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 Family Positioning and V5R4 Overview
- Other Cool Stuff
  - New Tools
  - Why “i” for BI
  - Are You Connected?

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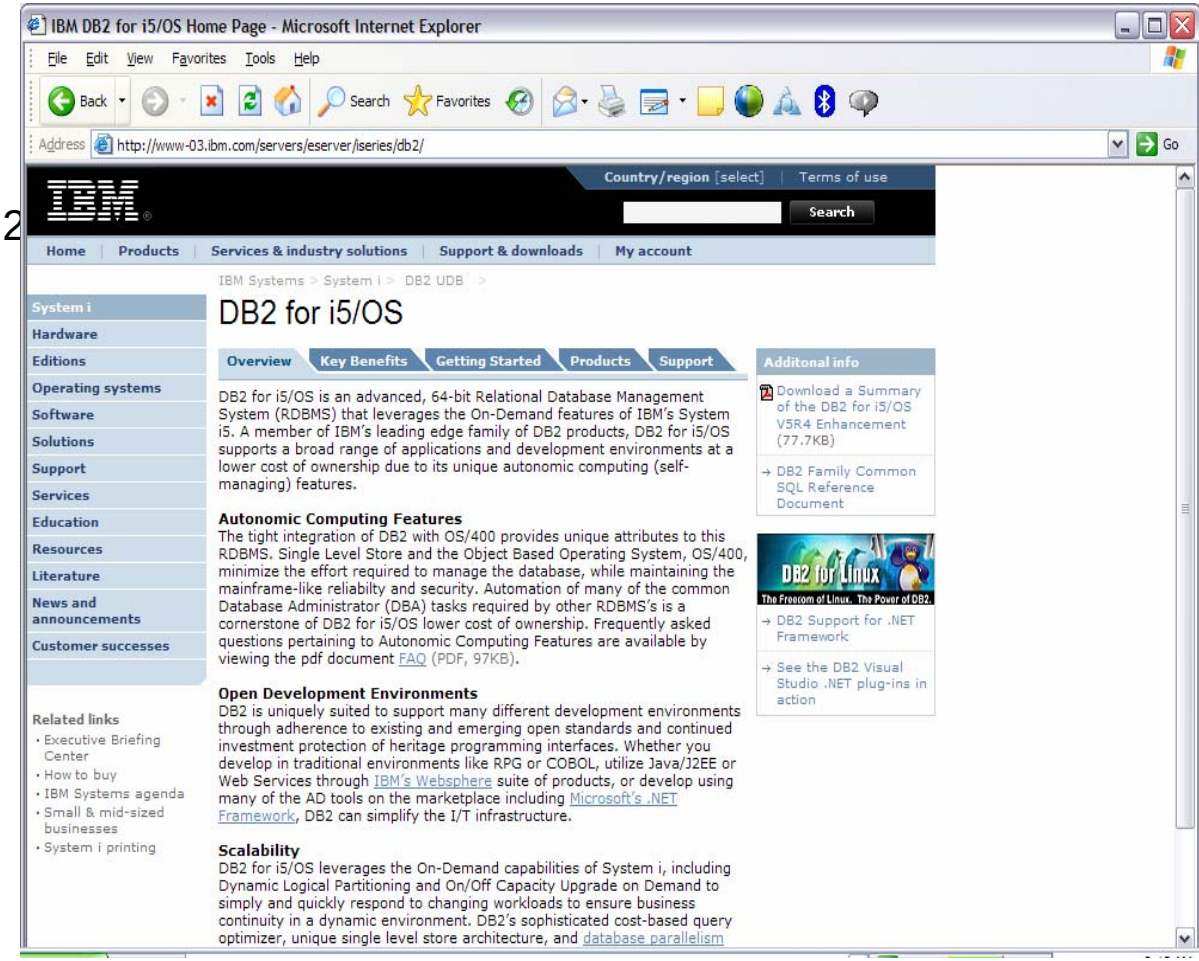
DB2 for i5/OS Home Page

Ibm.com/iseries/db2

- Your portal to everything DB2
- General Information
- See it Action Demos
- What's New
- Education Roadmaps
- ***HOW TO Papers***
  - Click on SUPPORT
  - Articles and 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

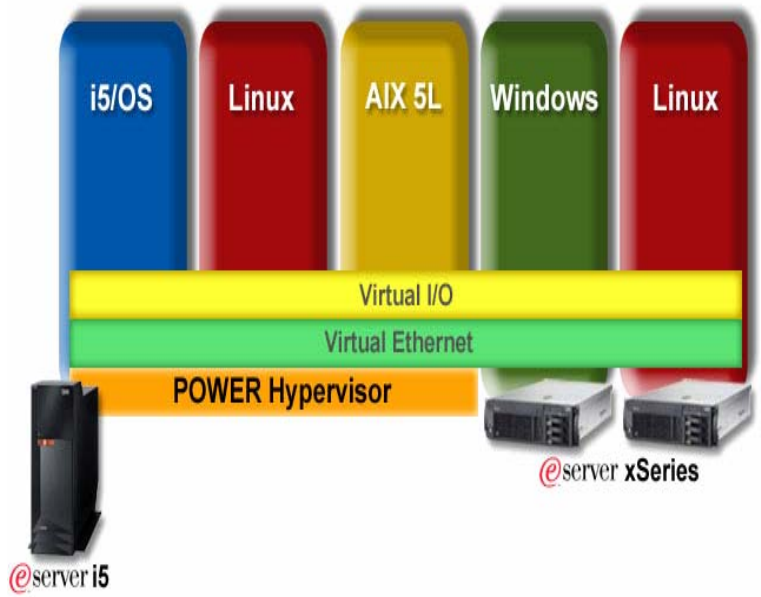
Two Types of Differences

- 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/enable/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
- XML Extender
- Data Propagator
- Websphere Federation Server
- QMF for Windows
- DB2 Everywhere
- Web Services Object Framework (WORF)
- Content Manager and CM On Demand
- Rational XDE Data Modeler
- Migration Toolkit
- Development Center - Stored Procedure Builder
- OmniFind (future enhancement)
- ...

See “DB2 for i5/OS Frequently Asked Questions”

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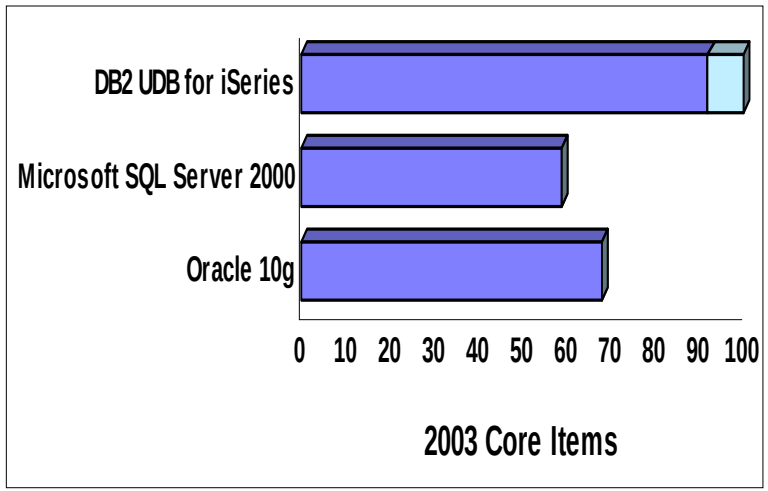
DB2 for i5/OS: V5R4

- 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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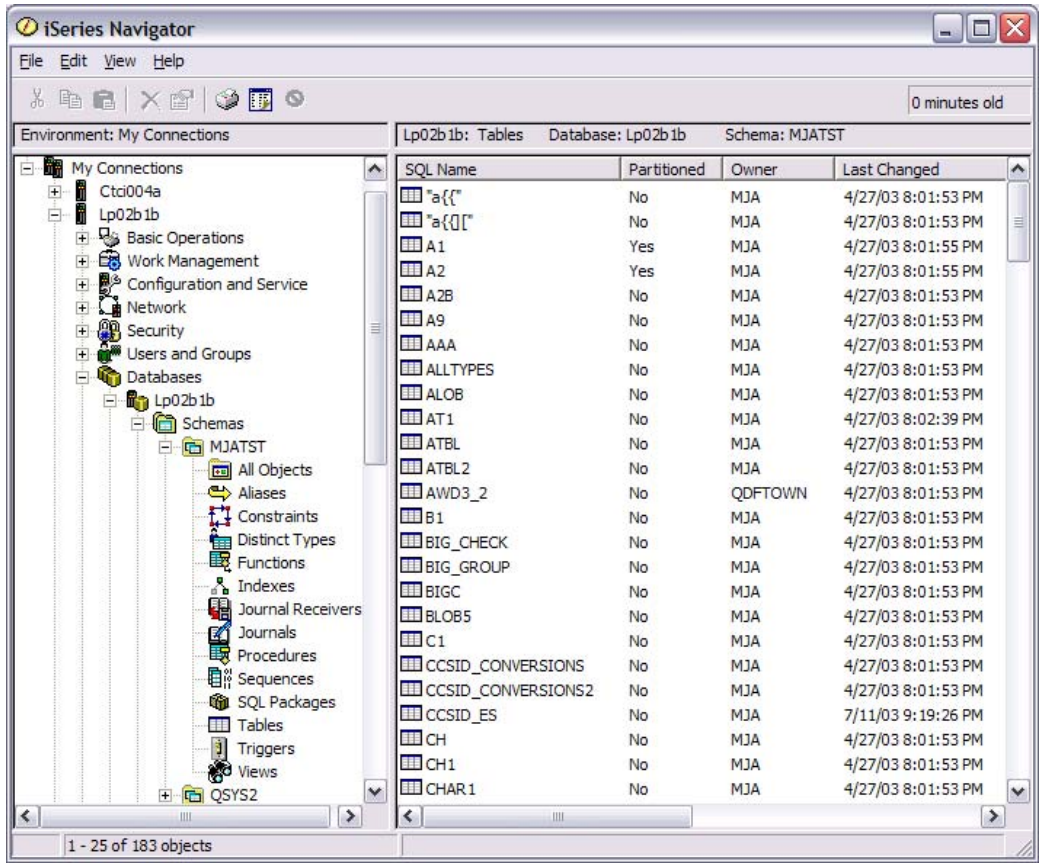
DB2 Administration: V5R4 System i5 Navigator

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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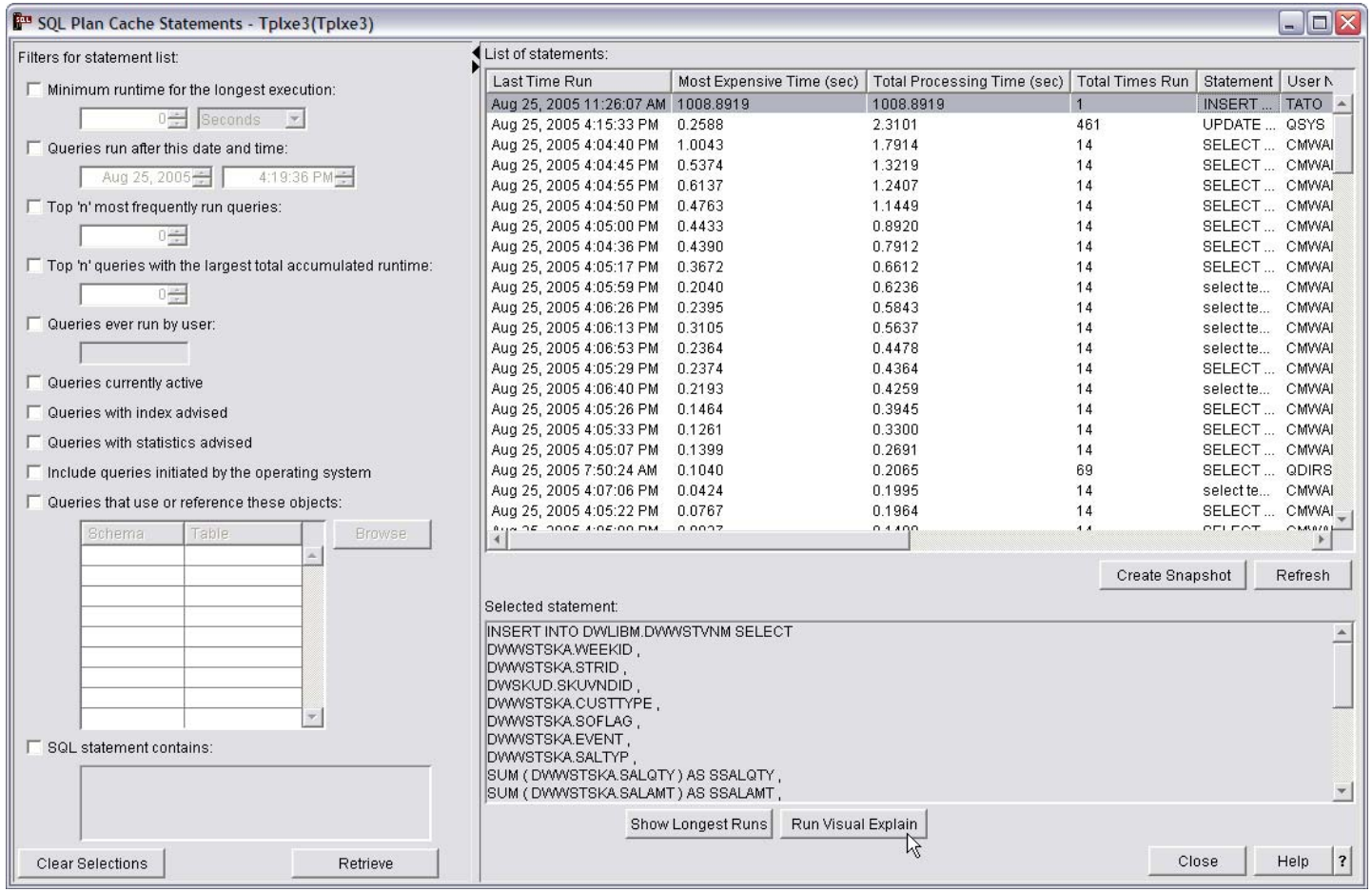
Live DB2 Performance Analysis via SQL Plan Cache



Always On - no database monitor overhead

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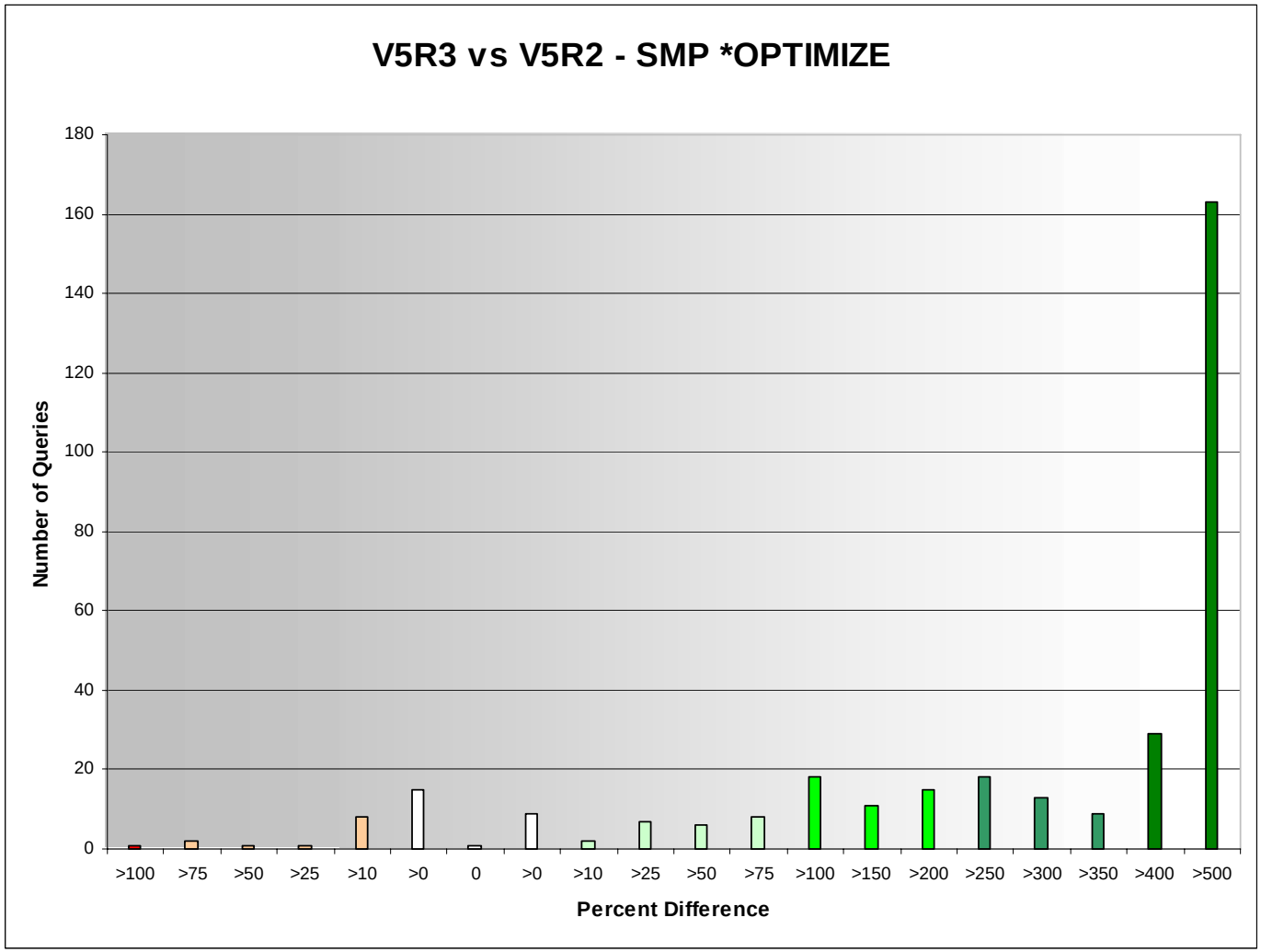
SQE vs. CQE



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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Application Development

- Bigger & Badder Limits
  - 2 MB SQL statement maximum
  - 1000 tables per query (DML Only)
  - 128 byte Column Names
  - 1024 parameters for Stored Procedure
  - 32K index keys & ORDER BY
- New SET SESSION Authorization statement
  - Better SQL auditing with the ability to supply actual user of remote connections
  - New SESSION USER & SYSTEM USER special registers
  - Considerations
    - *ALLOBJ authority required to execute
    - DB2 resources are freed, so performance can be impacted
    - Other settings such as SQL Path may need to be reset

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OLAP Expressions – RANK & DENSE_RANK

- RANK & DENSE_RANK for highlighting data attribute – independent of the result set sorting

```
SELECT empno, lastname, salary+bonus AS TOTAL_SALARY,
  RANK() OVER (ORDER BY salary+bonus DESC) AS Salary_Rank
FROM employee WHERE salary+bonus > 30000 ORDER BY lastname
```

SELECT empno, lastname, salary+bonus AS TOT...

EMPNO	LASTNAME	TOTAL_SALARY	SALARY_RANK
000050	GEYER	40975.00	5
000010	HAAS	53750.00	1
200010	HEMMINGER	47500.00	2
000090	HENDERSON	30350.00	11
200220	JOHN	30440.00	9
000030	KWAN	39050.00	6
000110	LUCCHESSI	47400.00	3
000220	LUTZ	30440.00	9
000070	PULASKI	36870.00	7
000060	STERN	32750.00	8
000020	THOMPSON	42050.00	4

Dense_Rank() Output

SALARY_RANK
5
1
2
10
9
6
3
9
7
8
4

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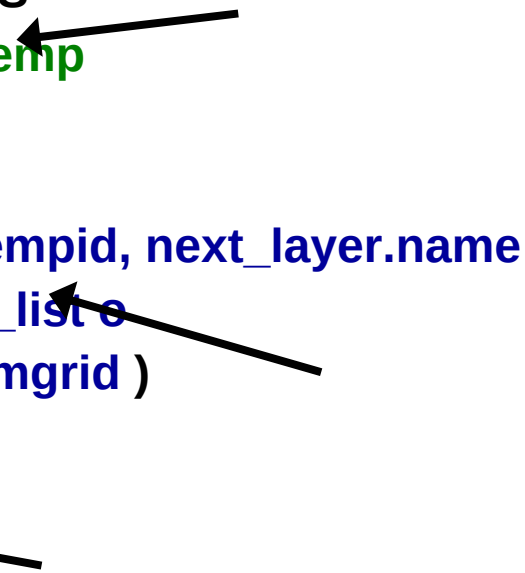
Recursive SQL

- Recursive Common Table Expressions
  - Useful for navigating tables where rows are inherently related to other rows in same table - Bill of Materials, Organizational Hierarchies, …
  - Example:

```
WITH emp_list (level, empid, name) AS
      (SELECT 1, empid, name  FROM emp
        WHERE name = 'Carfino‘
      UNION ALL
       SELECT o.level + 1, next_layer.empid, next_layer.name
        FROM emp as next_layer, emp_list o
         WHERE o.empid = next_layer.mgrid )
SELECT level, name FROM emp_list
```



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INSTEAD OF Triggers (IOTs)

- New Trigger Type can be used to change the semantics of INSERTs, UPDATEs, & DELETE operations against a view – only can be defined over an SQL view
  - Many Views are read-only due to derivations, joins, grouping, etc
  - IOTs useful in setting up encryption to be semi-transparent
  - V5R4 support builds on base IOT support delivered via V5R3 PTF (ibm.com/iseries/db2/iot.html) by providing support for join views, etc

```
CREATE VIEW empdept AS
     SELECT empno, firstname, lastname, deptname FROM employee, department
     WHERE workdept=deptno

CREATE TRIGGER UpdateJoin
 INSTEAD OF UPDATE ON empdept
 REFERENCING OLD ROW AS o NEW ROW AS n
 FOR EACH ROW
BEGIN
  UPDATE employee
     SET empno=n.empno, firstname=n.firstname, lastname=n.lastname
     WHERE empno=o.empno;
  UPDATE department SET deptname = n.deptname WHERE deptname=o.deptname;
END
```


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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

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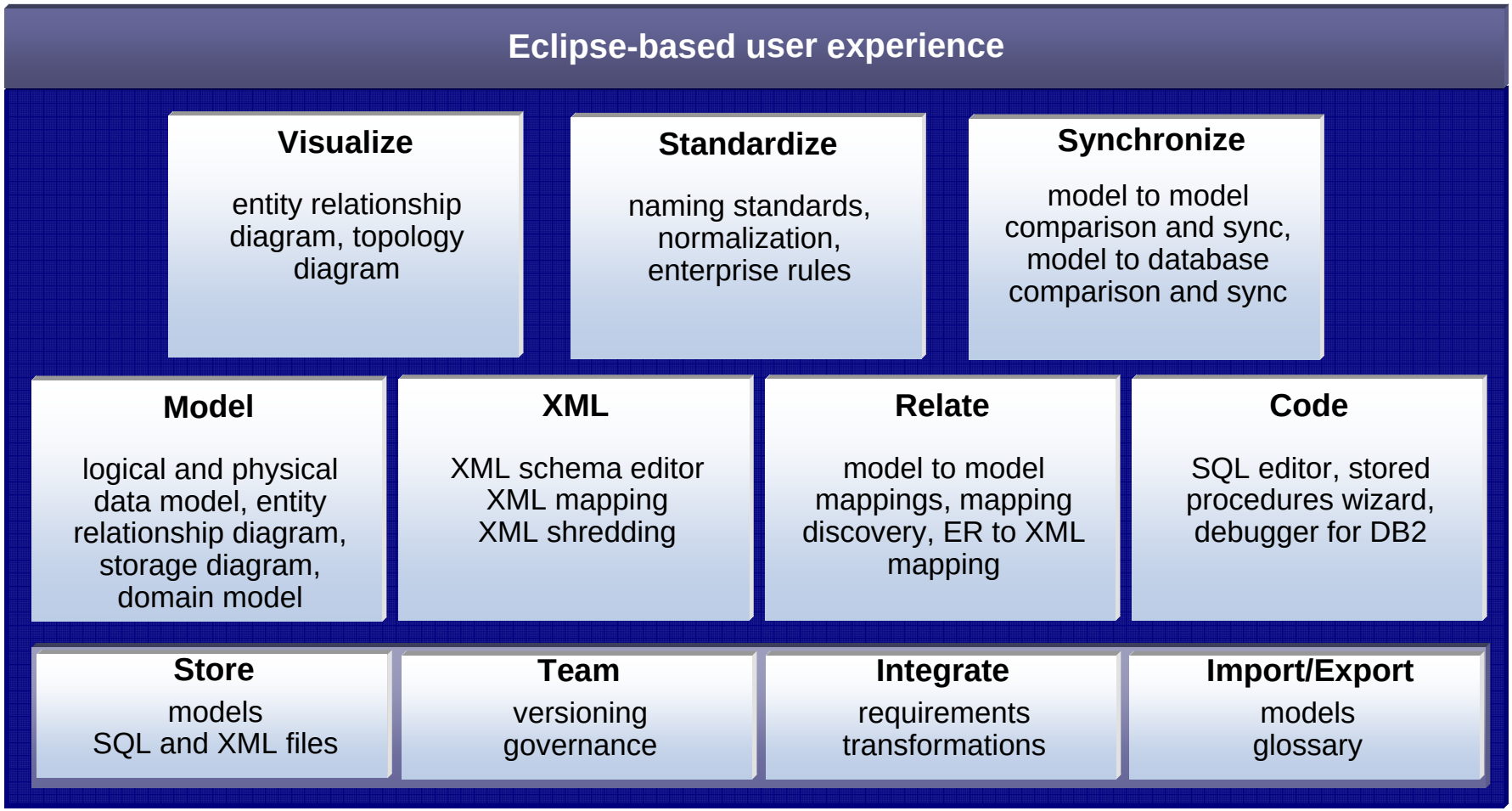
Rational Data Architect

Enterprise data modeling and integration design tool



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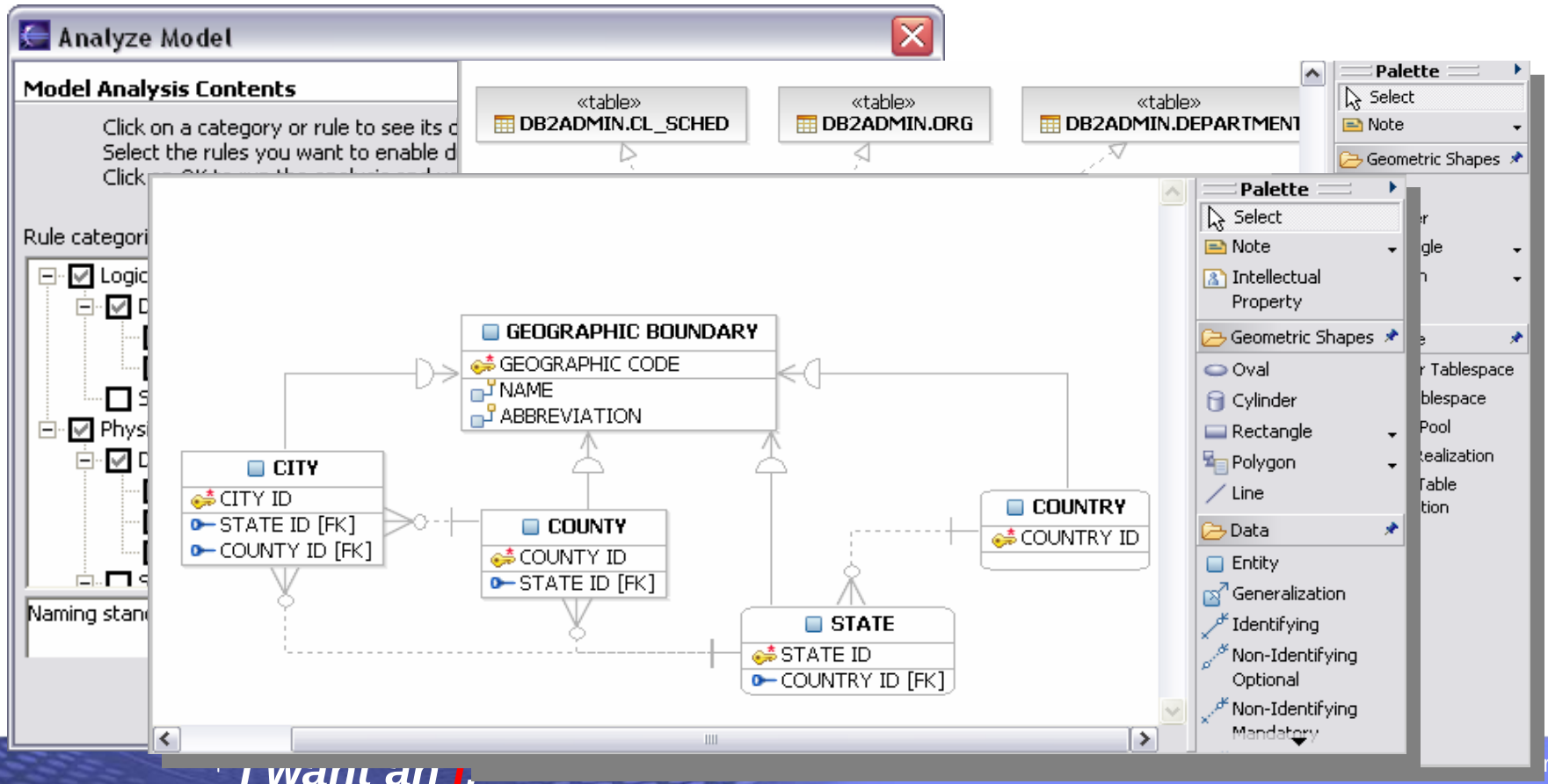
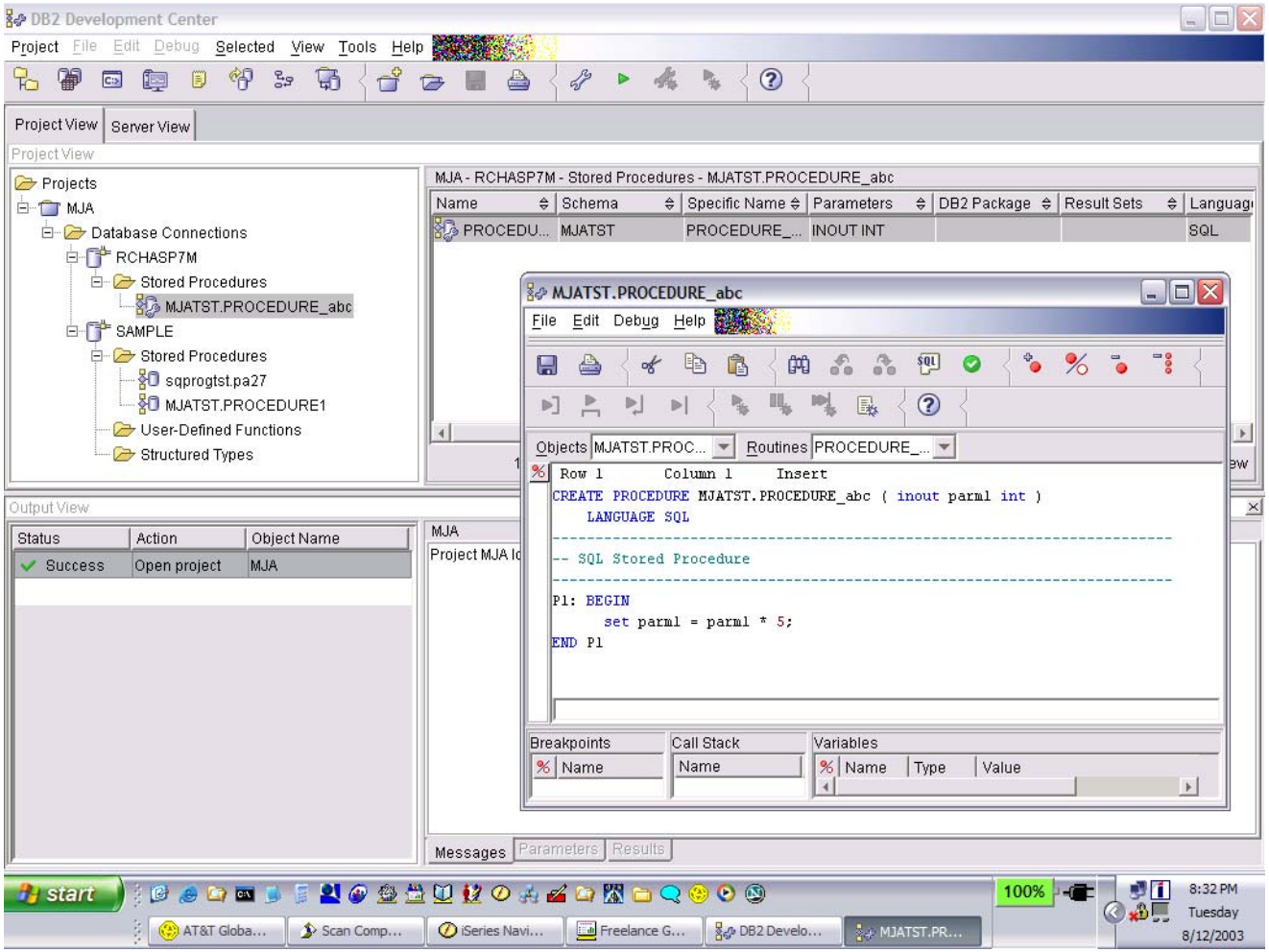
Data Modeling: IBM Rational Data Architect

- 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/



DB2 Development Center



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

Graphical Debug currently available via System i5 Navigator and WDSc

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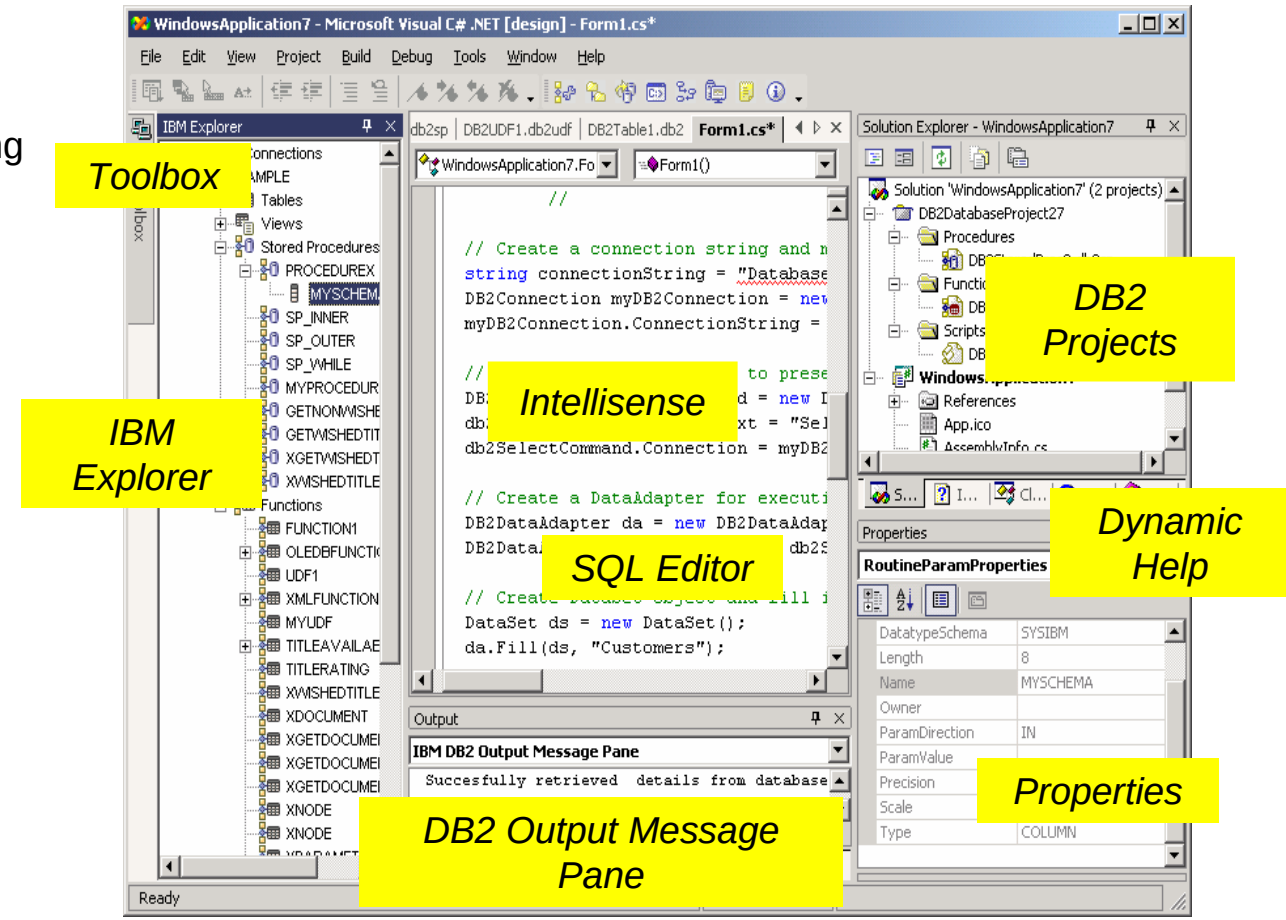
DB2 Connect for iSeries

- 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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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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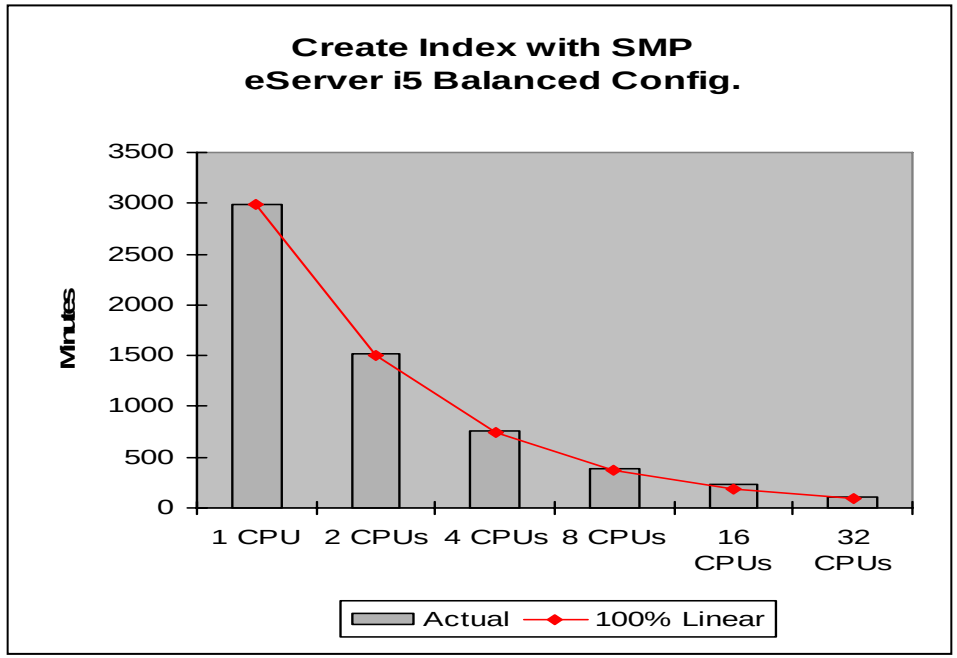
DB2 for i5/OS Enablers for BI

- 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

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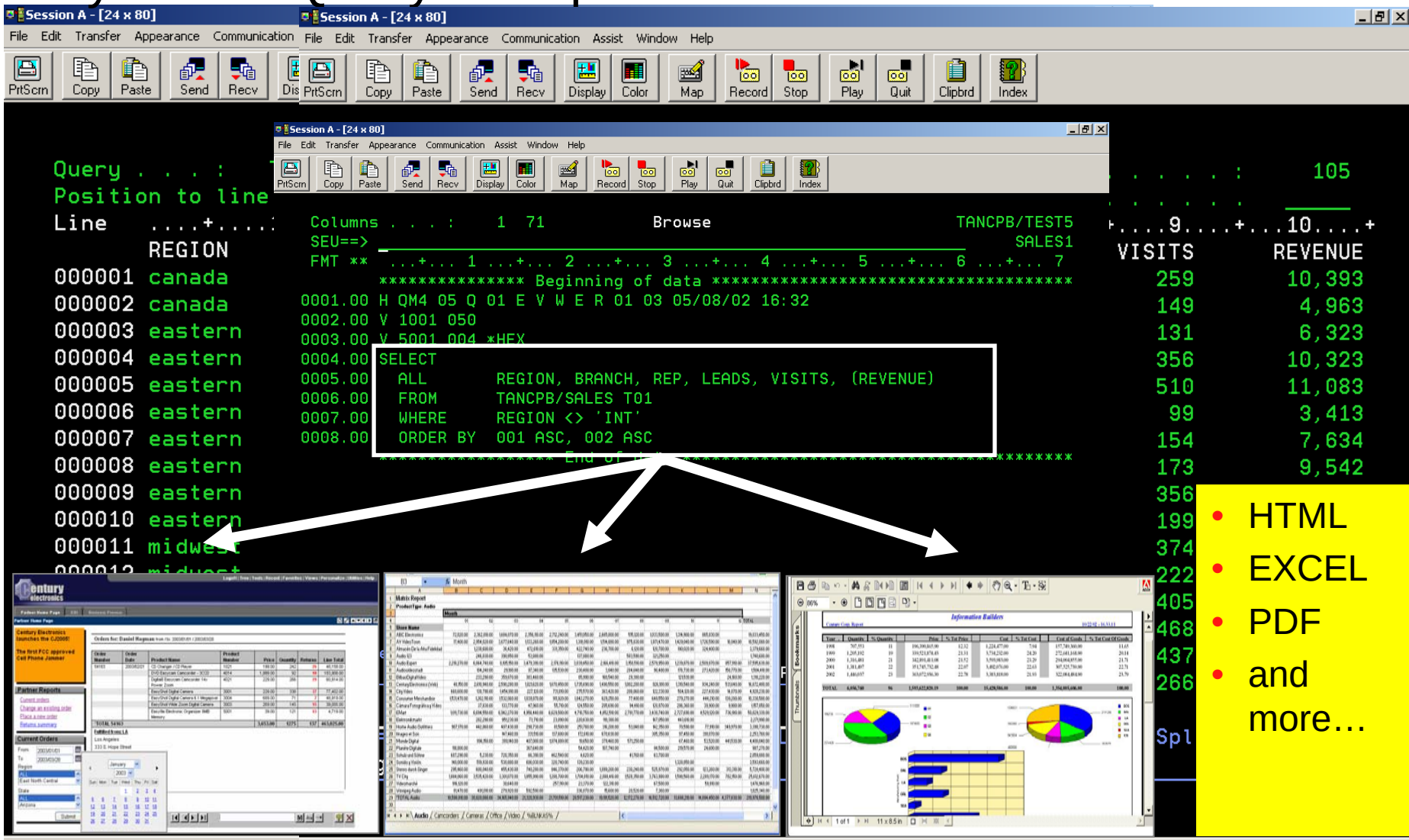
Any stored Query/400 queries?



- HTML
- EXCEL
- PDF
- and more…

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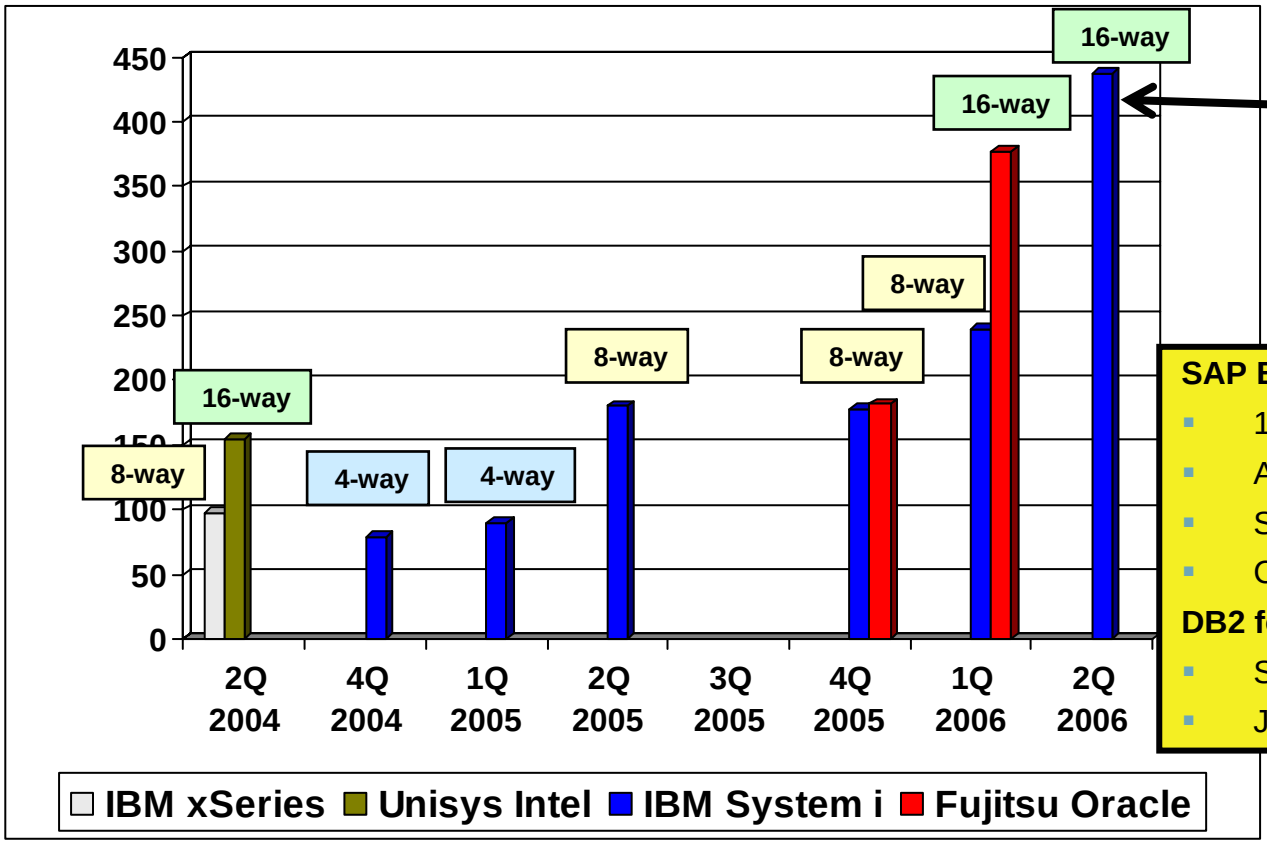
System i5 Optimized for SAP



i5 16-way

437K queries/hour

67M rows/hour (load)

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

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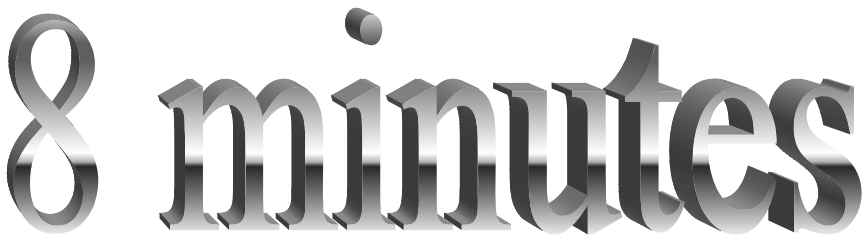
Data Warehouse Load Experiences

- 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…..



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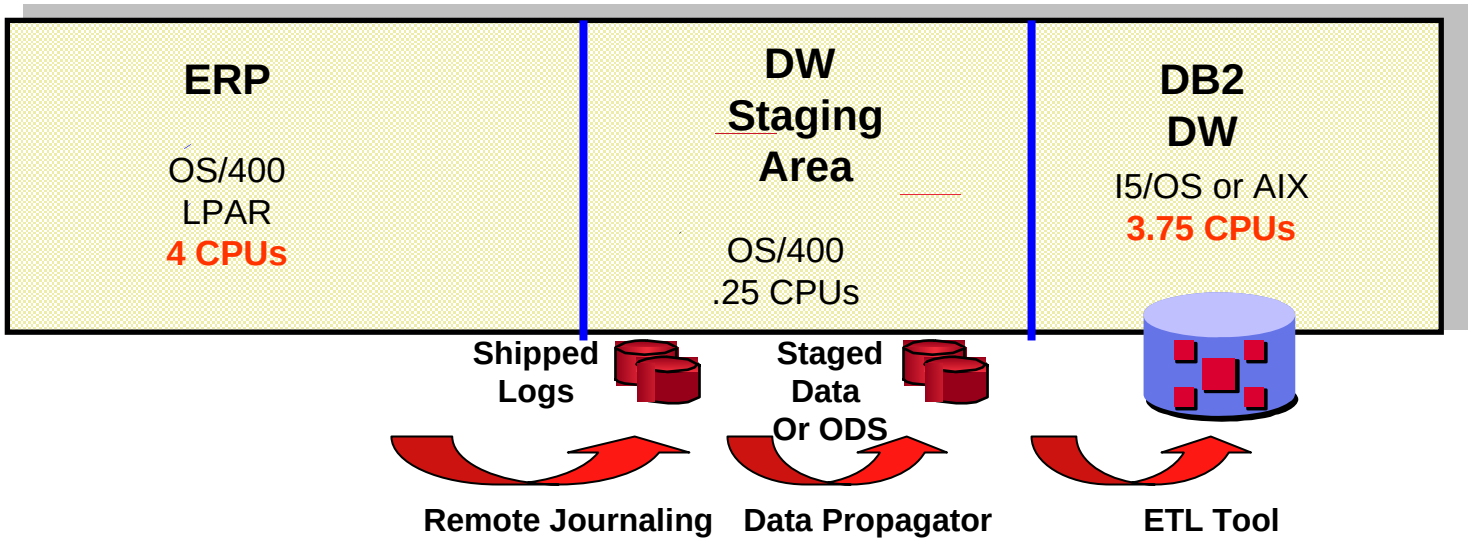
The (near) real time Data Warehouse



Remote Journaling during normal business processing hours

- Trickle Feed Staging Area/ODS
- Eliminate EXTRACTION impact on production systems
- No Charge Feature of OS/400
- Requires Program (e.g., Data Propogator) to read data from journal receivers

Virtualization Engine Technologies

- Optimize resources for supporting production and daytime data warehouse queries
- High speed data transfers over Virtual Ethernet
- Can add SQL logic to remove unwanted fields, change datatypes,
- Common Backup and other Shared I/O

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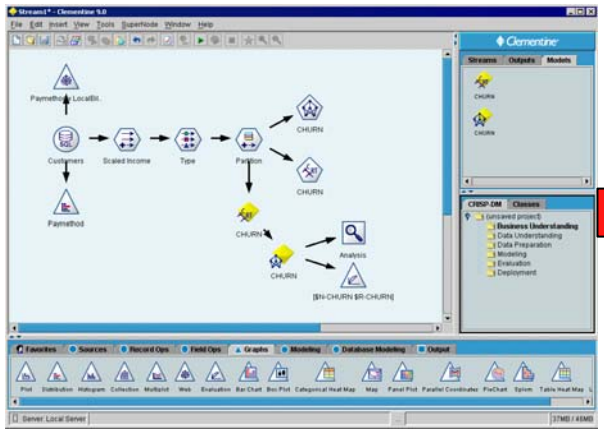
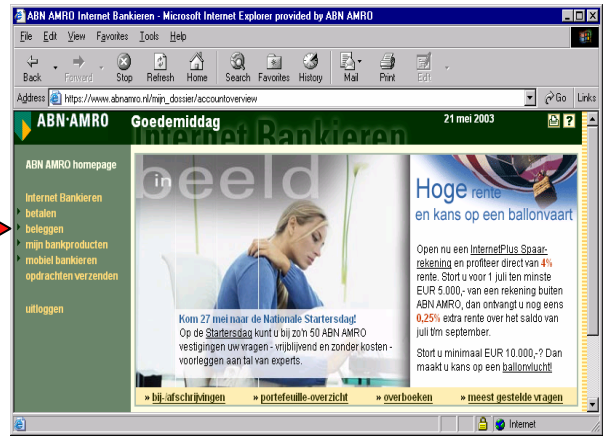
What about…. Data Mining ???

- 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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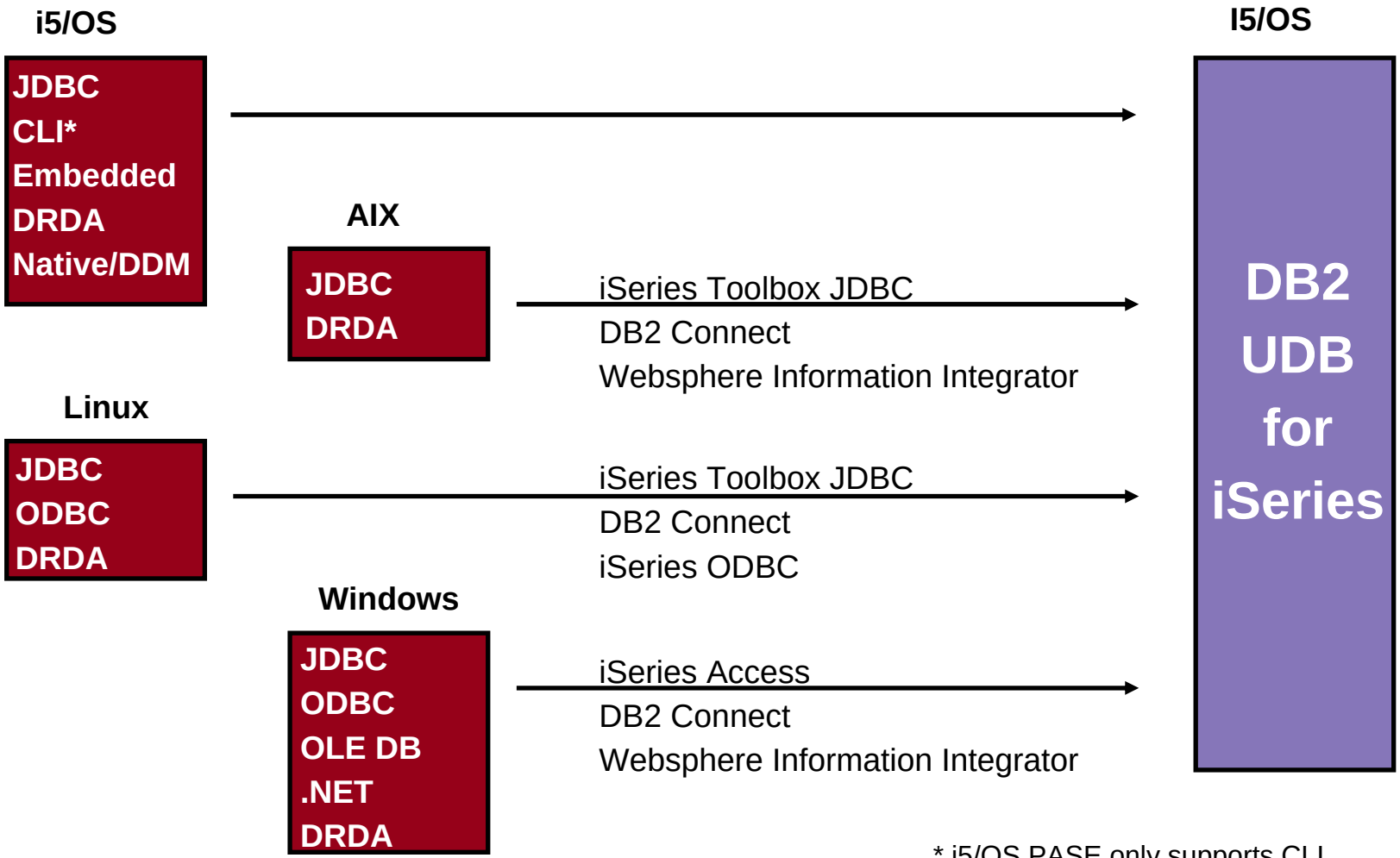
Are You Connected?



* i5/OS PASE only supports CLI

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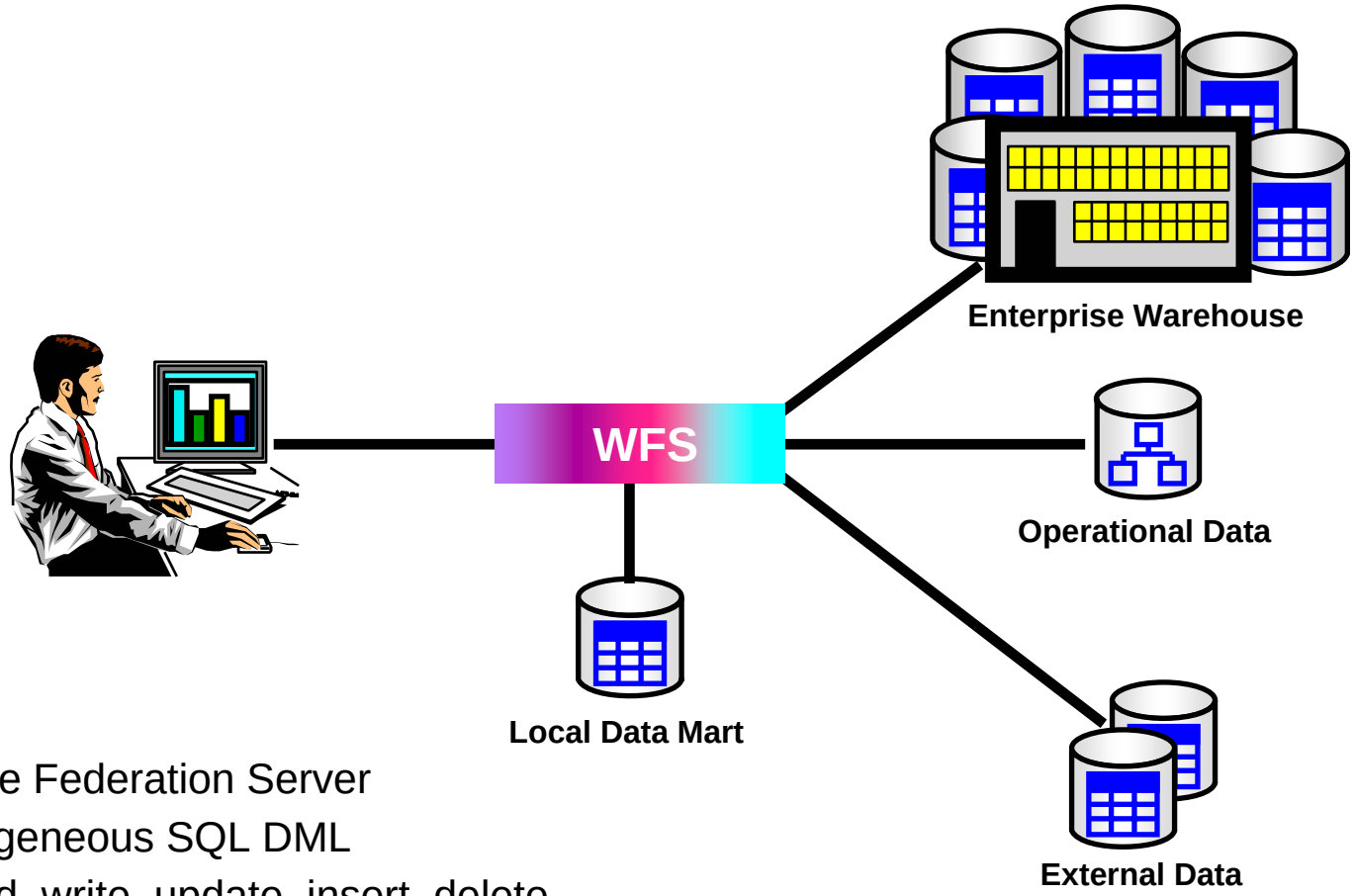
What About Heterogeneous Database Access ?



- Websphere Federation Server
  - 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

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Configuring WFS: Oracle

- One-time setup & configration
  - 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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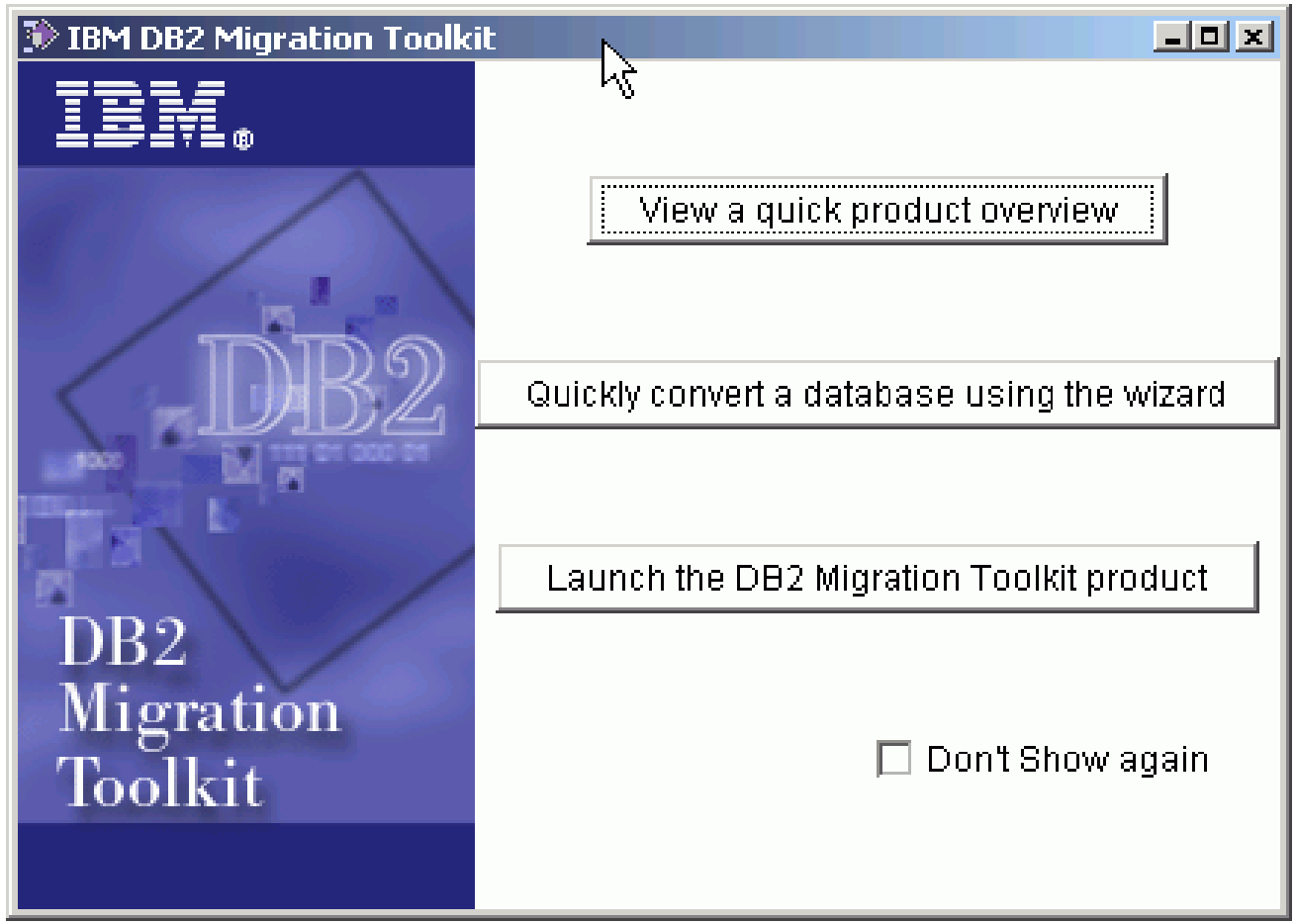
Database Migrations (to DB2)

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

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Questions & Answers

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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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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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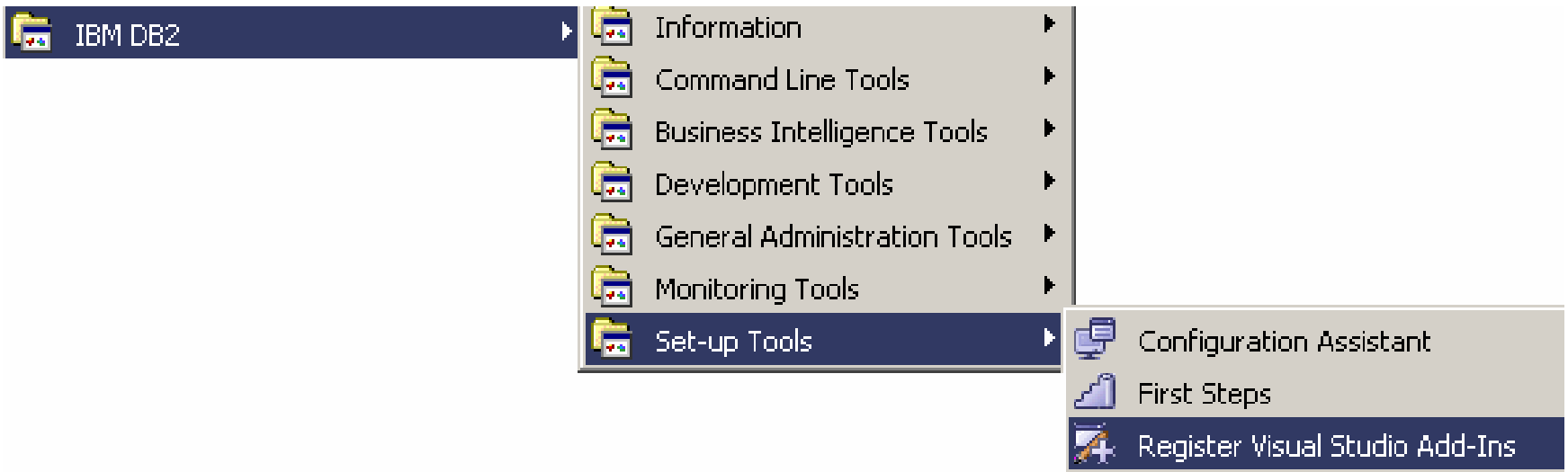
Registering Add ins

- 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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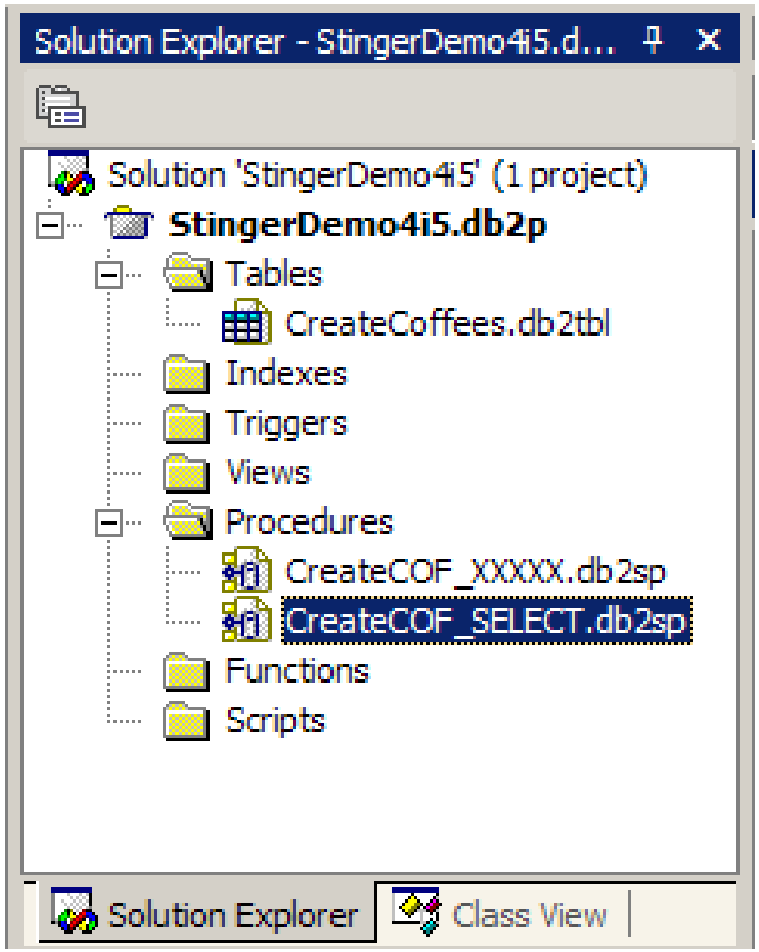
Solution Explorer

- Solution Explorer allows you to create and manage DB2 projects



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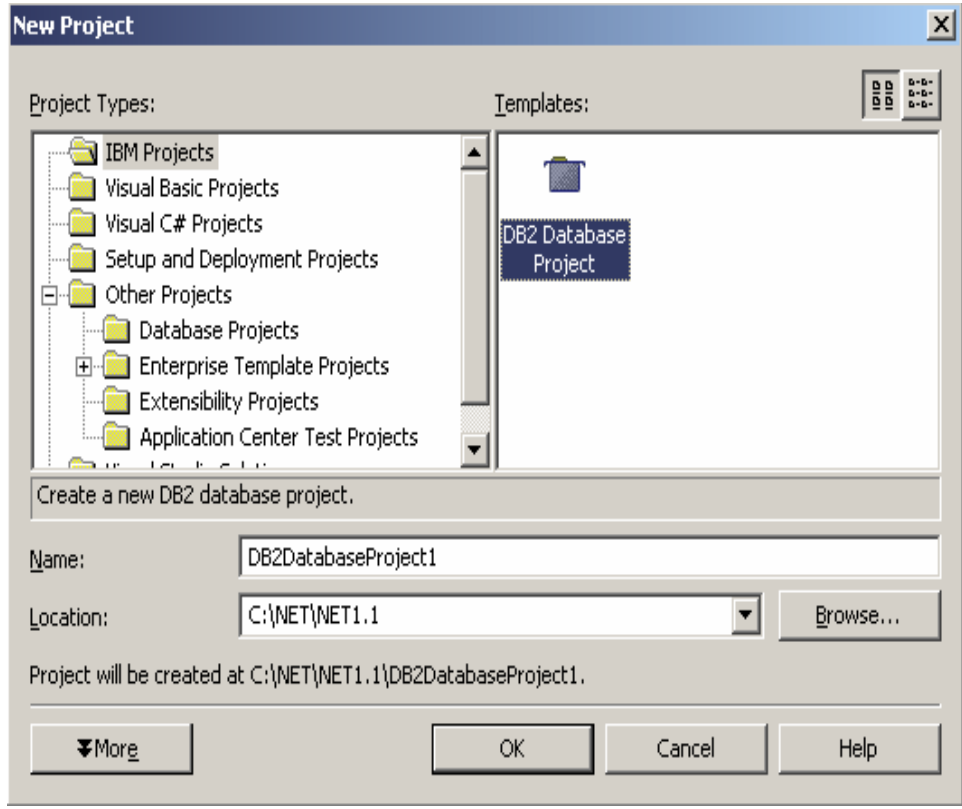
DB2 Database Projects

- 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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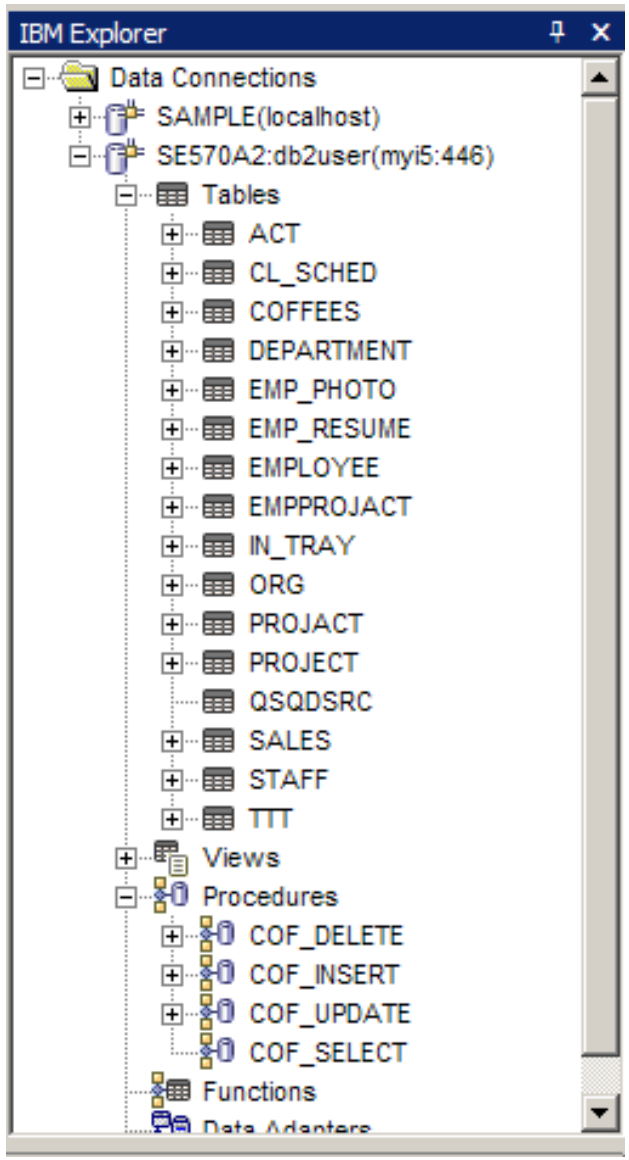
IBM Database Explorer

- 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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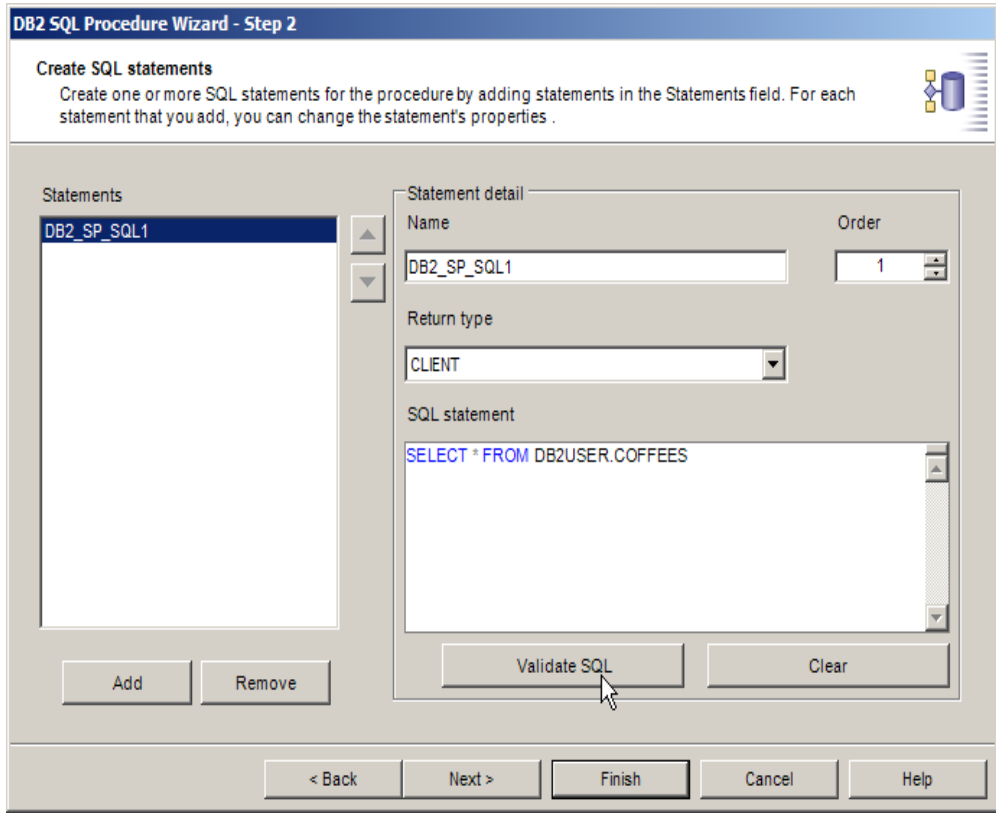
Example: SQL Procedure Wizard

- 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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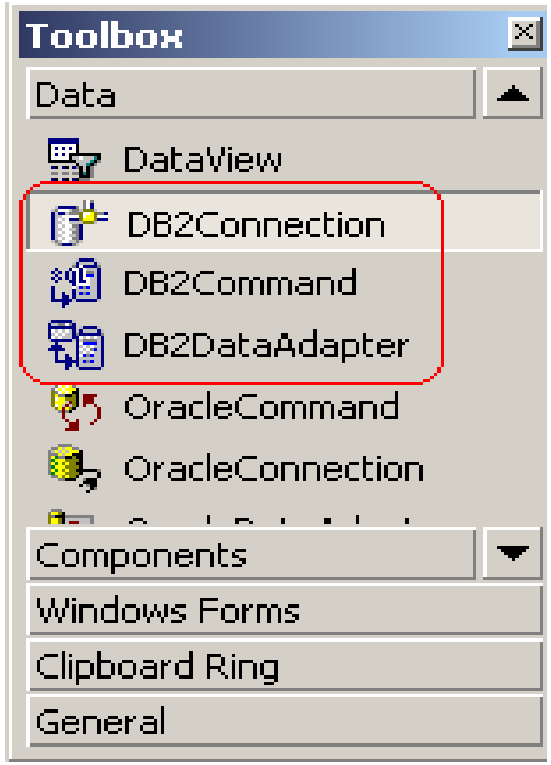
DB2 Data Controls

- 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



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