



IBM System i™

## DB2 for i5/OS: V5R4 and other Cool Stuff

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*i want stress-free IT.*  
*i want control.*  
*i want an **i**.*

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## Agenda

- DB2 Strategy
  - Positioning
  
- V5R4
  
- Other Cool Stuff
  - Why “i” for BI
  - Are You Connected?

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## DB2 for i5/OS Home Page

**ibm.com/iSeries/db2**

- Your portal to everything DB2!
- General Information
- See it Action Demos
- What's New
- Education Roadmap
- Technical White Papers

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## DB2 Family

z/OS, i5/OS, Linux/Unix/Windows

Managing family compatibility

- Data Management Steering Committee
- Data Management Architecture Board
- SQL Language Council

Common design, algorithms, and code sharing where possible

Two Types of Differences

- Short term differences based on different release dates and different customer priorities
- Long term differences based on Operating System differences (Isolated to database configuration and utilities)

IBM DB2 Cross Platform Reference

- <http://www-1.ibm.com/servers/enablen/site/db2/db2common.html>

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## DB2 Product support for i5/OS

### DB2 for i5/OS “firsts”

- DRDA RUW
- Column-level CCSID tagging
- Scrollable Cursor
- National Language Sort Sequence
- Predictive Governor
- Parallel Index Build
- Standard SQL Procedures
- Encoded Vector Indexes
- Sparse Indexes
- Standard SQL User Defined Functions
- Complete ALTER TABLE support
- Autonomic Statistics Generation
- Autonomic Index Usage Information
- Local Table Partitioning
- ...

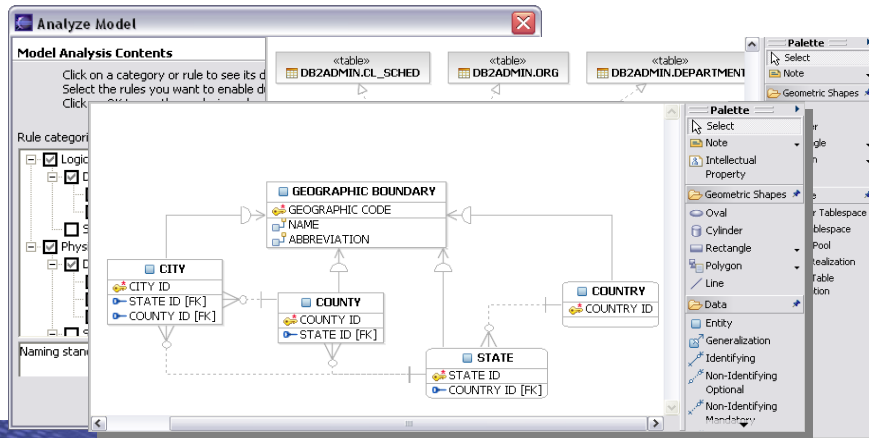
### DB2 Family Common Products

- Text Extender
- Text Extender Search Engine
- XML Extender
- Data Propagator
- Information Integrator
- QMF for Windows
- DB2 Everywhere
- WORF
- Content Manager and CM On Demand
- Rational XDE Data Modeler
- Migration Toolkit
- Development Center - Stored Procedure Builder
- Net Search/OmniFind (future enhancement)
- ...

See “DB2 for i5/OS Frequently Asked Questions”

## Commonality Example: IBM Rational Data Architect

- Enterprise data modeling and management
  - Compare & synchronize
  - Forward & reverse engineering
- Model analyzer for enterprise standard conformance
- Database development – SQL Stored Procedures and Function
- Trial Download: [ibm.com/software/data/integration/rda/](http://ibm.com/software/data/integration/rda/)



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## DB2 Development Center

- SQL procedures
- Java procedures
- External procedures
- Run and Deploy
- Debug

Graphical Debug currently available via System i5 Navigator and WDS

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## DB2 Connect for iSeries

- DB2 Family Connectivity and Federation
  - z/OS Heritage
  - Connectivity
    - JDBC, ODBC, DRDA
    - Gateway, Connection Pooling
  - Development Enablers
    - PHP, Eclipse, .NET
  - Federation
  - Mobility on Demand
- What it is NOT
  - Replacement for iSeries Access
  - A requirement for DB2 in i5/OS Access

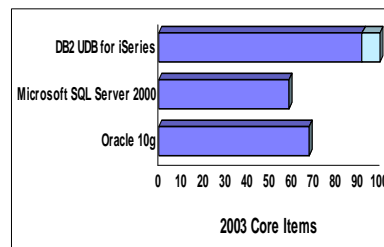
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## DB2 for Linux Unix Windows Utilities

DB2 LUW Utility	DB2 for i5/OS Equivalent
Control Center	iSeries Navigator
DB2 Development Center	DB2 Development Center
DB2 Warehouse Center	DB2 Warehouse Center
DB2 Health Center	Not Applicable
DB2 Replication Center	Data Propogator + DB2 Replic. Center
DB2 Connect	DB2 Connect for iSeries
DB2 Performance Center	i5/OS Performance Tools, DB2 Monitors
Query Patroller	iSeries Navigator, Centerfield Technologies
Materialized Query Tables	Materialized Query Tables
Multidimensional Clusters	N/A
Cube Views	Future MQT Design Support
Table Partitioning	Usually not required but available

## DB2 for i5/OS: V5R4

- On Demand Performance Center
  - DB2 Usability Enhancements: iSeries Navigator
    - Index Advisor (real time vs. requiring DB Mon data to be captured)
    - Real time analysis of SQL Plan Cache
  - Improved database monitoring capabilities
    - Filters to focus on specific user or sql call
    - Drill through analysis
    - Before/after comparison (what changed?)
  - Autonomic Indexes
- Additional Standards Support
  - SQL and DB2 Family
    - E.g., OLAP extensions
- Many Performance Improvements
  - SQL Stored Procedures, SQL Query Engine
  - Data Warehouse Enablement
- Improved .Net Support
  - iSeries Access and DB2 Connect for iSeries



**SQL 2003 Core Standard  
100% Complete with V5R4!!**

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## DB2 Administration: V5R4 System i5 Navigator

iSeries Navigator

- Optimizer information
  - Index use and statistics
  - MQT use and statistics**
  - Advised indexes (EVIs)**
  - Show pending statistics
- Database monitor
  - Explainable stmt filters
  - Drill-through
  - Compare
  - Summary
  - SQL Plan Cache Analysis**
- Health Center
  - Database metrics and limits
- EDTRBDAP support
- Import/Export
- Table actions
  - CLRPFM command
  - CPYF command
  - INZPFM command
- Show current SQL
  - Statement name
  - Program or package name
  - Open information
- Delimiter option on Creates



Manages all aspects of an System i5 - not just Database

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## On Demand System Wide Index Advice

Table for Which Index was Advised	Schema	Keys Advised	Index Type Advised	Last Advised for Query Use	Times Advised for Query Use
ADDRESSES	DB2ADM	LINK_ID,LOCATION,TYPE	Binary Radix	7/5/05 5:22:53 AM	82
HISTORICAL_VARIATION_PER...	COORSCD16	ENVIRONMENT	Binary Radix	9/20/05 10:22:38 AM	82
T_02G2TMD05	DATAWFD	TIPOLOGIA_ID, TIENDA_ID	Binary Radix	12/31/05 5:55:27 AM	82
T_02G2TMD02	DATAWFD	TIPOLOGIA_ID, TIENDA_ID	Binary Radix	12/31/05 5:55:27 AM	82
TO1061MD04	DATAWFD	SECCION_ID	Binary Radix	1/1/06 5:20:42 AM	82
TO1061MD03	DATAWFD	SECCION_REF_ID	Binary Radix	1/1/06 5:20:42 AM	82
BPRTOPL_DATA_PERIOD	DB2ADM	TOPL_PERIOD,TOPL_YEAR,TOPL_STOCKROOM_CODE	Binary Radix	7/6/05 8:05:24 AM	81
CUST_DIM	STAR100G	CUSTKEY	Encoded vector (not unique)	12/29/05 12:09:47 AM	80
FEMEQ	CORPDB	JDE_EQUIP_TAG	Encoded vector (not unique)	12/28/05 11:31:52 PM	80

Advice can be viewed at database, schema or table level

Enhanced Advice provided (SQE Only)

- Join, Grouping, Ordering criteria
- Available on V5R3 with latest DB Group PTF

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## Live DB2 Performance Analysis via SQL Plan Cache

**Always On - no database monitor overhead**

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## SQE vs. CQE

### V5R3 vs V5R2 - SMP \*OPTIMIZE

**Testing Results:**

- 337 queries exercising a wide range of function.
- All longer running queries and most short running queries performed better
- 13 short running queries (under 3 seconds) performed slightly worse

**V5R4:**

- Support for LIKE, LOB Columns, SUBSTR, and Sensitive Cursors
- Enhanced Partitioned Table Support
- Autonomic Indexes

**Remaining Restrictions:**

- Sort/Sequence
- Select/Omit LFs

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## DB2 UDB for iSeries V5R4 Enhancements: Summary

### Application Flexibility & Portability

- Free Format RPG & SQL
- Enhanced SQL Standards support
  - Scalar FullSelect
  - Standard Flagger
- Improved DB2 Family Compatibility
  - Recursive Expressions
  - OLAP Support – RowNumber & Rank
  - ANS Timestamp Format
  - TDES Encryption
  - 2 MB SQL Statements & 32K keys

### OnDemand & Availability

- Cross-Reference Files Robustness
- Automatic Journaling Enhancements
- SMAPP for EVIs
- Parallel Rollback Unlock

### Performance

- SQL Query Engine enhancements
  - LIKE & LOB Support
  - Sensitive Cursors
  - Autonomic Indexes
- Faster SQL Procedural Language
- Enhanced MQT Optimization
- Faster XML Extenders

### Usability

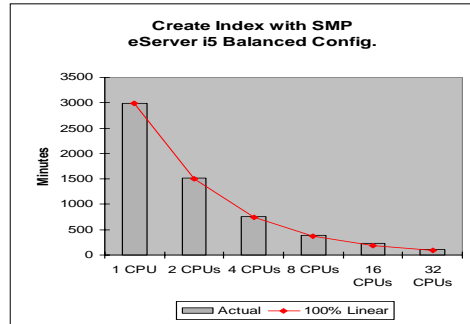
- iSeries Navigator Enhancements
  - DB2 On Demand Performance Center
  - SQE Plan Cache Analyzer
  - DB2 Health Center
- Resource Governor
- Governor Exit Point
- DB2 Content Manager

## Agenda

- DB2 Strategy
  - Positioning
- V5R4
- Other Cool Stuff
  - Why “i” for BI
  - R U Connected?

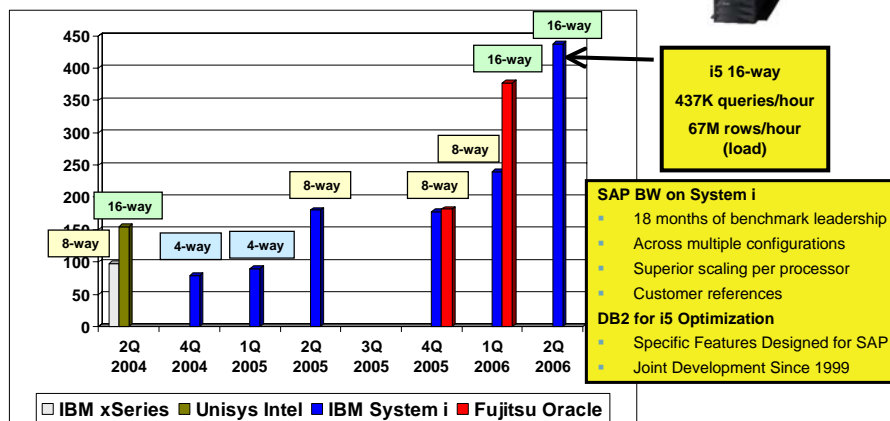
## DB2 for i5/OS Enablers for BI

- Built into i5/OS
  - SQL Query Engine (SQE)
  - On Demand Performance Center
  - Database Parallelism\*
  - Real time statistics
  - Materialized Query Tables
  - Star Join
  - Query Rewrite
  - Encoded Vector Indexing
  - Remote Journaling (Trickle Feed)
  - Single Level Storage
  - Autonomic Indexes
  - Index Advisor
  - Database Monitors



NEAR LINEAR SCALABILITY

## System i5 Optimized for SAP



**SAP BW on System i**

- 18 months of benchmark leadership
- Across multiple configurations
- Superior scaling per processor
- Customer references

**DB2 for i5 Optimization**

- Specific Features Designed for SAP
- Joint Development Since 1999

\*See detailed certified benchmark results at [http://www.sap.com/solutions/benchmark/BW2\\_results.htm](http://www.sap.com/solutions/benchmark/BW2_results.htm)

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## Data Warehouse Load Experiences

- Previous environment
  - Data Warehouse Load programs written in RPG using non-SQL I/O
  - Add/Update 3 tables, total refresh of an additional 5 summary tables
  - Read logical file, chain to another file to get "group by", and add/update
  - 7 Hours to complete
- Current Environment
  - RPG altered to use embedded SQL for 3 table add/updates
  - 5 Summary tables replaced by MQTs (Materialized Query Tables)
    - Refreshed with "Refresh Table" SQL Command
  - Binary Radix and Encoded Vector Index techniques used
- Result
  - 7 Hour job reduced to.....

**8 minutes**

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## The (near) real time Data Warehouse

**Remote Journaling during normal business processing hours**

**Virtualization Engine Technologies**

- Trickle Feed Staging Area ODS
- Eliminate EXTRACTION impact on production systems
- Optimize resources for supporting production and daytime data warehouse queries
- No Charge Feature of OS/400
- Requires Production Data propagator, Virtual Enterprise and SQL Logic, and other shared files.
- Can add SQL Logic, rename shared files, change datatypes, comment back, and other shared files.

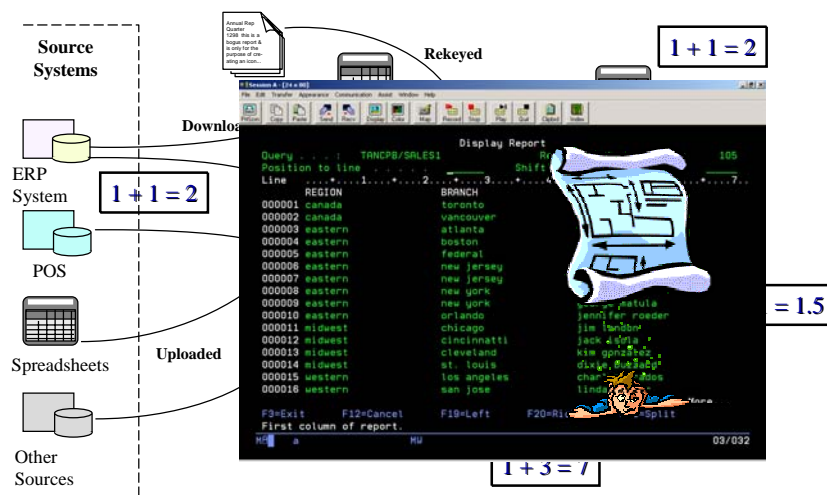
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## Elie Tahari

- U.S. Apparel Designer and Manufacturer
  - Operational Systems on System i
  - Required FASTER analysis to leverage fashion changes
  - Required Scorecards (dashboards) to reflect business performance
  - Too much time spent gathering vs. analyzing
- Compared DB2 UDB for iSeries performance vs. Microsoft SQLServer
  - DB2 outperformed, and disparity grew as table sizes grew
- REAL TIME Data Warehouse Implementation
  - Leveraged Remote Journaling and MQ
  - IBM's (Ascential) DataStage used for ETL

*"We built identical models over identical sets of data. There was no comparison in performance. In fact, the bigger the tables, the bigger the advantage of DB2 over SQL Server. That proved to us that DB2 for i5/OS was a better choice."*  
 - Sam Gottlieb, Project Lead, Elie Tahari

## Are you in Spreadsheet or I/T Purgatory?



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# WebFOCUS 7 Any stored Query/400 queries?

Query . . . . . Position to line

Line . . . . . Columns . . . . . 1 71 Browse TRNCPB/TESTS TRNCPB/SALES1 VISITS REVENUE

```

000001 canada
000002 canada
000003 eastern
000004 eastern
000005 eastern
000006 eastern
000007 eastern
000008 eastern
000009 eastern
000010 eastern
000011 midwest
000012 midwest
  
```

SELECT ALL REGION, BRANCH, REP, LEADS, VISITS, (REVENUE)  
FROM TRNCPB/SALES T01  
WHERE REGION <> 'INT'  
ORDER BY 001 ASC, 002 ASC

- HTML
- EXCEL
- PDF
- and more...

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## iSeries Tools Innovation – Business Intelligence Vendors

SQL/Query Performance & tuning

On-Line Analytical Processing (OLAP)

Enterprise Reporting

Data Replication

Data Extraction/Transformation/Load

Data Mining/Predictive Analytics

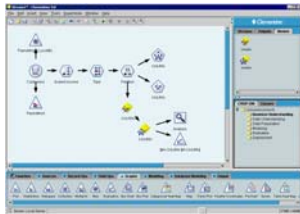
Managed Services – Business Insight

iSeries Tools Innovation Web Portal - <http://www-1.ibm.com/servers/enable/tools/innovation/>

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## What about.... Data Mining ???

- **Predict what may happen in the future**
  - Example: Predict orders for next quarter based on historical patterns so you can optimize supply chain and inventory management.
- **Classify / Cluster people or things into groups by recognizing patterns**
  - Example: Find new ways to segment customers based on buying patterns or other attributes to help with marketing campaign effectiveness.
- **Associate what events are likely to occur together**
  - Example: Perform market basket analysis (what products are customers buying together/) to determine the best cross selling opportunities.
- **Sequence what events are likely to lead to later events**
  - Example: Perform Web click stream analysis (what path do buying customers take on-line?) so they can optimize their e-business strategies.



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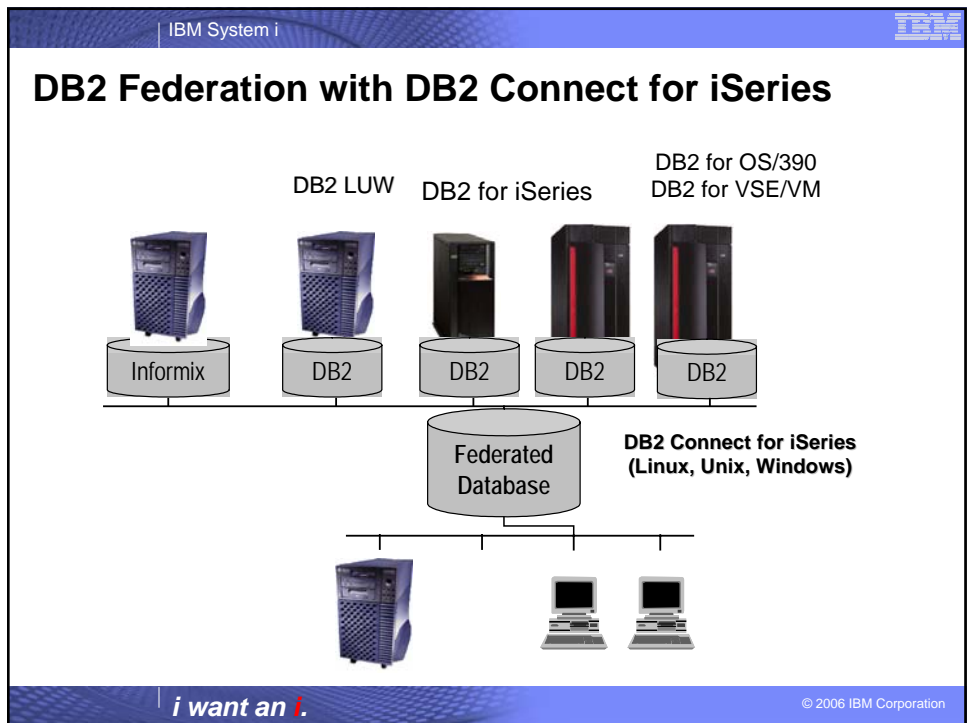
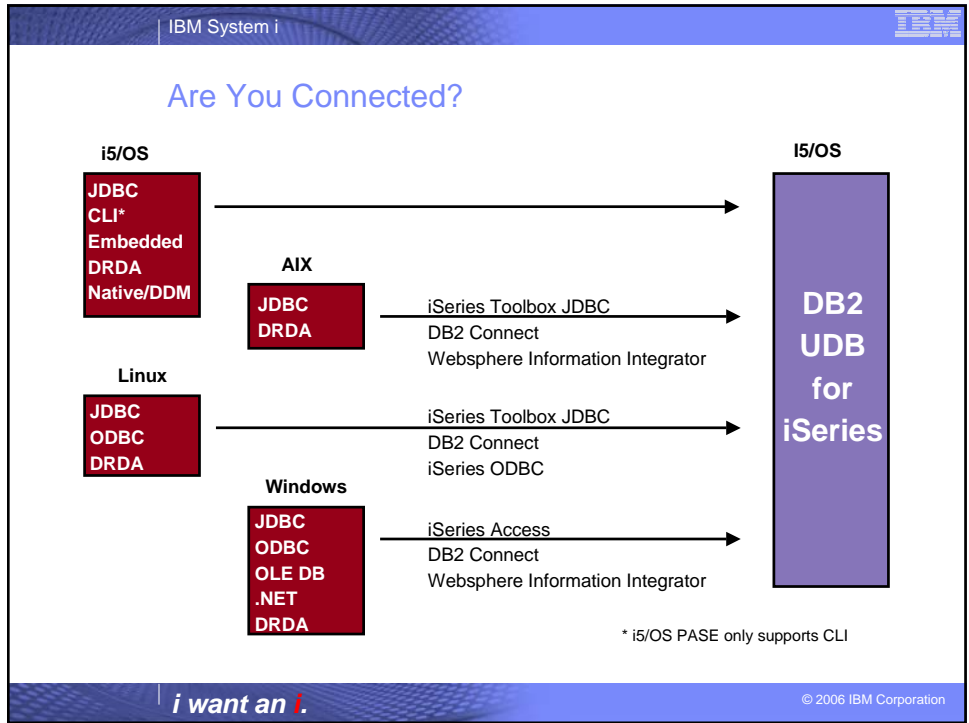
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## Examples

- **Telecom Wireless Service Provider**
  - Customer Churn is a huge problem. How can you create an offer that is presented to a customer BEFORE they leave for some other service provider?
- **Auditing: Tax Returns**
  - How can you shift through thousands of tax returns to identify those that are more likely to be fraudulent and require an audit?
- **Marketing**
  - With a limited marketing budget, how can I promote an event or offering that BEST TARGETS those that are more likely to respond?
- **Risk Assessment**
  - How do you determine, ON THE FLY, whether a bank loan should be given to a consumer? Or how can you determine, while the customer is ON THE PHONE with the service rep, whether an insurance claim should just be paid or investigated?
- **Web Commerce**
  - Upsell Cross Sell ON THE FLY
- **Distribution/Manufacturing**
  - Predictive Trucking/Machinery Maintenance
  - Warranty Analysis

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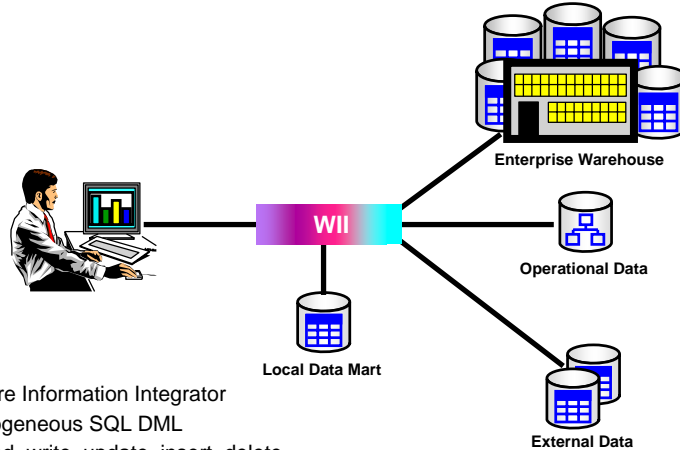
## Distributed database join example

- First the local DB2 Connect instance needs to be enabled as a DB2 federated server
  - Set the database manager configuration parameter FEDERATED to YES:  
db2=> update dbm cfg using FEDERATED YES
- Connect to the federated database:  
db2=> connect to sample
- Use the CREATE WRAPPER statement to register a wrapper for the System i data source
  - Wrappers are library routines that are used by the federated server to perform operations such as connecting to a data source  
db2=> create wrapper drda
- Use the CREATE SERVER statement to register a data source as a server within the federated database.
  - The server definition specifies the type and version of the data source and the wrapper used for communications with this data source.  
db2=> list database directory  
Database alias = TPLX  
Database name = DCS82A80  
Node name = NDE3BA33  
db2=> create server tplx type db2/400 version 5.4.0 wrapper  
drda authorization db2user password mypassword options(node  
'NDE3BA33', dbname 'TPLX')

## Page 2

- Define the user mappings that instructs the federated server what userid and password should be used when connecting to the iSeries data source:  
db2=> create user mapping for user server tplx options(remote\_authid 'db2user', remote\_password 'mypassword')
- Specify the nickname for the iSeries table or view
  - A nickname is an identifier used by the federated server to reference an object located at the data source  
db2=> create nickname tplx\_staff for tplx.db2user.staff
- Test the distributed join query  
db2=> SELECT deptname, name, salary + COALESCE(comm,0) as compensation FROM org o,  
tplx\_staff s WHERE o.deptnumb = s.dept ORDER BY deptname, compensation DESC
  - The query runs on the federated server rather than on iSeries
- Modify the cursordj.sqc so that it executes a distributed join.
  - EXEC SQL CONNECT TO SAMPLE USER :userid USING :passwd;
  - Modify the select statement so that it performs a distributed join.
  - Save the new source version as cursordj.sqc.
- Prepare, bind, and compile the distributed join version of the program  
db2 prep cursordj.sqc bindfile  
db2 bind cursordj.bnd  
gcc -I\$HOME/sql/lib/include -L\$HOME/sql/lib/lib -ldb2 -o cursordj  
cursordj.c

## What About Heterogeneous Database Access ?



- Websphere Information Integrator
  - Heterogeneous SQL DML
    - read, write, update, insert, delete
  - Heterogeneous Replication with Data Propagator
    - White Paper: [ibm.com/servers/enable/site/education/ibo/record.html?hetdata](http://ibm.com/servers/enable/site/education/ibo/record.html?hetdata)

## Configuring Websphere II: Oracle

- One-time setup & configuration
  - Create Oracle data access wrapper:
 

```
CREATE WRAPPER NET8
```
  - Identify the name and type of the target Oracle database.
 

```
CREATE SERVER orasvr
TYPE oracle VERSION 8.1.7
WRAPPER NET8 OPTIONS(NODE 'ORA817')
```
  - Specify the Oracle userid that will be used for Oracle data access:
 

```
CREATE USER MAPPING FOR USER SERVER orasvr
OPTIONS (REMOTE_AUTHID 'scott', REMOTE_PASSWORD 'xxxx')
```
  - Define a nickname for the Oracle table, emp, that needs to be accessed:
 

```
CREATE NICKNAME oraemp FOR orasvr.scott.emp
```
- Now, **any** iSeries SQL Interface can read the oraemp table in the Oracle database with the following simple steps
 

```
CONNECT TO IISVR USER udbuser USING password
SELECT * FROM oraemp
```

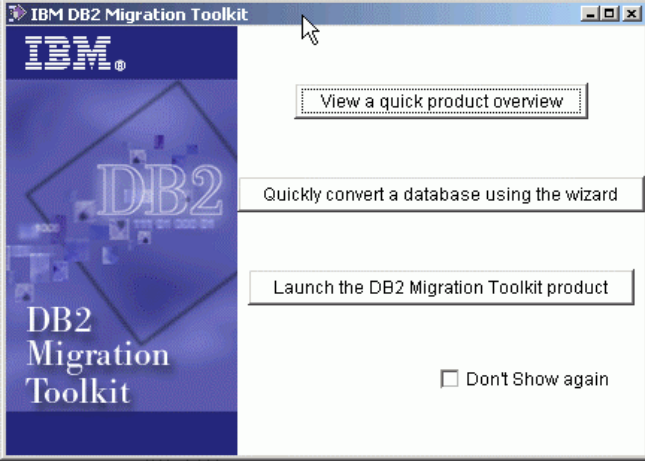
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## Database Migrations (to DB2)

Supported Sources:

- Microsoft SQL Server (6,7,2000)
- Oracle (7, 8i, 9i,10g)
- Sybase ASE (11-12.5)
- Informix (IDS v7.3, v9)

**NO-CHARGE**  
**Download:**  
[ibm.com/servers/enable/site/db2/porting.html](http://ibm.com/servers/enable/site/db2/porting.html)



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## Add ins for .NET Developer

- IBM DB2 Development Add-Ins for Visual Studio.Net 2003
  - install also the latest database group PTF on iSeries
- The key features include:
  - DB2 .NET Managed Provider
  - Solution Explorer, which allows you to create and manage DB2 projects
  - IBM Explorer, which allows you to view DB2 server catalog information and supports client-side ADO.NET code generation
  - DB2 Data Controls
  - SQL Editor, which facilitates editing of DB2 scripts, including syntax colorization and statement auto-completion

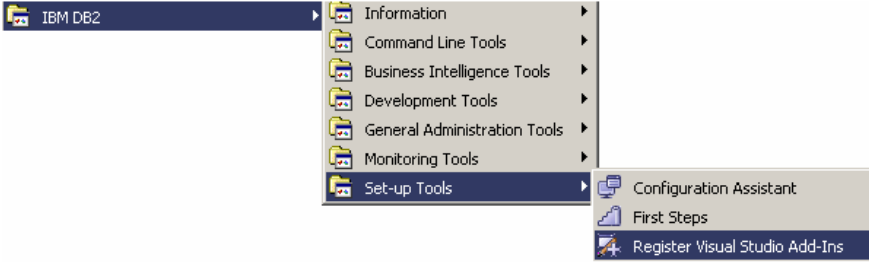
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## Registering Add ins

- Automatic Registration
  - If Visual Studio .NET installed before installing DB2 Connect
- Manual
  - If Visual Studio .NET installed after installing DB2 Connect
  - Run db2vsrgx.bat located in SQLLib/bin directory
    - or
  - Use DB2 Set-up Tools menu as show below



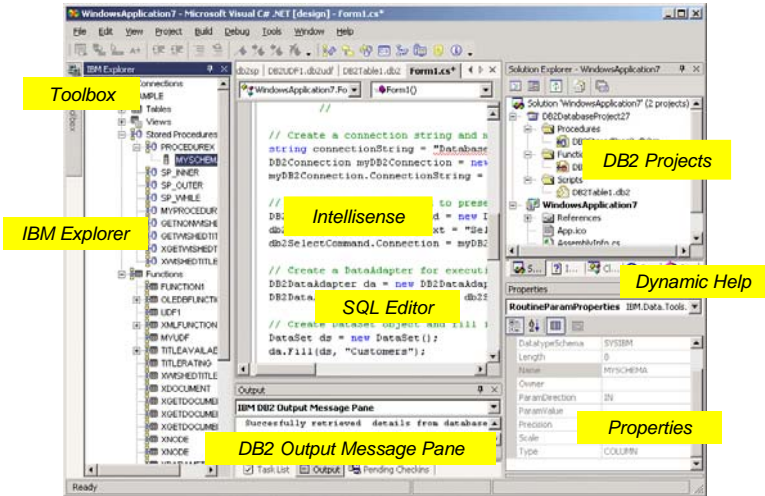
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- Information
- Command Line Tools
- Business Intelligence Tools
- Development Tools
- General Administration Tools
- Monitoring Tools
- Set-up Tools
  - Configuration Assistant
  - First Steps
  - Register Visual Studio Add-Ins

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## DB2 Connect Plug-ins for Visual Studio .Net



WindowsApplication7 - Microsoft Visual C# .NET [design] - Form1.cs\*

Toolbox

IBM Explorer

Intellisense

SQL Editor

DB2 Output Message Pane

Dynamic Help

Properties

DB2 Projects

```

// Create a connection string and a
string connectionString = "Database
DB2Connection myDB2Connection = new
myDB2Connection.ConnectionString =

// Create a DataAdapter for execute
DB2DataAdapter da = new DB2DataAdapter
DB2Data

// Create dataset object and fill it
DataSet ds = new DataSet();
da.Fill(ds, "Customers");

```

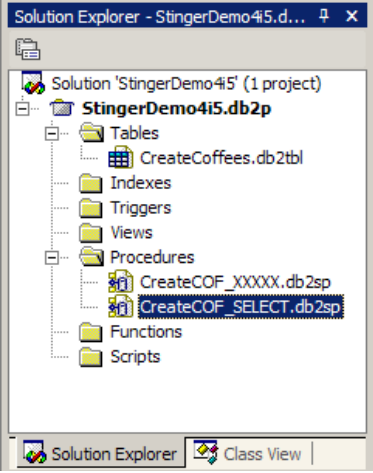
ibm.com/servers/enable/site/education/ibo/view.html?oc#db2  
 ibm.com/servers/enable/site/education/ibo/view.html?wp#db2

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## Solution Explorer

- Solution Explorer allows you to create and manage DB2 projects

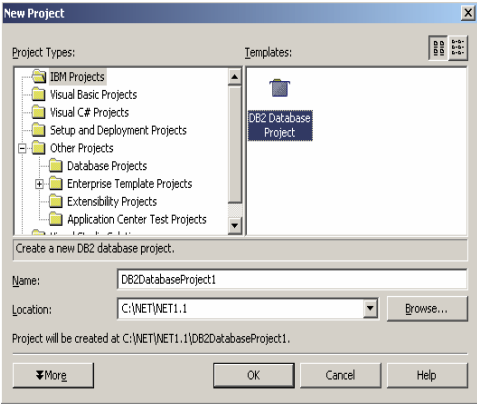


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## DB2 Database Projects

- With a DB2 Database Project, you can:
  - Add new or existing SQL stored procedure scripts.
  - Add new or existing SQL UDF scripts.
  - Add new or existing scripts based on generic templates.
  - Add new or existing SQL table, index, view and triggers scripts.
  - Specify build configuration options, including script build order.
  - Check script files into Microsoft Visual Source Safe source-control management system.

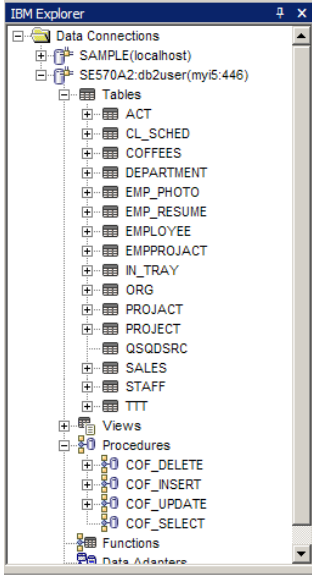


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## IBM Database Explorer

- IBM Explorer (like Server Explorer)
  - DB2 Data Connections listing Tables, Views, SPs, and UDFs
  - Table/View details (columns, indexes, triggers)
  - New SP, UDF using wizards
  - Run and view source of SP, UDF
  - Retrieve/update data of tables, views
  - Filtering and caching

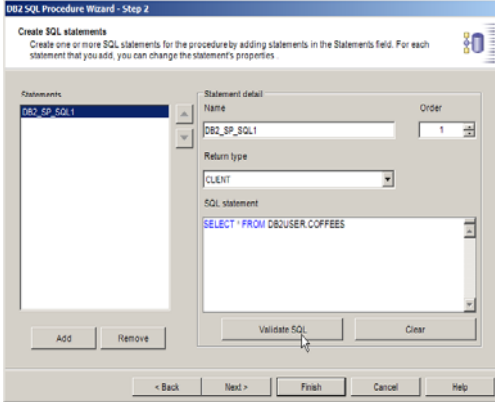


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## Example: SQL Procedure Wizard

- Used to create SQL Stored Procedures
- Specify procedure schema name, procedure name, specific name
- Create SQL statements
- Specify input/output parameters
  - Recommendation: Validate the SQL statements to allow the wizard to automatically derive the attributes of parameters!
- Insert code fragments
- Compile stored procedure on System i
  - \*PGM created in the specified schema

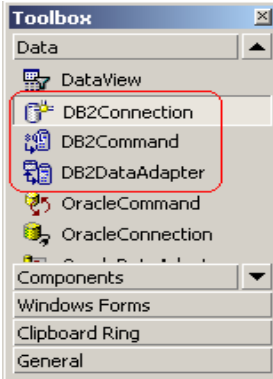


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## DB2 Data Controls

- There are two methods to generate Windows front-end or Win Form code for interacting with a database:
  - writing code for each functionality
  - dragging and dropping (binding) database-related controls
    - requires few lines of code
    - provides an easy and fast way to develop GUI applications
- Data controls available in DB2 Add-in are:
  - DB2Connection
  - DB2Command
  - DB2DataAdapter



The screenshot shows the Visual Studio Toolbox with the 'Data' category selected. A red box highlights three items: DB2Connection, DB2Command, and DB2DataAdapter. Other items visible include DataView, OracleCommand, OracleConnection, Components, Windows Forms, Clipboard Ring, and General.

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## Connecting .NET apps to DB2 using DB2 Connect for iSeries and Web Services

- Generate Web Method
  - Create calls to DB2 as a web method
  - Deploy the web method to a Windows Application Server
  - Use "Generate Web Services" wizard to build ASP.NET Web Service
- V9 adds some new functionality
  - IBM Script Designer
    - Create, modify, and run SQL scripts
  - IBM Output Message Panel
    - View messages associated with .NET and DB2 interaction
- Assumes Visual Studio 2005 and DB2 Connect for iSeries Refresh (V9)
- White Paper "Building Web Services in a Flash":
  - <http://www-03.ibm.com/servers/enable/site/education/wp/e102/>

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# Questions & Answers



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