

# DB2 for i: Today and Tomorrow

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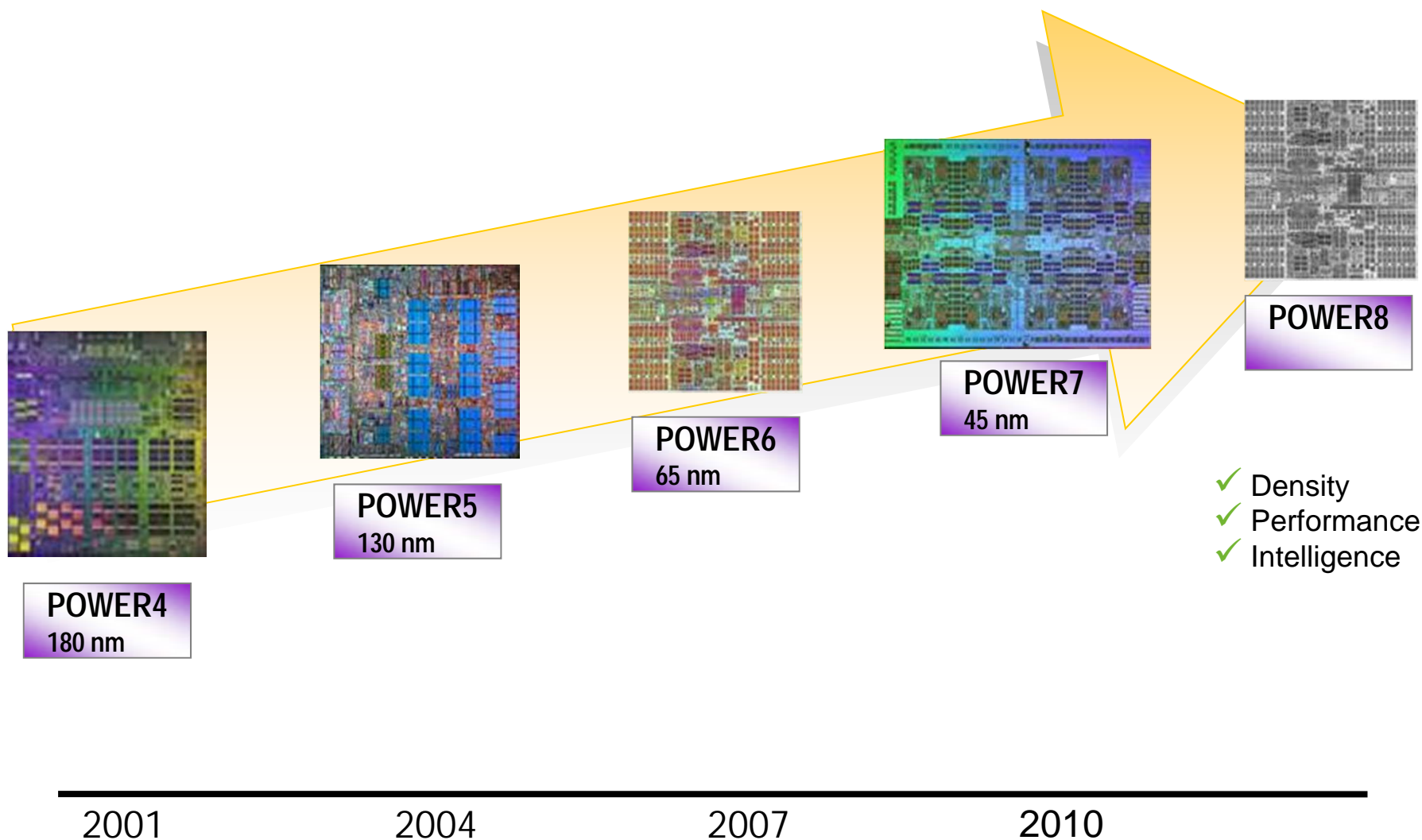


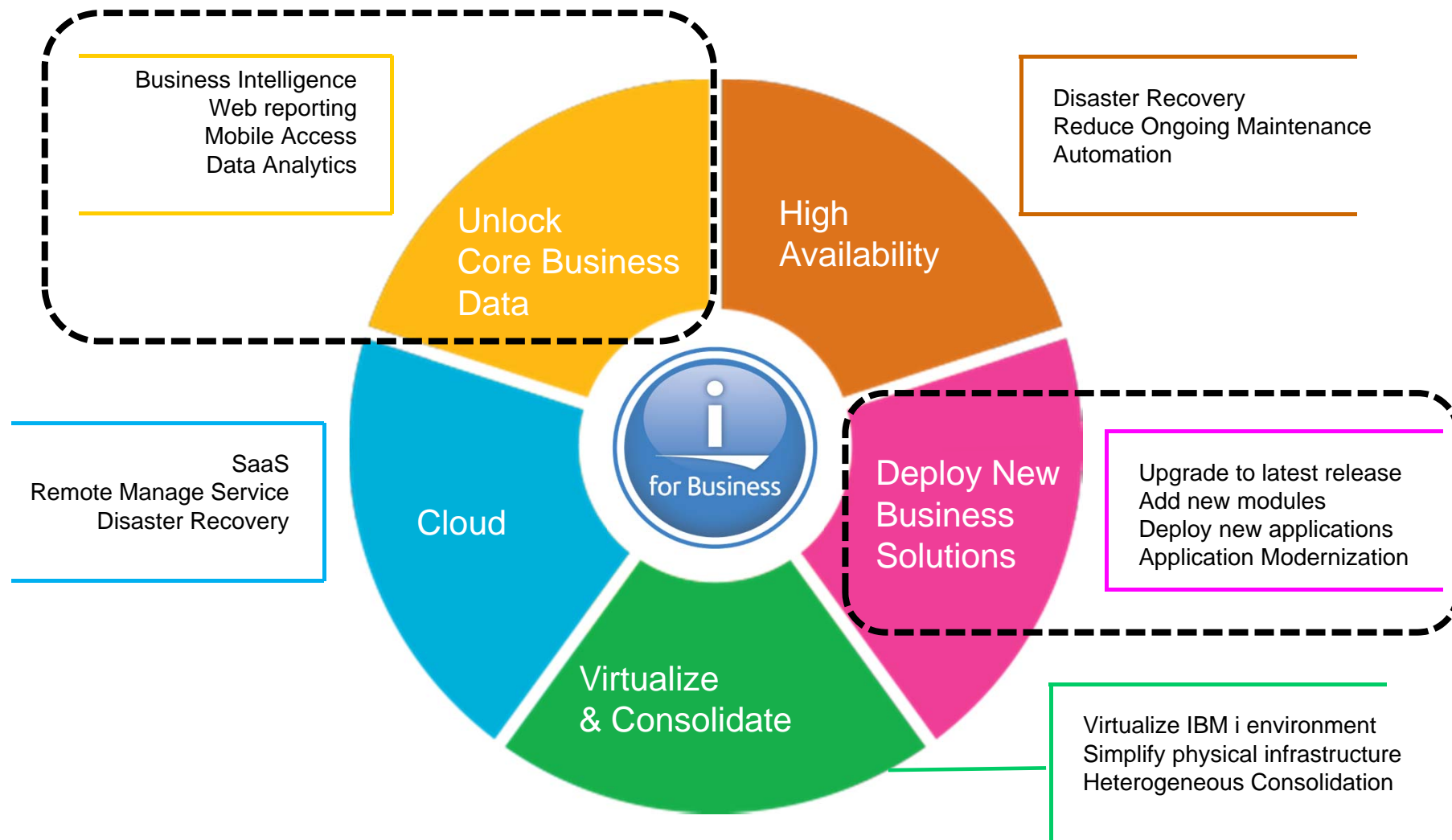
**Information Management**

DB2 for i  
is in here



# POWER Processor Roadmap





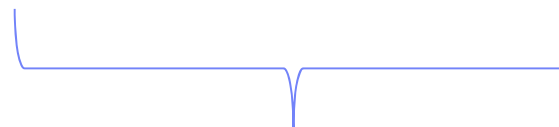
Upgrade and Modernize IBM i Infrastructure

# IBM i Roadmap

2008

2010

2011-13



Technology Refresh  
Add Function PTFs

# DB2 for i



The Easy Way to *High Performance* SQL on DB2 for i?

**Move to IBM i 7.1**

Data-centric programming is all about getting the database management system to **do more** on your behalf.



We want to drive as much work down  
into the database management system  
as possible.

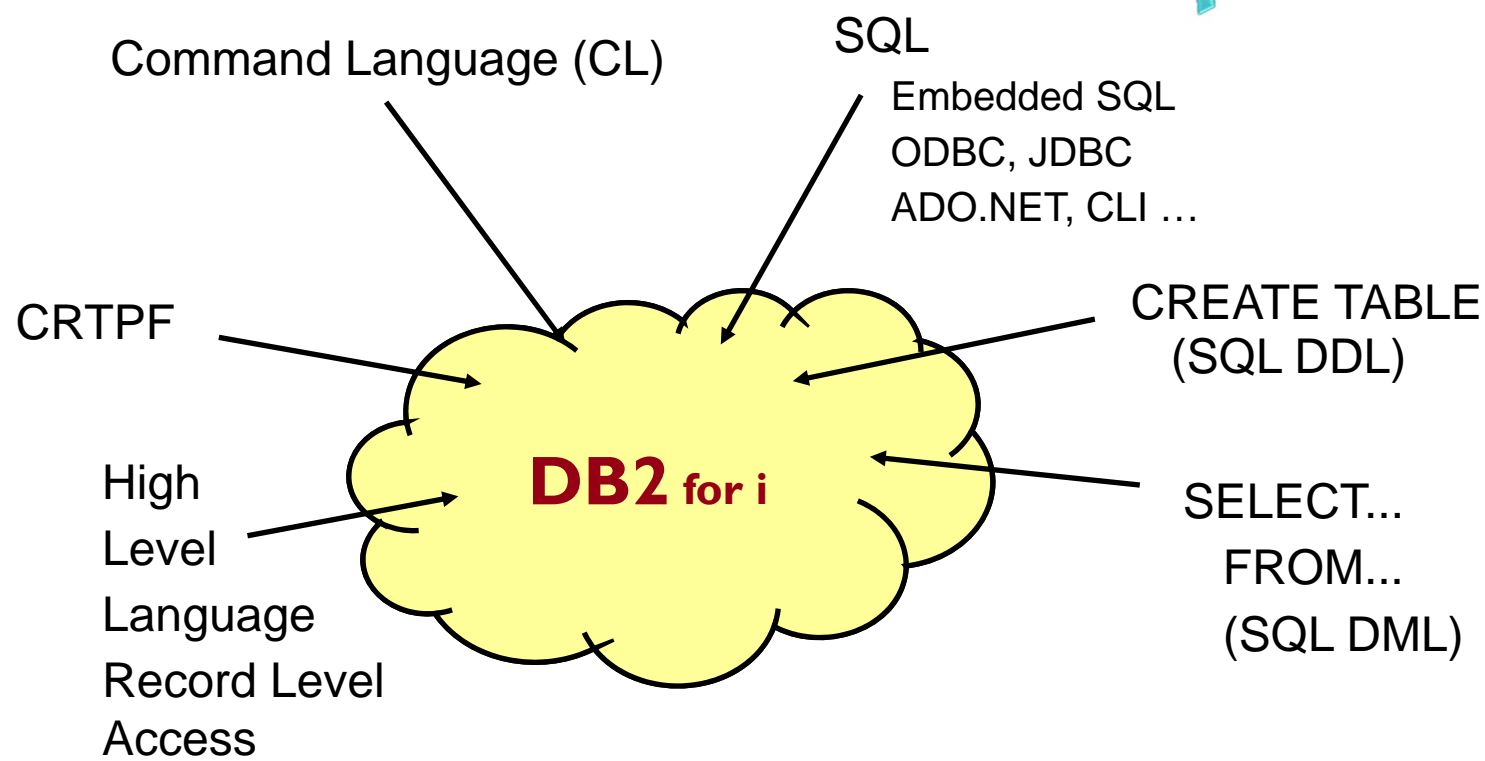
**But how?**

**SQL**

## IBM i Objects

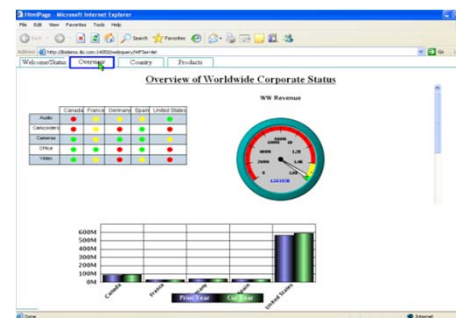
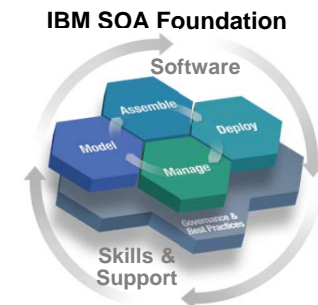
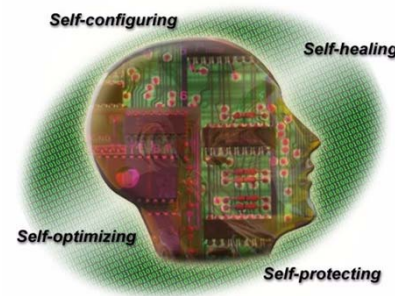
One Database Management System with multiple interfaces

Advantage



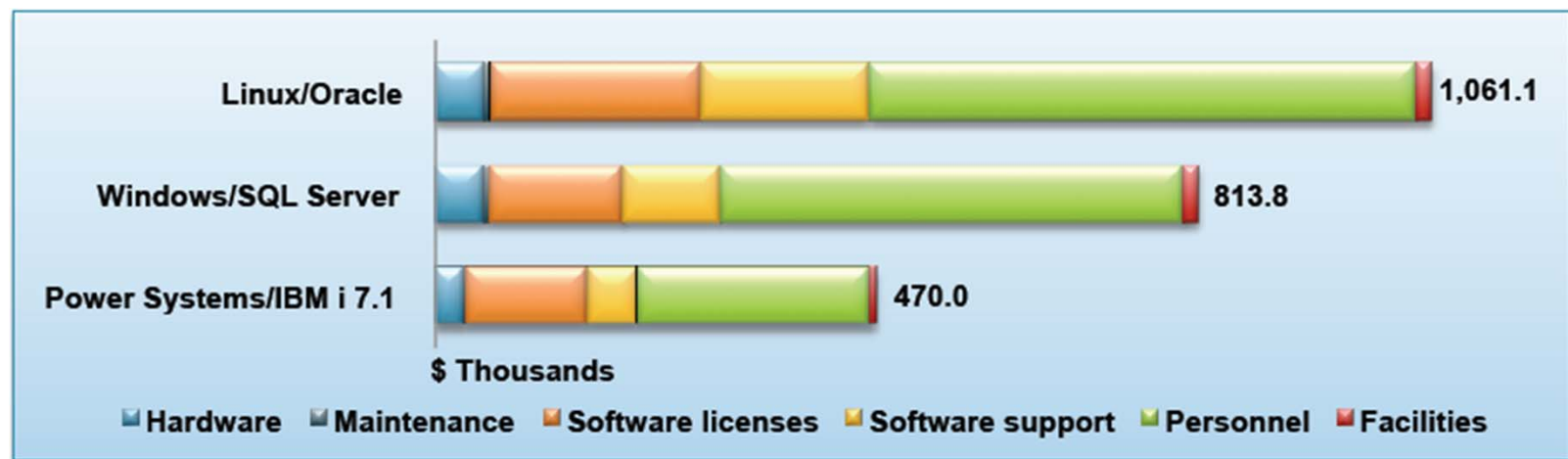
## DB2 for i Focus Areas

- **The Self Managing Database**
  - Reduced TCO thru automation
  - Integration: Built-in Security and Auditing
- **Trusted Reliability & Scalability**
  - Simplified, best of breed scaling
  - Integrated transaction management
  - Advanced, flexible logging facilities
- **Open for Business**
  - SQL, the strategic interface
  - Latest de facto standards
- **Innovative Applications**
  - SQL & Data-centric programming
  - Move to SOA over time
- **Business Intelligence**
  - Store, manage, and analyze data
  - End user query and reporting to large scale data warehousing



## Lower Overall Three-year Costs

*An advantage sustained throughout the life of the platform*



ITG Management Brief: Value Proposition for IBM Power Systems Servers and IBM i - Minimizing Costs and Risks for Midsize Businesses; January 2011

**42% less** than x86, Microsoft Windows Server and Microsoft SQL Server

**56% less** than x86, Linux and Oracle DB

## DB2 for i 7.1 Enhancements

### Rapid Application Development

- **SQL & RPG Integration**
- **Stored procedure Result Set consumption**
- **FIELDPROC for transparent column-level encryption**
- **XML Integration**
  - XML data type
  - Annotated XML Decomposition
  - SQL XML Publishing functions
- **Three-part Aliases**
- **Compatibility with DB2 Family & Oracle**
  - MERGE statement
  - Array support & Global Variables
  - REPLACE option on CREATEs
  - Currently Committed supported
- **JDBC & .NET enhancements**

### Trusted Reliability

- **Enhanced Remote Journal filtering**
- **Library-level Journaling filtering**
- **IASP spanning transactions**

### Performance & Self-Tuning Enhancements

- **SQL Query Engine (SQE) enhancements**
  - Adaptive Query Processing
  - Self-Learning Optimization
  - Inline UDF query rewrite
  - Logical File on FROM support
- **Indexing Advancements**
  - SQL Select/Omit Indexes
  - EVI Aggregates
- **CPYFRMIMPF performance**
- **SSD & In-Memory Database Enablement**
- **OmniFind Text Search Server enhancements**

### Simplified Management

- **IBM i Navigator Enhancements**
  - Progress Monitors – Alter Table, Index Build
  - Index Advisor improvements
  - Enhanced Generate SQL capability
  - Object Folder content saves

### Data Intelligence & Interoperability

- **DB2 Web Query for System i**
  - Excel client support
  - Microsoft SQL Server adapter

## On the Web

### DB2 for i 7.1 Overview

[ibm.com/partnerworld/wps/servlet/ContentHandler/RBAA-86BKUP](http://ibm.com/partnerworld/wps/servlet/ContentHandler/RBAA-86BKUP)

### DB2 for i 6.1 Overview

[ibm.com/partnerworld/wps/servlet/ContentHandler/servers/enable/education/ibp/13db6/](http://ibm.com/partnerworld/wps/servlet/ContentHandler/servers/enable/education/ibp/13db6/)

### DB2 for i 5.4 Overview

[ibm.com/partnerworld/wps/servlet/ContentHandler/servers/enable/site/education/ibp/c0d6/](http://ibm.com/partnerworld/wps/servlet/ContentHandler/servers/enable/site/education/ibp/c0d6/)

## Mid-release DB2 for i Enhancements

- **We have always PTFed enhancements back to prior releases**
  - In some cases the enhancement is new to all releases
  - In some cases the enhancement already exists in some shipped release
  - Whether we PTF an enhancement back to what release depends on customer value, cost, and risk
  
- **Changes over the last several releases have made it easier to PTF enhancements**
  - Greatly expanded use of user defined table functions
  - In 6.1 CL commands can be enhanced without considering language translation
  
- **We have provided a single place for customers to find new enhancements**



## New Wiki for DB2 Enhancements via PTF

- Regularly check (or subscribe) to the ***DB2 for i Updates Wiki***
  - Contains details on new PTFs that deliver new DB2 capabilities
  - Wiki URL:  
<https://www.ibm.com/developerworks/ibmi/techupdates/db2>
- The wiki is part of a new IBM i zone in IBM developerWorks  
<https://www.ibm.com/developerworks/ibmi/>

## 7.1 Application Development Enhancements

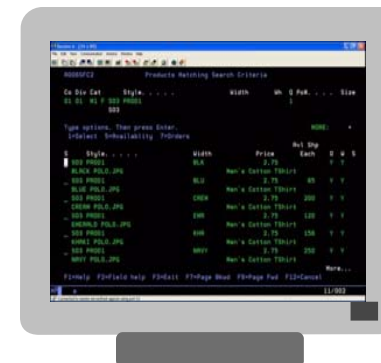
# FIELDPROC - Seamless Column-Level Encoding and Decoding

## New Order

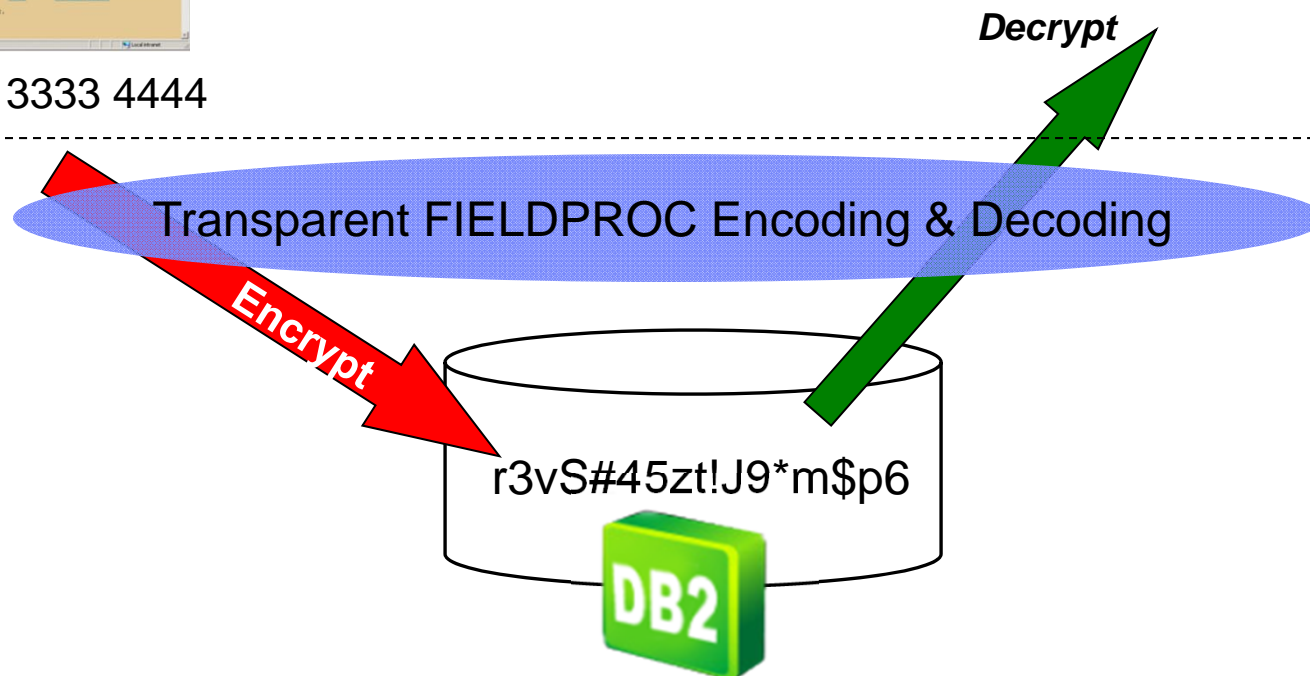


1111 2222 3333 4444

## Authorized Access




1111 2222 3333 4444



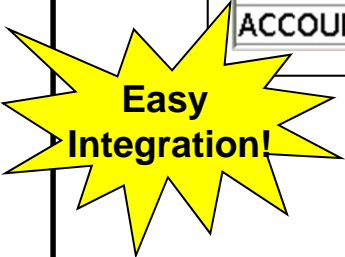
## Result Set Integration – Embedded SQL & SQL Routines

- Programmers can now directly integrate stored procedure result sets with embedded SQL & SQL Routines
  - Key Enabler Statements: ASSOCIATE LOCATOR & ALLOCATE CURSOR
  - Optionally, DESCRIBE PROCEDURE & DESCRIBE CURSOR statements can be used to dynamically determine the number and contents of a result set

```
...  
DECLARE sprs1 RESULT_SET_LOCATOR VARYING;  
CALL GetProj(projdept);  
ASSOCIATE LOCATORS(sprs1) WITH PROCEDURE GetProj;  
ALLOCATE mycur CURSOR FOR RESULT SET sprs1;  
SET totstaff=0;  
myloop: LOOP  
  FETCH mycur INTO pname, prstaff;  
  
  IF row_not_found=1 THEN  
    LEAVE fetch_loop;  
  END IF;  
  SET totstaff= totstaff + prstaff;  
  IF prstaff > moststaff THEN  
    SET bigproj = pname;  
    SET moststaff= prstaff;  
  END IF;  
END LOOP;  
CLOSE mycur;  
...
```



PROJNAME	PRSTAFF
GENERAL ADMIN ...	6.00
PAYROLL PROGR...	2.00
PERSONNEL PRO...	1.00
ACCOUNT PROGR...	2.00



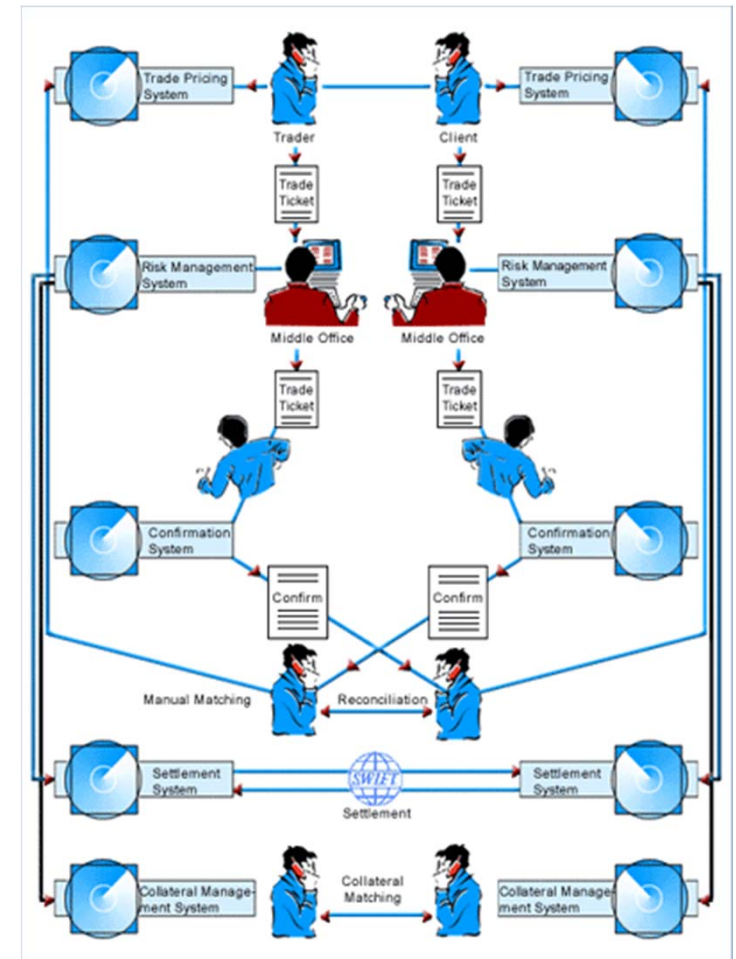
**Easy  
Integration!**

## 7.1 XML Integration

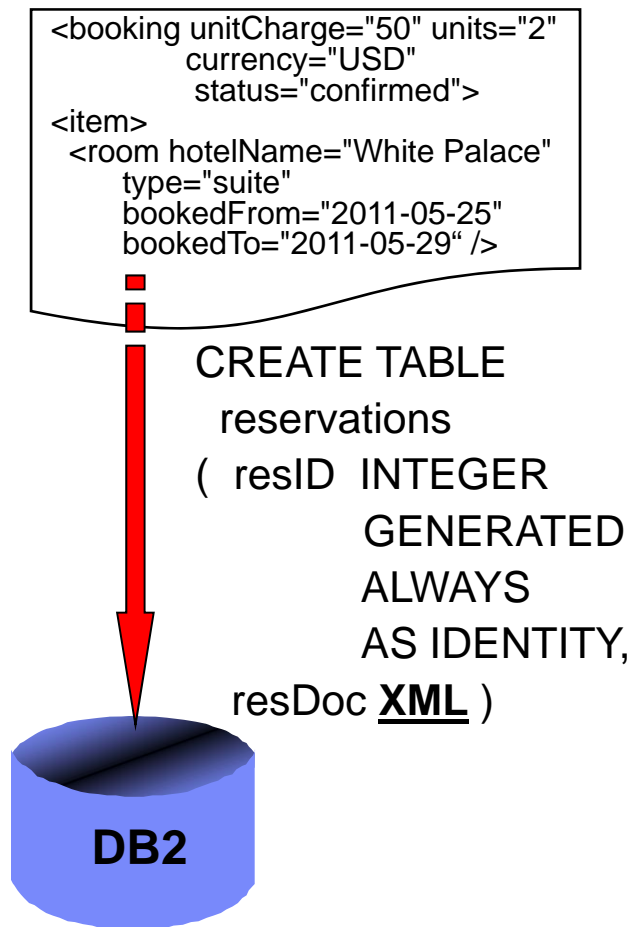
## Rich XML Support within DB2 for i – integrated solution that replaces DB2 XML Extender product

- ## IBM OmniFind Text Search Server provides advanced, high-speed search capabilities for stored XML documents

- Scope searches to specific elements of an XML document: `/book/title[. contains(“winning”) ]`
- XQuery interface not yet supported



## XML Data Type



- New XML data type
  - Support XML values up to 2 GB
  - Type can be used for column, parameter, and host variable values

- XML Schema-based validation supported

```
INSERT INTO reservations(resdoc)
VALUES (XMLVALIDATE (
  XMLPARSE (DOCUMENT
    GET_XML_FILE('/dir1/r6.xml'))
  ACCORDING TO XMLSCHEMA
  ID mylib.resschema) )
```

- XML File Reference variables enable simple export XML documents to IFS

```
D MY_XMLFILE      S      SQLTYPE(XML_CLOB_FILE)
/free
MY_XMLFILE_NAME= '/out1.xml';
MY_XMLFILE_NL = 9;
MY_XMLFILE_FO = SQFCRT;
exec sql SELECT resDOC INTO :MY_XMLFILE
FROM reservations WHERE resID=1;
/end-free
```




## 7.1 SQL Enhancements

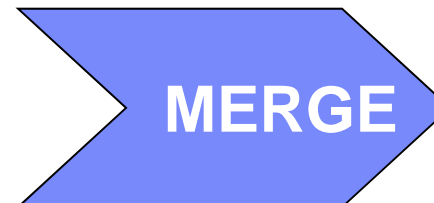
## MERGE Statement

- Allows application to use a **single** SQL statement to Update, Delete, or Insert into a table based on values from a source table/query
- Simplifies applications trying to merge detailed transaction data into a summary file
  - Typical processing...
    - Perform INSERT when transaction type does NOT yet exist in summary file
    - Perform UPDATE when transaction type does exist in summary file to add to the total for that type

## MERGE Statement - Example

**ORDERS\_DETAIL**

ORDID	ORDREG	...	ORDAMT
A11	W	...	10.00
A12	W	...	5.00
A13	E	...	30.00
A14	W	...	30.00
A15	E	...	20.00
...	...	...	...

***INSERT******UPDATE*****REGION  
Summary**

REG	REG_TOT
W	45.00
E	30.00

## DB2 Concurrent Access Resolution

- Concurrent Access Resolution behavior controllable at different levels
  - System-wide: SQL\_CONCURRENT\_ACCESS\_RESOLUTION QAQQINI option
  - Program-level: CONACC pre-compiler option
  - Connection-level property/attribute
    - IBM i Access middleware: ADO.NET, JDBC, ODBC, OLE DB
    - SQL CLI & Native JDBC Driver
  - Statement-level
    - USE CURRENTLY COMMITTED
    - WAIT FOR OUTCOME
    - SKIP LOCKED DATA (added in 6.1)

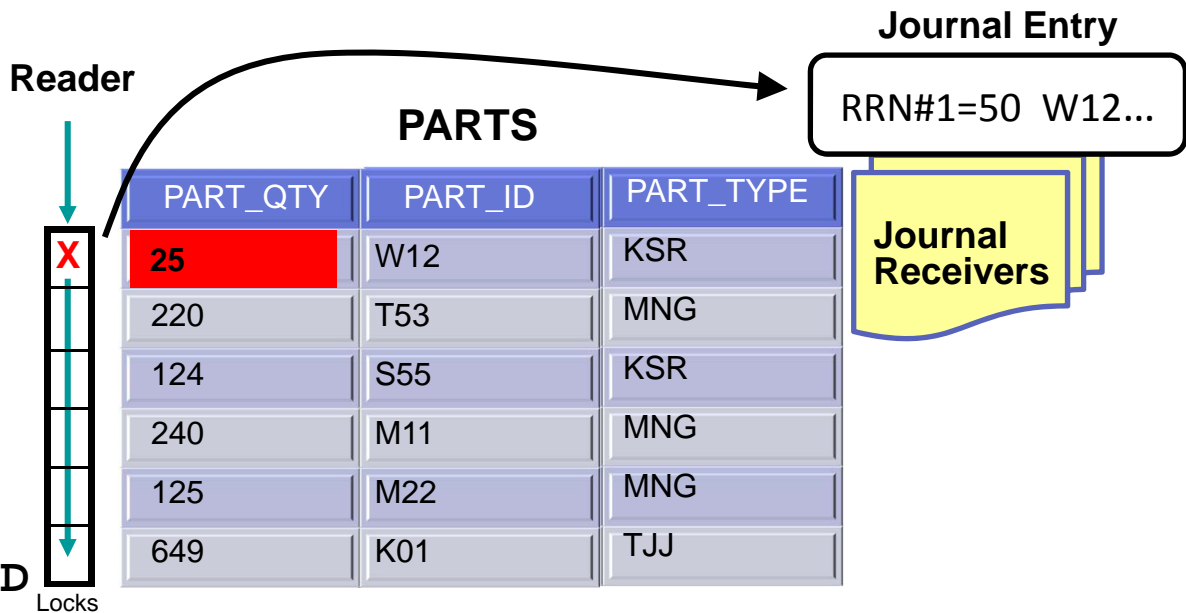


JOB#1:

```
UPDATE parts
SET part_qty = 25
WHERE part_id='W12'
```

JOB#2:

```
SELECT part_id
FROM parts
WHERE part_type
  IN('KSR','MNG')
USE CURRENTLY COMMITTED
```



## Miscellaneous SQL Enhancements

### ■ REPLACE Option for CREATE statements

- Eliminates need for the Drop statement
- Preserves existing object dependencies & privileges!
- Supported objects: Alias, Function, Procedure, Sequence, Trigger, Variable, View

```
CREATE OR REPLACE ALIAS myAlias FOR schema.tab1
```

### ■ ALTER TABLE Enhancements

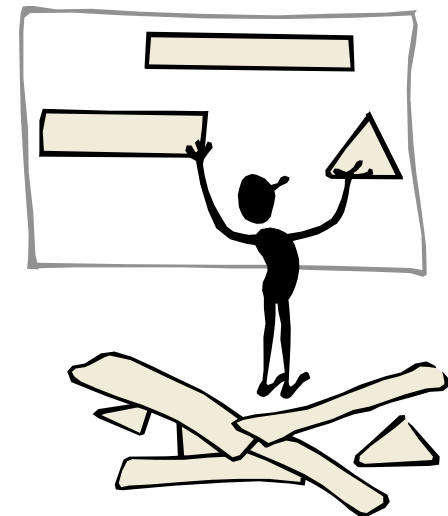
- ADD BEFORE column
- Identity Column support for existing columns
- Preservation of statistics
- Improved performance for partitioned tables

### ■ Partitioned Table Enhancements

- RI Constraint support
- Identity Column support

### ■ SQL Object Deflation – Table, View, Index

### ■ 128-byte Schema Names



## 7.1 Performance Enhancements

## DB2 Performance Enhancements

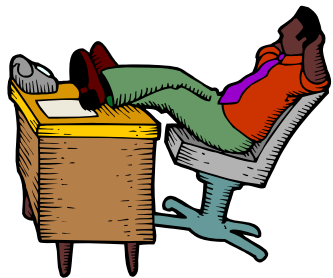
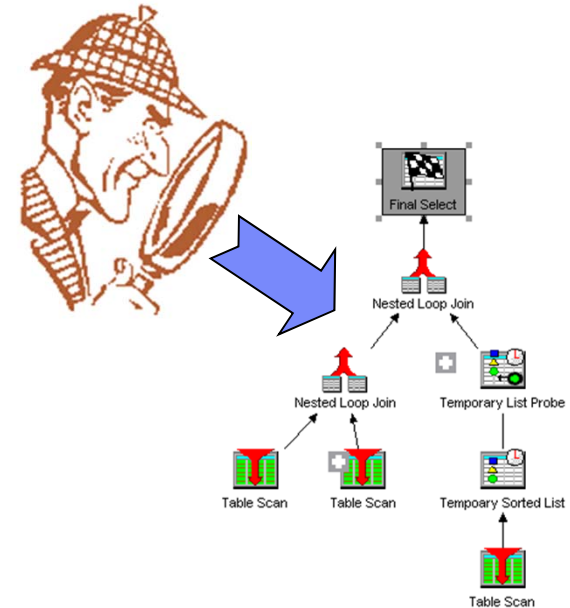


- SQL Query Engine (SQE) Enhancements
  - Support for Logical File on FROM clause
  - Performance advancements
    - Background Self-Learning Query Optimization
    - Adaptive Query Processing
    - Global Statistics Cache
    - Inline User-Defined Function rewrite
- SQE Indexing Advancements
  - Optimizer awareness of SQL Select/Omit Indexes & Select/Omit Logical Files
  - Encoded Vector Index Aggregate support
- Improved locking performance for LARGE transactions
- Improved CPYFRMIMPF performance (6.1 & 5.4 PTFs)
- DB2 Object-level performance
  - SSD Media Preference and Random/Sequential Usage Statistics
  - OVRDBF ... **REUSEDLT(\*NO)** for faster Blocked Inserts/Writes
  - In-Memory Database Enablement
    - CHGPF ... KEEPINMEM( \*YES )**
    - CHGLF ... KEEPINMEM( \*YES )**



## SQE Adaptive Query Processing

- Real-time self-learning query optimization
  - Enables query plan to be changed while query is running
  - Plan adjustments & query restart completely transparent to the application
- Intelligent monitor agents automatically assigned to each query by SQE
  - Monitoring starts after 2 seconds
  - Periodically polling measures progress against estimates and other plan assumptions
- Real-time plan adjustments can include
  - Change in join order
  - Utilization of a new index
  - ...



No user  
interaction  
required!

## SQE Indexing Advancements

- Query Optimizer awareness of SQL Select/Omit Indexes for query plans

```
CREATE INDEX cust_ix1 ON customers(cust_id) WHERE activeCust='Y'
```

- Encoded Vector Index (EVI) Aggregate Support

```
CREATE ENCODED VECTOR INDEX idx1 ON sales(region)
      INCLUDE ( SUM(saleamt), COUNT(*) )
```

```
CREATE ENCODED VECTOR INDEX idx2
      ON sales(territory)
      INCLUDE (SUM(saleamt + promoamt))
```

EVIs are maintained as the underlying table is modified

```
SELECT territory, SUM(saleamt+promoamt) FROM sales
      GROUP by territory
```

```
SELECT region, SUM(saleamt) FROM sales GROUP BY region
```

## DB2 SSD (Solid State Disks) Enablement

- SSD can improve performance for some DB2 objects
  - Large amount of random data access and...
  - Data that is read many times, but written less frequently
- DB2 interfaces enhanced to allow a user to indicate an SSD *media preference* on table, index, physical file, and logical file
  - SQL: UNIT SSD clause for object and partition
    - CREATE/ALTER TABLE
    - CREATE INDEX
  - CL: UNIT(\*SSD) parameter
    - CRTPF, CRTLF, and CRTSRCPF
    - CHGPF, CHGLF, and CHGSRCPF

**5.4 - Database Group SF99504 #23**

**6.1 - Database Group SF99601 #10**

- ALTER and CHGPF/LF interfaces support asynchronous movement of data and indexes
- Key DB2 7.1 Addition - New random and sequential statistics for tables and indexes



### Associated Bank

Moving DB2 tables to SSD reduced month end batch run time by **40%! \***

# of SAS Disk Drives	# of SSDs	Batch Run Time
72	0	4:22
72	8	2:43
60	4	2:48

\*[http://www.ibmssystemsmagpowersystemsibmidigital.com/nxtbooks/ibmsystemsmag/ibmsystems\\_power\\_200909/index.php#/16](http://www.ibmssystemsmagpowersystemsibmidigital.com/nxtbooks/ibmsystemsmag/ibmsystems_power_200909/index.php#/16)

# IBM DB2 Web Query Enhancements

## ■ New Product Version – 1.1.2

### – InfoAssist Interface

- Simpler and faster report creation with ribbon-like interface
- Report output flexibility
- Full Compatibility with existing 1.1.1 reports

### – Oracle JDEdwards OneWorld and EnterpriseOne Adapter

### – Performance Enhancements

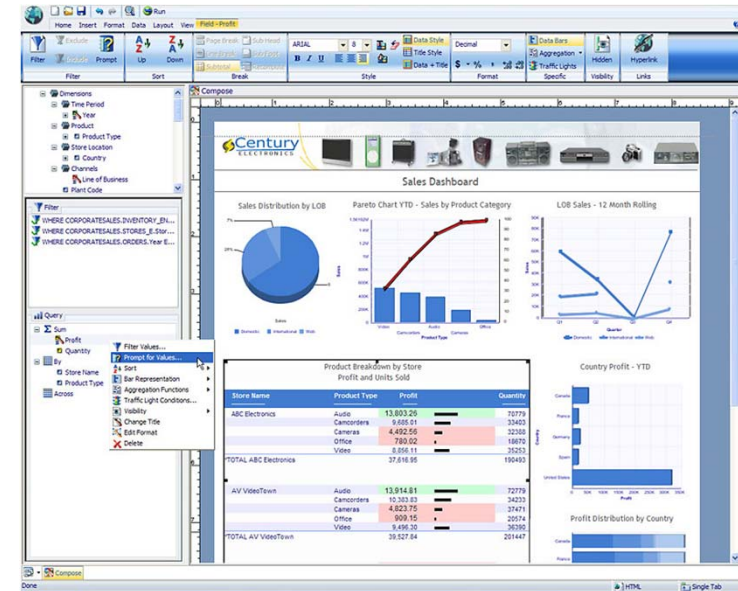
- Optimized SQL translation
- Enhanced join support and performance
- Simplified Work Management with new Dedicated Subsystem

### – Usability

- Dynamic report output formatting
- Cancel long-running query interface

### – Security - DBA for segment, column, and value level security

## ■ DB2 Web Query supports querying XML documents with IBM i 7.1

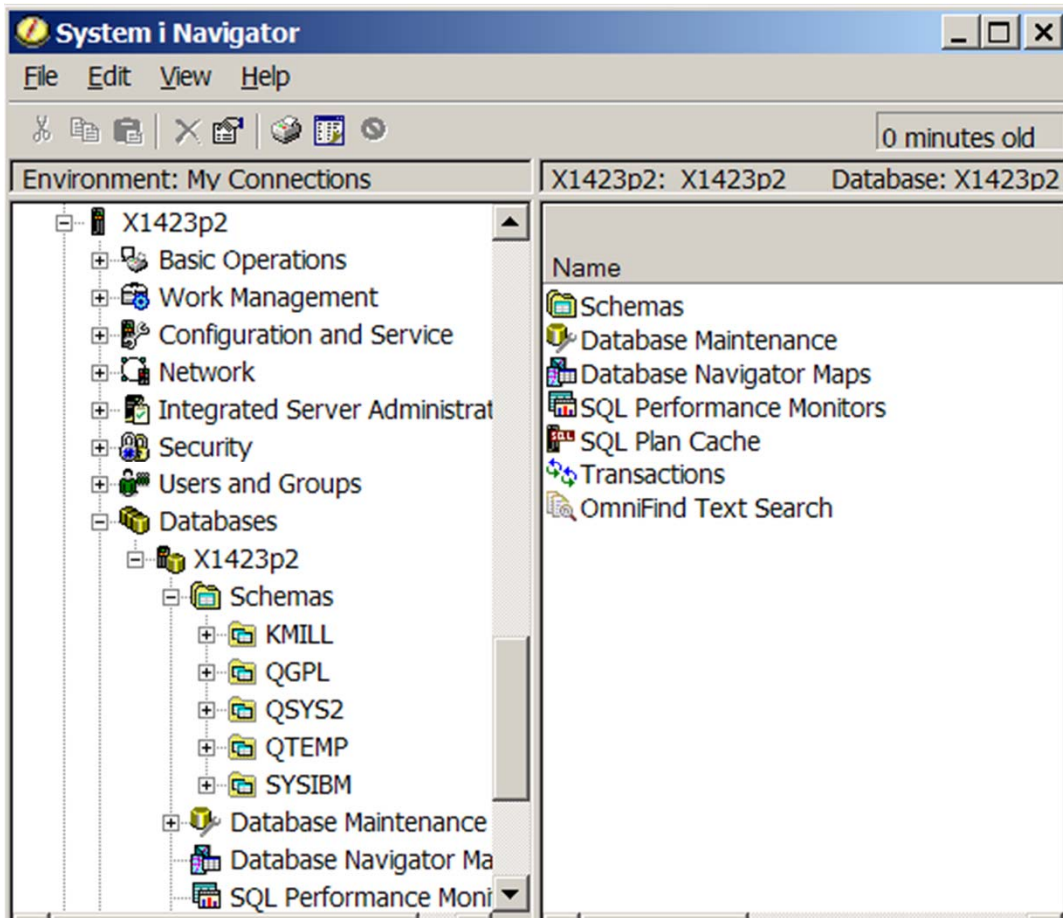


## ✓ Bring BI and Query Solution Back to IBM i

- Stop the pain and expense of replicating data
- Make decisions with current data

*DB2 Web Query provides an integrated Business Intelligence solution that offers rich functionality and breakthrough performance*

## Simplified DB2 for i Management - IBM i Navigator



### **IBM i 7.1 Enhancements:**

#### OnDemand Performance Center

- Authority Simplification
- Index Advisor Improvements
- Database monitor
  - Client register filter
  - Errors only filter
- Show Statements - Variable replacement
- Enhanced SQL Details for a Job
  - SQL Monitor integration
  - Connecting QSQRVR job info

#### Database Management

- OmniFind Text Index support
- Generate SQL – Privilege & CCSID
- Progress Status Monitors
  - Index Build
  - Table Alters
  - Enhanced Reorganize
- Object List enhancements
  - Performance of large lists
  - Object list filtering
  - Save list contents

#### Health Center

- SQL0901 Error Tracker

## Additional Information

- DB2 for i Websites
  - Home Page: [ibm.com/systems/i/db2](http://ibm.com/systems/i/db2)
  - DeveloperWorks Zone: [ibm.com/developerworks/db2/products/db2i5OS](http://ibm.com/developerworks/db2/products/db2i5OS)
  - Porting Zone: [ibm.com/partnerworld/i/db2porting](http://ibm.com/partnerworld/i/db2porting)
- Newsgroups & Forums
  - USENET: [comp.sys.ibm.as400.misc](http://comp.sys.ibm.as400.misc), [comp.databases.ibm-db2](http://comp.databases.ibm-db2)
  - DeveloperWorks: <https://www.ibm.com/developerworks/forums/forum.jspa?forumID=292>
  - System i Network DB2 Forum: <http://forums.systeminetwork.com/isnetforums/>
- Education Resources - Classroom & Online
  - [ibm.com/systemi/db2/gettingstarted.html](http://ibm.com/systemi/db2/gettingstarted.html)
  - [ibm.com/partnerworld/wps/training/i5os/courses](http://ibm.com/partnerworld/wps/training/i5os/courses)
- DB2 for i Publications
  - White Papers: [ibm.com/partnerworld/wps/whitepaper/i5os](http://ibm.com/partnerworld/wps/whitepaper/i5os)
  - Online Manuals: [ibm.com/systems/i/db2/books.html](http://ibm.com/systems/i/db2/books.html)
  - DB2 for i Redbooks (<http://ibm.com/redbooks>)
    - Getting Started with DB2 Web Query for System i (SG24-7214)
    - OnDemand SQL Performance Analysis ... in V5R4 (SG24-7326)
    - Preparing for and Tuning the SQL Query Engine on DB2 for i5/OS (SG24-6598)
    - Modernizing iSeries Application Data Access (SG24-6393)

# Q & A



Thank You

- ➔ **Need help using the newest DB2 for i technologies?**
- ➔ **Are you getting the most out DB2 for i?**



### IBM DB2 for i Center of Excellence

- ✓ Database modernization
- ✓ DB2 WebQuery
- ✓ Database design, features and functions
- ✓ DB2 SQL performance analysis and tuning
- ✓ Data warehousing and Business Intelligence
- ✓ DB2 for i education and training

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