.10 and Tivoli Automation for z/OS V3.3** http://publibfp.dhe.ibm.com/epubs/pdf/iapacs03.pdf
  - **DB2 10 for z/OS with SAP on IBM System z Performance Report – new techdocs white paper** http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/WP101845
  - **DB2 10 for z/OS – Optimized for SAP –** http://cattail.boulder.ibm.com/cattail/?source=s#view=andreas.r.mueller@de.ibm.com/files/3198290001883DDBA202FBE4093F23B6
  - **SAP on DB2 10 for z/OS - Being More Productive, Reducing Costs and Improving Performance –** http://www.sdn.sap.com/irj/sdn/db2?rid=/library/uuid/005c6b33-aaf0-2d10-fcbb-b42e89ac5791
  - **Enhancing SAP by Using Db2 9 for z/oS** http://www.redbooks.ibm.com/abstracts/sg247239.html
  - **Best Practices for SAP BI using DB2 9 for z/OS** http://www.redbooks.ibm.com/abstracts/sg246489.html

<u>**Some Certifications so far...**</u>
- SAP NetWeaver 7.30 and SAP R/3 4.6 is certified for DB2 10
- SAP NetWeaver 7.00 and 7.01 are certified for DB2 10
- PeopleSoft PeopleTools 8.50 and 8.51 is certified for DB2 10