IBM Software Group

DB2 for z/OS Version 9 Update

DB2 Information Management Software

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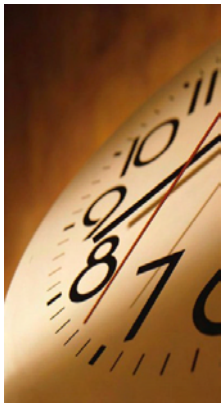
e business on demand software

Greatest Hits: DB2 for z/OS V8

- ✓High availability
- ✓Scalability or very large database
- ✓Java and the web
- ✓Queries and data warehouses
- ✓Migrating or porting applications
- ✓Application packages

SAP PEOPLESOFT SIEBEL

Continuous Availability

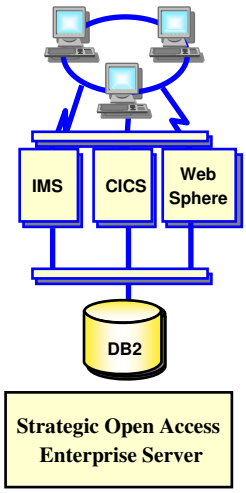


- Online Schema Evolution: database changes with ALTER instead of DROP / CREATE e.g. ADD partition
- System-Level Log Point Recovery
- Data Partitioned Secondary Indexes
- Improved LPL Recovery
- Additional online zparms

Scalability and Very Large Database

- Add partitions
- Separate partitioning & clustering
- Index improvements
- 4096 Partitions
- Rotate partitions
- Extend columns
- Optimization improvements
- Memory and scale increased

Java and the web



- Application Connectivity for JAVA
- Improve data sharing member routing
- LOCATION aliases at requester & server
- Extended function, standards
- Reduced processing
- Stored Procedure Enhancements
- Java Universal Driver

Queries and data warehouses

- Optimization Improvements
  - Improved techniques
  - Enhanced data
  - Visual Explain
- Enhanced index options
- Materialized Query Tables
- New Partitioning options
- QMF improvements
- SQL enhancements

Migrating and porting applications

- Multi-row INSERT, FETCH & UPDATE
- GET DIAGNOSTICS
- INSERT within SELECT
- IDENTITY Column enhancements
- SEQUENCES
- CURRENT PACKAGE PATH
- SQL Procedure Language
- Dynamic Scrollable Cursor, Common Table Expression, Recursion
- Scalar Fullselect
- Materialized Query Table
- UNICODE SQL, Multiple CCSIDs
- XML Publishing
- Long names, long statements...

Enterprise Applications & : DB2 for z/OS

SAP 4.6 certified

PEOPLESoft 8.45 certified

SIEBEL 7.8 certified

- 64 bit virtual storage
- Unicode
- Schema evolution
- System-level backup and recovery
- Multi-row fetch & insert
- Multiple DISTINCT Clauses
- Lock Contention on volatile Tables
- Fast Retrieval of Most Recent Value
- Longer Table Names & Column Names
- Additional statistics
- Convert Column Type
- Altering CLUSTER Option
- Adding Columns to Index
- Index-only Access Path for VARCHAR
- Adding New Partitions
- Separate Clustering from Partitioning
- ...

DB2 for z/OS Version 8 is

- ✓ **SQL OLTP Leadership**: name lengths, statements, scrolling, expressions, predicates, diagnostics, …
- ✓ **Break through limitations**: storage, partitions, log
- ✓ **Performance enhancements**: index, materialized query tables, more efficient IO, multi-row
- ✓ **Database changes without an outage**: add partition, rotate partition, backup / restore
- ✓ **Integration**
  - System z, z/OS & ESS platform
  - Middleware stack

SAP PEOPLESoft SIEBEL

Rational. WebSphere. DB2. Lotus. Tivoli.

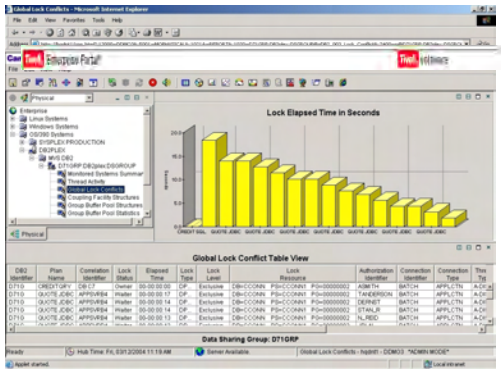
Reengineered for e-business on demand

DB2 for z/OS Version 8 News

- **New function**
  - now
    - **Cross loader with LOBs**
    - **Built in functions ASCII, TIMESTAMPDIFF**
    - **DSN1COPY with 1000 OBIDs**
    - **QMF with multirow fetch**
    - **Online Check Index**
    - **z/OS 1.7 up to 7257 extents**
  - soon
    - **LOAD, UNLOAD with LOBs**
    - **IBM System z9 Integrated Information Processor (IBM zIIP)**
- **New and updated books: Library refresh Feb. 2006**
- **Messages, Codes became separate books August 2005**
- **Redbooks: Design Guidelines for High Performance and Availability, Business Value, Performance Topics, WebSphere, MLS, Disaster Recovery, others updated …**
- **Customer information on the web**

Tivoli OMEGAMON XE for DB2 PE on z/OS 3.1.0

- Improved ability to monitor and manage mainframe based applications through a single integrated solution
- Familiar interfaces from DB2 PE and OMEGAMON XE products provides easy migration
  - DB2 z/OS v8 exploitation
  - DB2 Connect reporting/monitoring
  - Performance warehouse (historical data mining)
  - DB2 to CICS transaction linking
  - History monitoring
  - Event exceptions
  - Threshold checking



http://www.ibm.com/software/tivoli/products/omegamon-xe-db2-peex-zos/

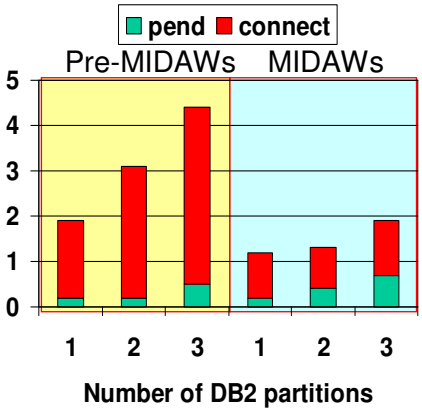
IBM System z9, z/OS & DB2 for z/OS

✓System z9 Integrated Information Processor (zIIP)
✓Enhanced Cryptography
✓Enhanced channels (MIDAW)
✓Faster Processors
✓Up to 54 Processors
✓More memory, better value; 64 bit virtual storage
✓z/Architecture new instructions
✓…

Baldor Electronic

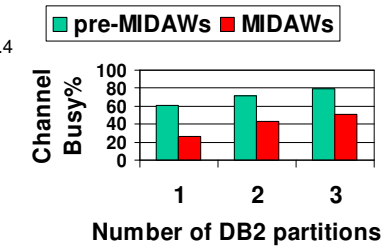
✓Backup and restore
✓Multilevel Security
✓Unicode conversion
✓Compression
✓System z Application Assist Processor
✓WLM enhanced
…

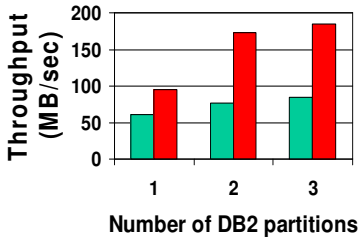
Parallel DB2 Table Scan, EF 4K (single channel)



Configuration:
- **MIDAW:** z/OS 1.7
- **Pre-MIDAW:** z/OS 1.4

- DB2 for z/OS V8
- 4000 byte row size
- System z9 109
- FICON Express 2
- 2 Gbit/sec link
- DS8000 control unit





Technology Evolution with Mainframe Specialty Engines

Building on a strong track record of technology innovation with specialty engines, IBM intends to introduce the System z9 Integrated Information Processor

IBM System z9 Integrated Information Processor (IBM zIIP) planned for 2006

Designed to help improve resource optimization for eligible data workloads within the enterprise

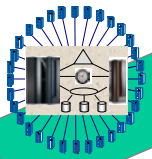
System z9 Application Assist Processor (zAAP) 2004

Incorporation of JAVA into existing mainframe solutions

Integrated Facility for Linux (IFL) 2001

Support for new workloads and open standards

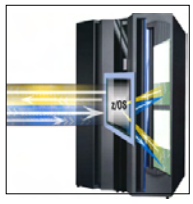
Centralized data sharing across mainframes



Internal Coupling Facility (ICF) 1997

New IBM System z9 Integrated Information Processor (IBM zIIP)

- New specialty engine for the System z9 mainframe designed to help:
  - Customers integrate data across the enterprise
  - Improve resource optimization and lower the cost of ownership for eligible data serving workloads
- z/OS manages and directs work between the general purpose processor and the zIIP
  - Number of zIIPs per z9-109 not to exceed number of standard processors. No changes to DB2 for z/OS V8 applications
- DB2 for z/OS V8 will be first user of the zIIP with
  - System z9 109
  - z/OS 1.6 or later
  - DB2 for z/OS V8
- Webcast replay ibm.com/servers/systems/z/2006/



DB2 V8 and IBM zIIP can add value to database work

- Portions of the following DB2 for z/OS V8 workloads may benefit from zIIP*:

1 - ERP, CRM, Business Intelligence or other enterprise applications
- Via DRDA over a TCP/IP connection

New Specialty Engine

2 - Data warehousing applications*
- Requests that utilize star schema parallel queries

3 - DB2 for z/OS V8 utilities*
- Internal DB2 utility functions used to maintain index maintenance structures

*** The zIIP is designed so that a program can work with z/OS to have all or a portion of its enclave Service Request Block (SRB) work directed to the zIIP. The above types of DB2 V8 work are those executing in enclave SRBs, of which portions can be sent to the zIIP.**

Vnext DB2 Technology Themes

- **Enable high-volume transaction processing for next wave of Web applications**
  - **Extend the lead in transaction processing availability, scalability and performance**
  - **Reduce cost of ownership and zSeries-specific skill needs**
  - **Improve data warehousing and OLTP reporting**

DB2 SQL

z z/OS V7
common
LUW Linux, Unix & Windows V8.2

z — Range partitioning

common — Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index Support, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, Call from trigger, statement isolation

LUW — Updateable UNION in Views, ORDER BY/FETCH FIRST in subselects & table expressions, GROUPING SETS, ROLLUP, CUBE, INSTEAD OF TRIGGER, EXCEPT, INTERSECT, 16 Built-in Functions, MERGE, Native SQL Procedure Language, SET CURRENT ISOLATION, BIGINT data type, file reference variables, SELECT FROM UPDATE, DELETE & MERGE, multi-site join, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, FOR READ ONLY KEEP UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT

DB2 SQL

z z/OS V8
common
LUW Linux, Unix & Windows V8.2

z Multi-row INSERT, FETCH & multi-row cursor UPDATE, Dynamic Scrollable Cursors, GET DIAGNOSTICS, Enhanced UNICODE for SQL, join across encoding schemes, IS NOT DISTINCT FROM, Session variables, range partitioning

common Inner and Outer Joins, Table Expressions, Subqueries, GROUP BY, Complex Correlation, Global Temporary Tables, CASE, 100+ Built-in Functions including SQL/XML, Limited Fetch, Insensitive Scroll Cursors, UNION Everywhere, MIN/MAX Single Index Support, Self Referencing Updates with Subqueries, Sort Avoidance for ORDER BY, and Row Expressions, 2M Statement Length, GROUP BY Expression, Sequences, Scalar Fullselect, Materialized Query Tables, Common Table Expressions, Recursive SQL, CURRENT PACKAGE PATH, VOLATILE Tables, Star Join Sparse Index, Qualified Column names, Multiple DISTINCT clauses, ON COMMIT DROP, Transparent ROWID Column, Call from trigger, statement isolation, FOR READ ONLY KEEP UPDATE LOCKS, SET CURRENT SCHEMA, Client special registers, long SQL object names, SELECT from INSERT

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DB2 SQL

z z/OS Vnext
common
LUW Linux, Unix & Windows V8.2

z Multi-row INSERT, FETCH & multi-row cursor UPDATE, Dynamic Scrollable Cursors, GET DIAGNOSTICS, Enhanced UNICODE for SQL, join across encoding schemes, IS NOT DISTINCT FROM, Session variables, range partitioning, TRUNCATE, DECIMAL FLOAT, VARBINARY, optimistic locking, FETCH CONTINUE, ROLE, MERGE

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LUW Updateable UNION in Views, GROUPING SETS, ROLLUP, CUBE, 16 Built-in Functions, SET CURRENT ISOLATION, multi-site join, MERGE

DB2 for z/OS Vnext SQL, DB2 family & porting

- **XML**
- **MERGE**
- **SELECT FROM UPDATE, DELETE, MERGE**
- **TRUNCATE**
- **INSTEAD OF TRIGGER**
- **BIGINT, VARBINARY, DECIMAL FLOAT**
- **Native SQL Procedure Language**
- **Optimistic locking**
- **LOB File reference variable & FETCH CONTINUE**
- **FETCH FIRST & ORDER BY in subselect and fullselect**
- **INTERSECT & EXCEPT**
- **ROLE & trusted context**
- **Many new built-in functions, caseless comparisons**
- **Index on expression**
- **Improved DDL consistency**
- **CURRENT SCHEMA**

Native SQL Procedural Language

- Eliminates generated C code and compilation
- Fully integrated into the DB2 engine
- Extensive support for versioning:
  - VERSION keyword on CREATE PROCEDURE
  - CURRENT ROUTINE VERSION special register
  - ALTER ADD VERSION
  - ALTER REPLACE VERSION
  - ALTER ACTIVATE VERSION
- BIND PACKAGE with new DEPLOY keyword

Optimistic Locking Support

- Built-in timestamp for each row or page
  - Automatically updated by DB2
  - Allows simple timestamp predicate to validate that row has not changed since last access
- Eliminates need for complex predicates on WebSphere CMP updates, improves performance

XML Processing Paradigms

XML has become the "data interchange" format between B2B/B2C, inter- and intra-enterprise environments.

XML View Of Relational Data

- SQL data viewed and updated as XML
  - Done via document shredding and composition
- DTD and Schema Validation

XML Documents As Monolithic Entities

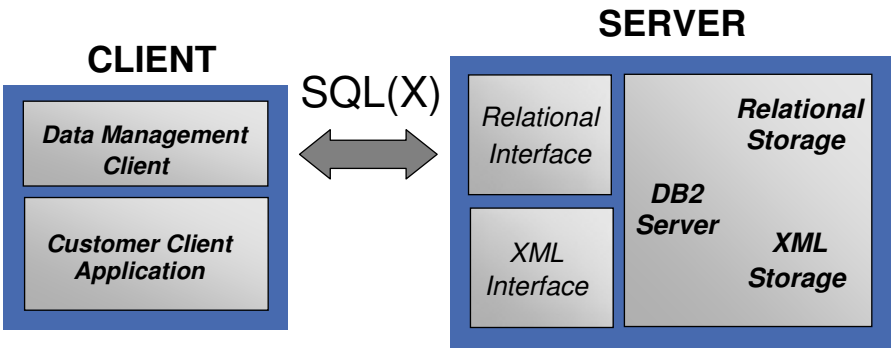
- Atomic Storage And Retrieval
- Search Capabilities

XML As A Rich Data Type

- Full Storage and Indexing
- Powerful Query Capabilities

XML Capabilities Inside the Engine

Performance, Performance, Performance



Native storage Schema Index functions utilities

XML Support

- Support XML data type
- Store the XML document natively
- DDL --
  - CREATE/ALTER Table with XML type column
    - Implicitly create XML Auxiliary objects (tablespace/table/index) - one per XML column
  - Index support
    - Created by users
    - uses XPath to determine which nodes in the XML document to index.

```
CREATE INDEX dependentName ON deptTable(deptDocs)
  GENERATE KEY USING XMLPATTERN
'/department/empl/dependent/name'     ATOMIC AS SQL
VARCHAR(20);
```

- INSERT/UPDATE/DELETE
  - INSERT with VALUES and SUBSELECT
  - No Subdocument update

XML Support -- Query

- Enhanced V8 XML Constructors (XML Publishing Functions)
- SQL/XML Functions and Predicates
  - XMLParse - Convert a XML text to XML value
  - XMLSerialize - Converts XML to character type
  - XMLQuery - executes an XPath expression against an XML value.

```
SELECT XMLQUERY ( '//item[USPrice = $price] ' PASSING
  PO.POrder,
  T.price AS “price”) FROM PurchaseOrders PO, T;
```

  - XMLCast - Cast XML to other types or other types to XML
  - XMLExists - a predicate, which returns TRUE if the XPath expression evaluates to a non-empty sequence

```
SELECT PO.pid  FROM PurchaseOrders PO, T
        WHERE XMLEXISTS( '//item[USPrice = $price] '
        PASSING PO.POrder,  T.price AS “price”)
```


XML Support (continued…)

- XPATH supported features from XPath 2.0:
- Utility Support
  - LOAD/UNLOAD, CHECK DATA/INDEX, COPY, REBUILD, RECOVER, REORG, etc.
- XML Schema Support
  - XSR – XML Schema Repository
  - Tables to store XML schemas
  - Stored procedures to register XML schemas
- DSN_XMLVALIDATE() SQL/XML function
  - Test XML values for validity against XML schema
  - Obtain default values and schema normalized values from XML schema
- XML decomposition using annotated XML schema

TRUNCATE Statement

- Allows fast delete of all rows in a given table (simple, segmented, or partitioned)
- Very useful for nightly refresh of summary tables, warehouses, etc.

```
TRUNCATE TABLE  TABLE-NAME

  < DROP STORAGE | REUSE STORAGE>

  < RESTRICT WHEN DELETE TRIGGERS  |
    IGNORE DELETE TRIGGERS>

  < IMMEDIATE>
```


Decimal Floating Point

- New datatype DECFLOAT
  - –Well suited to typical customer financial calculations
  - –Similar to “calculator” mathematics
    - •Eliminates rounding errors by using base 10 math
    - •Has up to 34 digits of precision
    - •Floating point convenience with fixed point precision!!!
  - –Improved hardware support will be provided in the next zSeries processor generation (new IEEE standard)
    - •Software emulation provided for other models

MERGE

- Array MERGE operation
- Targets OLTP applications like SAP

```
MERGE  INTO account AS T
USING VALUES (:hv_id, :hv_amt) FOR 5 ROWS  AS S(id,amt)
ON T.id = S.id
WHEN MATCHED THEN
   UPDATE SET balance = T.balance + S.amt
WHEN NOT MATCHED THEN
   INSERT (id, balance) VALUES (S.id, S.amt)
NOT ATOMIC CONTINUE ON SQLEXCEPTION
```


SQL Improvements – Family Compatibility

- INSTEAD OF triggers
- SELECT FROM UPDATE
- SELECT FROM DELETE
- SELECT FROM MERGE
- BIGINT and VARBINARY data types
- ORDER BY and FETCH FIRST in subselect

DDF Improvements

- 64-bit exploitation by DDF
  - Special “shared private” with xxxDBM1 to eliminate many of the data moves on SQL operations
- Support for IPv6 and SSL
- VTAM definition is now optional
- Elimination of PRIVATE protocol requester
  - Includes tools for identifying which packages need to be bound at remote servers

DB2 Vnext Themes

- **Enable high-volume transaction processing for next wave of Web applications**
- **Extend the lead in transaction processing availability, scalability and performance**
- **Reduce cost of ownership and zSeries-specific skill needs**
- **Improve reporting**

Schema Evolution – Database Definition On Demand

- Fast replacement of one table with another
- Rename column and index
- Alter index to change page size
- Table space that can add partitions, for growth
- Improve ability to rebuild an index online
- Online reorganization with no BUILD2 phase
- Modify early code without requiring an IPL
- Alter table space and index logging
- Create & alter STOGROUP SMS constructs

Partition by Growth & Universal Table Space

- New partitioning scheme:
  - Single table tablespace, where each partition contains a segmented pageset (allows segmented to increase from 64GB to 16TB or 128 TB with 32K pages)
- Partition By Growth
  - Eliminates need to define partitioning key and assign key ranges
  - A new partition is created when a given partition reaches DSSIZE (defaults to 64G)
  - Retains benefits of Utilities and SQL parallelism optimizations for partitioned tables

CREATE TABLE … APPEND(YES)

- New APPEND option:
  - Maximizes performance for “INSERT at end”
  - Avoids overhead of attempting to preserve clustering sequence
  - CREATE or ALTER table

Relief for Sequential Key INSERT

- New index page sizes: 8K, 16K and 32K
  - Fewer page splits for long keys
  - More key values per page
- INSERT at the end of the key range used to result in 50% free space in each index page
  - Enhanced support dynamically adapts page split boundary to minimize wasted space in index pages

LOB Performance/Scalability

- Elimination of LOB locks – LRSN and page latching is used instead of consistency checks
- New network flows for delivering LOBs
  - –JDBC, SQLJ, and CLI will let server determine whether to flow LOB values or LOCATORs based on size thresholds
  - –Significant reduction in network traffic
  - –Greatly reduces frequency of FREE LOCATOR statements

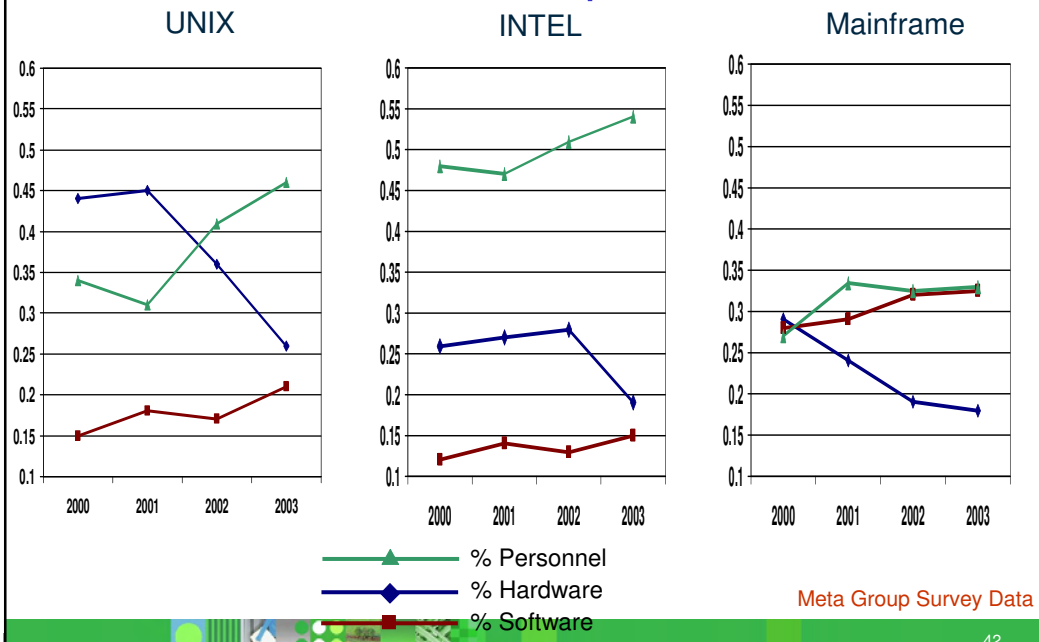
Other Performance / Availability Items

- Insert performance APPEND INDEX LOG
  - – INDEX on expression
  - – Log latch contention relief
  - – Not logged table space
- LOB performance, function, scalability
- CPU reductions in LOAD and REORG
- Online REBUILD INDEX
- Improved varying length performance
- FETCH FIRST n ROWS improvements
  - – Can now be specified in a subquery or fullselect
  - – ORDER BY now exploits FETCH FIRST n ROWS, so that work files are not created (less I/O)

DB2 Vnext Themes

- Enable high-volume transaction processing for next wave of Web applications
- Extend the lead in transaction processing availability, scalability and performance
- **Reduce cost of ownership and zSeries-specific skill needs**
- Improve reporting

Cost Of Ownership Trends



Meta Group Survey Data

Compliance/Auditing Pressure

- Regulatory compliance initiatives are impacting IT organizations in most countries/industries, and changing fast
  - Sarbanes-Oxley
  - Basel II
  - FDA: Food and Drug Administration 21 DFR Part 11
  - COPPA: Children's Online Privacy Protection Act of 2000
  - DPA: Data Protection Act (UK)
  - HIPAA: Health Insurance Portability and Accountability Act of 1996
  - PIPEDA: Personal Information Protection and Electronic Documents Act (Canada)
  - SEC Rule 17a-4: Records to be preserved by certain exchange members, brokers, dealers
  - USA Patriot Act: Uniting and Strengthening America by Providing Tools Required to Intercept and Obstruct Terrorism of 2001
- Focus is on both external threats (hackers) and internal employees

Security in DB2 for z/OS Vnext

Some key implementations

- ❑ Data Encryption
- ❑ Roles
- ❑ Network Trusted Contexts
- ❑ Instead of Triggers
- ❑ Improved auditing
- ❑ Secure Socket Layer

Protecting data on disk

- We will allow encryption for the key disk resources used by DB2:
  - Tables
  - LOBs
  - Indexes
  - Image copies
  - Logs
  - Archive logs

Database ROLEs

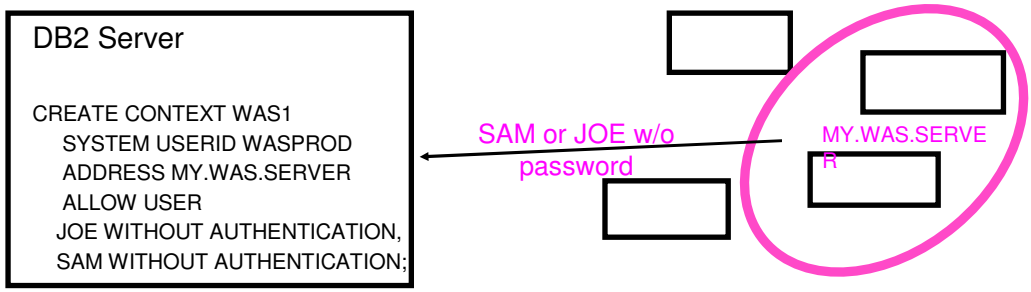
- ROLE is a “virtual authid”
  - Assigned via TRUSTED CONTEXT
  - Provides additional privileges only when in a trusted environment using existing primary AUTHID.
  - Can optionally be the OWNER of DB2 objects

```
CREATE ROLE PROD_DBA;
GRANT DBADM … TO PROD_DBA;

CREATE TRUSTED CONTEXT DBA1 …
   DEFAULT ROLE PROD_DBA OWNER(ROLE);
```

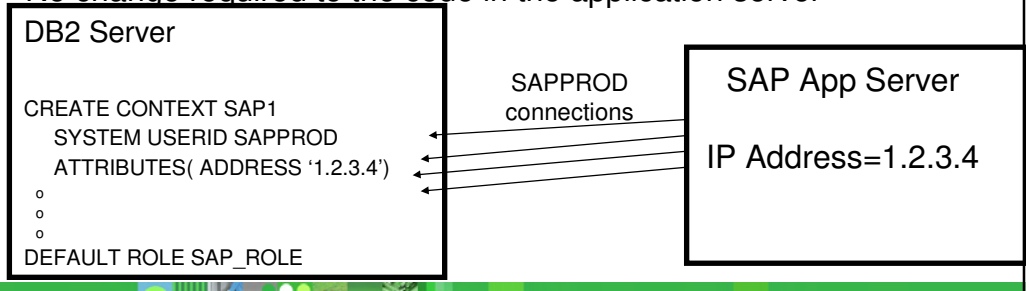
Trusted Security Context

- Identifies "trusted" DDF, RRS Attach, or DSN application servers
- Allows selected DB2 authids on connections without passwords
  - reduces complexity of password management
  - reduces need for an all-inclusive "system authid" in app servers
  - more visibility/auditability of which user is current running
  - enables mixed security capabilities from a single app server



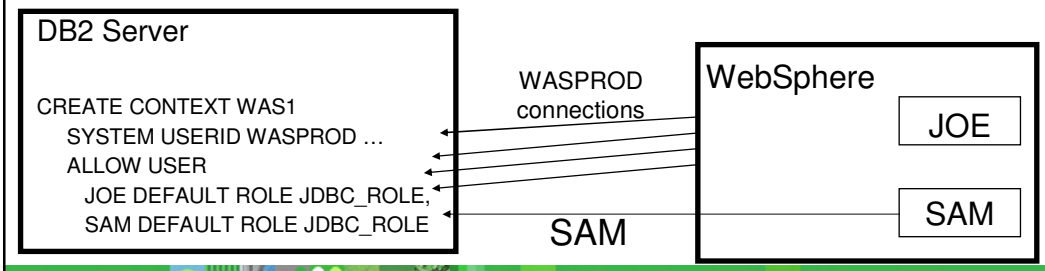
Example 1: ROLEs and Trusted Context used to Secure App Servers

- Most existing application servers connect to DB2 using userid/password pairs:
  - Significant exposure if someone steals the userid/password!!!
- Trusted Context and ROLEs can be used to limit exposure:
  - GRANTs to SAP_ROLE can be restricted so that they are only valid when used by a valid SAP app server IP address
- No change required to the code in the application server



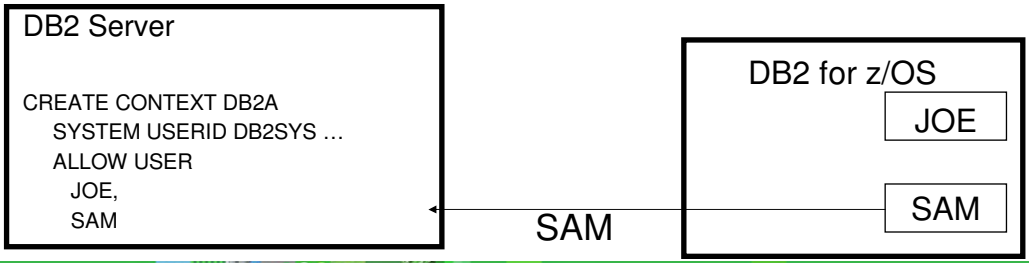
Example 2: ROLEs and Trusted Context for Dynamic SQL Auditing

- Better auditing controls:
  - GRANT dynamic SQL privileges to a ROLE
  - End user identity can be delegated directly to DB2 without granting dynamic SQL privileges directly to the end user
  - End user passwords can be optional.
  - No added complexity for administration of GRANTs, while retaining the ability to audit the end user's identity!!!



Example 3: ROLEs and Trusted Context for Already-Verified DRDA

- Can be used to establish already-verified TCP/IP connections:
  - Improves ability to replace SNA connections with TCP/IP
  - Communication Database is used to identify trusted connections and specify "system userid" for the Trusted Context
  - End user identity is automatically propagated from one DB2 system to the other.



Example 4: ROLEs and Trusted Context to Secure DBA Activities

- Many customers are concerned about DBA access to sensitive customer data. DB2 vNext can help by enabling an auditable DBA process:
  1. Grant DBA privileges to a ROLE
  2. Start audit trace for that ROLE
  3. When a DBA needs to perform a system change:
     - Use Trusted Context to assign DBA ROLE to person
     - DBA is given request and performs activity
     - Revoke Trusted Context
  4. Have another person review the audit trace

Auditing: DB2 Trace Filtering

- New filtering capabilities for –START TRACE that INCLUDE or EXCLUDE based on these keywords:
  - –USERID -- client userid
  - –WRKSTN -- client workstation name
  - –APPNAME -- client application name
  - –PKGLOC -- package LOCATION name
  - –PKGCOL -- package COLLECTION name
  - –PKGPROG -- PACKAGE name
  - –CONNID -- connection ID
  - –CORRID -- correlation ID
  - –ROLE – end user's database ROLE

Volume-based COPY/RECOVER

- FlashCopy technology used to capture entire content of disk volumes
- RECOVER modified to enable object-level recovery from volume FlashCopy
- Eliminates labor associated with setting up COPY jobs for each database / table space

Converged TEMP Space

- Single source for all temporary space in DB2, replacing: DSNDB07, temp databases, work file database
- Access is virtualized for small amounts of data, eliminating cost of work file creation (reduced CPU and I/O)
- Supports 4K and 32K page sizes, with automatic selection of the appropriate page size

DDL Porting Improvements

- Automatic selection of DATABASE and TABLESPACE when DDL omits these keywords
- Automatic CREATE of UNIQUE index for PRIMARY KEY
- Deprecated simple table space, default to segmented

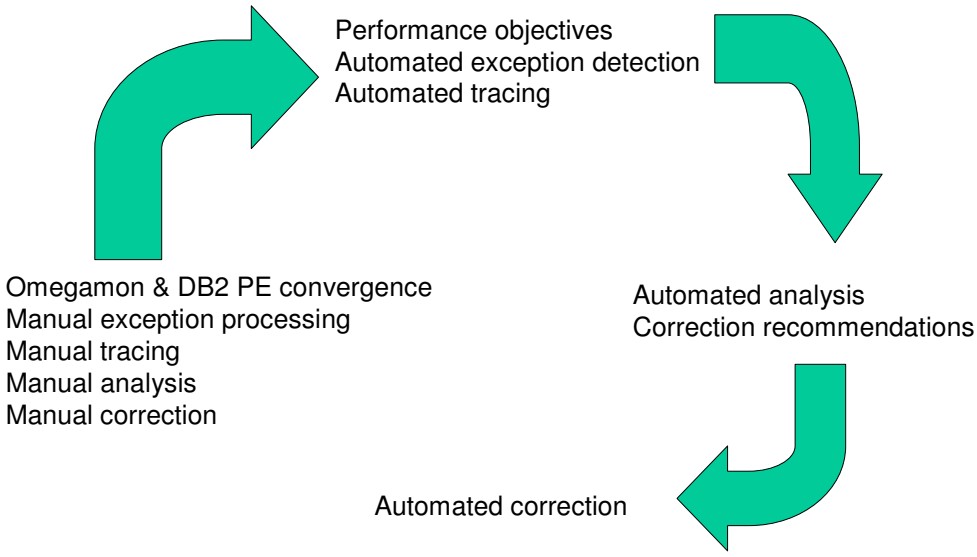
DB2 Vnext Themes

- **Enable high-volume transaction processing for next wave of Web applications**
- **Extend the lead in transaction processing availability, scalability and performance**
- **Reduce cost of ownership and zSeries-specific skill needs**
- **Improve data warehousing and OLTP reporting**

Data Warehousing, Reporting and Optimizer Improvements

- SQL enhancements: INTERSECT, EXCEPT, RANK, caseless comparisons, cultural sort, …
- Index improvements: index on expression
- Improved Optimization statistics: Histogram
- Optimization techniques
  - Cross query block optimization
  - Generalize sparse index & in-memory data cache method
  - Dynamic Index ANDing for Star Schema
- Analysis: instrumentation & Optimization Support

DB2 Performance Monitoring



TCO Improvements – DBA tools

- Autonomic Policy-based SQL query management/monitoring:
  - Automatic collection of performance data for long running queries
  - Automated query monitoring for the most frequent/expensive queries
  - REOPT(SMART)
  - Real time statistics exploitation by Optimizer
- Optimization Service Center (Web-based DBA admin – no 3270 screens)
  - DBA tool suite for tuning/managing SQL queries (Stats Advisor, Index Advisor, Query Rewrite Advisor, Query Workload Monitor, Resource Estimator, Query Formatter, Visual Explain, Visual Plan Hint, IBM Service Doc Generator, Partitioning/Clustering Advisor)
- Query Performance Warehouse
  - Execution history of queries
  - Identification of query patterns
  - Identification of usage patterns for tables/indexes

DB2 for z/OS Vnext

- ❑Integration
- ❑Availability
- ❑Scalability
- ❑Productivity
- ↳Total cost of ownership

➢XML, Unicode, LOBs

➢SQL for DB2 family

➢Data Definition On Demand

ftp://ftp.software.ibm.com/software/data/db2zos/VNEXT.pdf

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