



IBM System i™

Session: 420219

Agenda Key: 33CA

System i Access in the .NET World

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System i Access Development

i want stress-free IT.

i want control.

*i want an **i**.*

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Agenda

- Overview of .NET
- ADO.NET
- iSeries Access and DB2 Connect in .NET Environment
- iSeries Access .NET Provider Notes
- Example Code
- Performance / Coding Tips

.NET definitions

.NET framework

- Underlying plumbing for .NET applications
- Common Language Runtime (CLR)
- Unified set of class libraries

CLR

- Language integration, security handling, memory/thread/process management, exception handling, ...

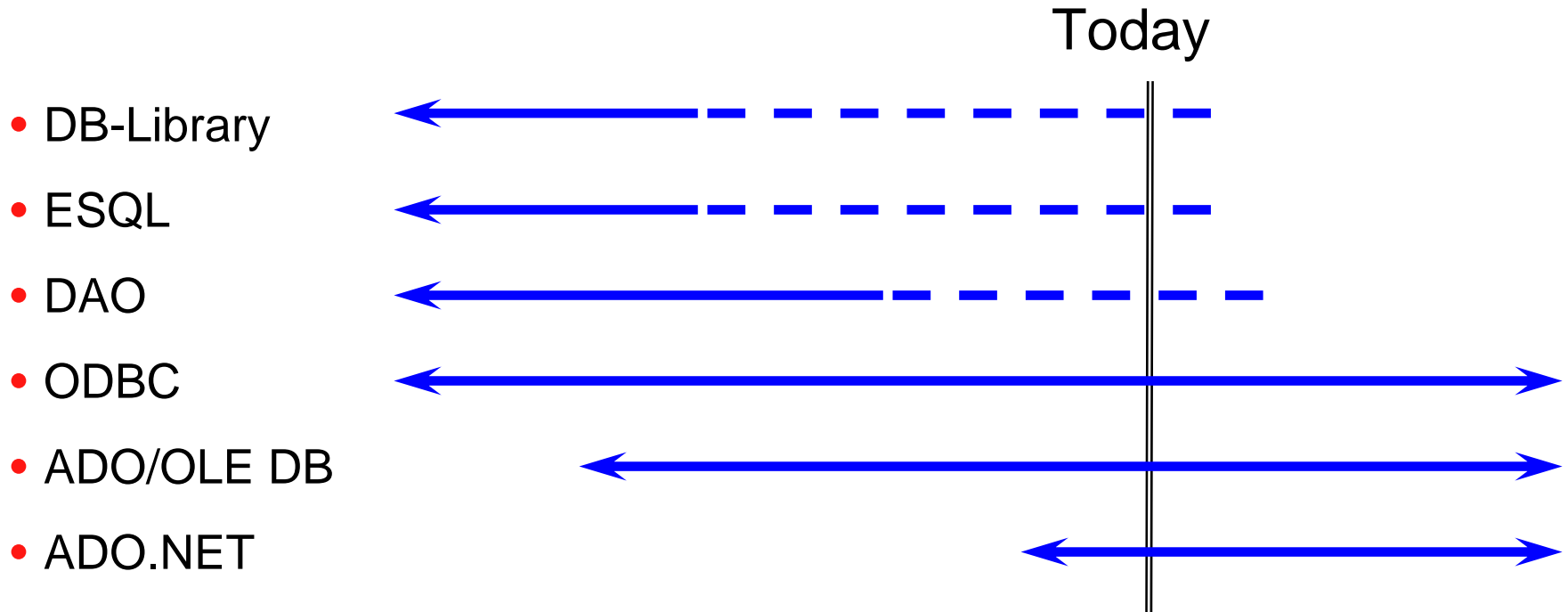
ADO.NET

- .NET classes enabling access to databases

ASP.NET

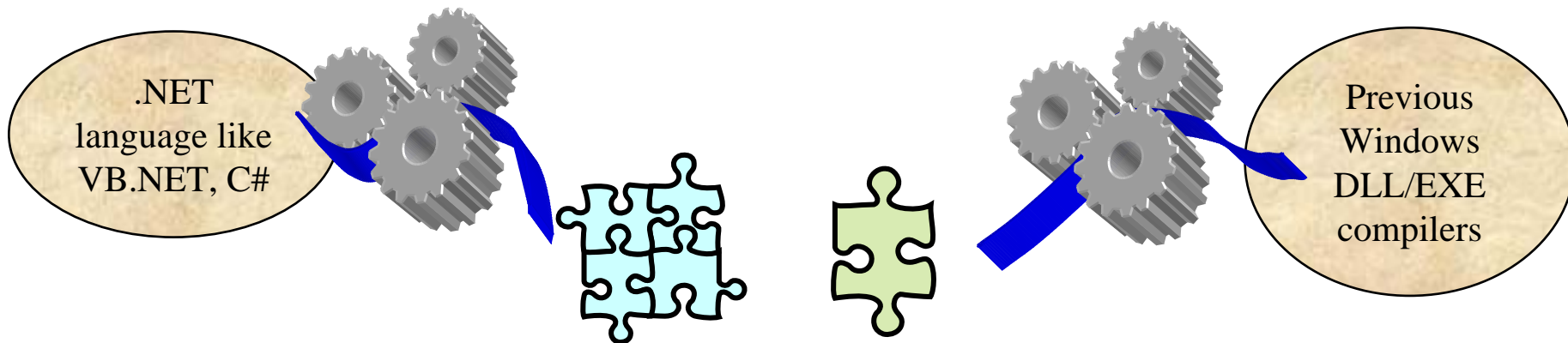
- .NET classes to support development of Web-based applications and Web services

Microsoft Technology Roadmap



Assemblies versus Binaries

- Intermediate Language (IL) JIT compile
- Self describing metadata
- Referenced by namespace, version, and culture
- Platform specific byte codes
- Type libraries (IDL)
- Referenced by Registry



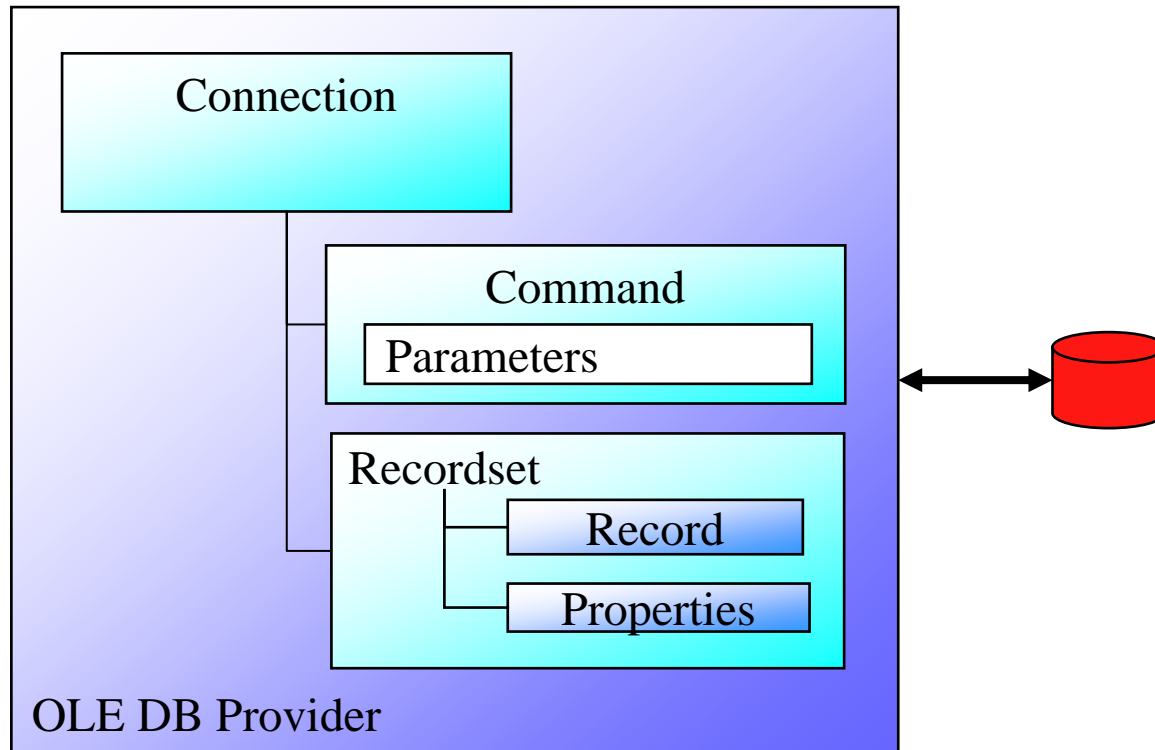
Interesting .NET features

- Can have multiple versions of same assembly
- Garbage collection
- Common Type System (CTS) but all the languages do not support all .NET data types
- COM still alive but calling it from .NET means bad performance

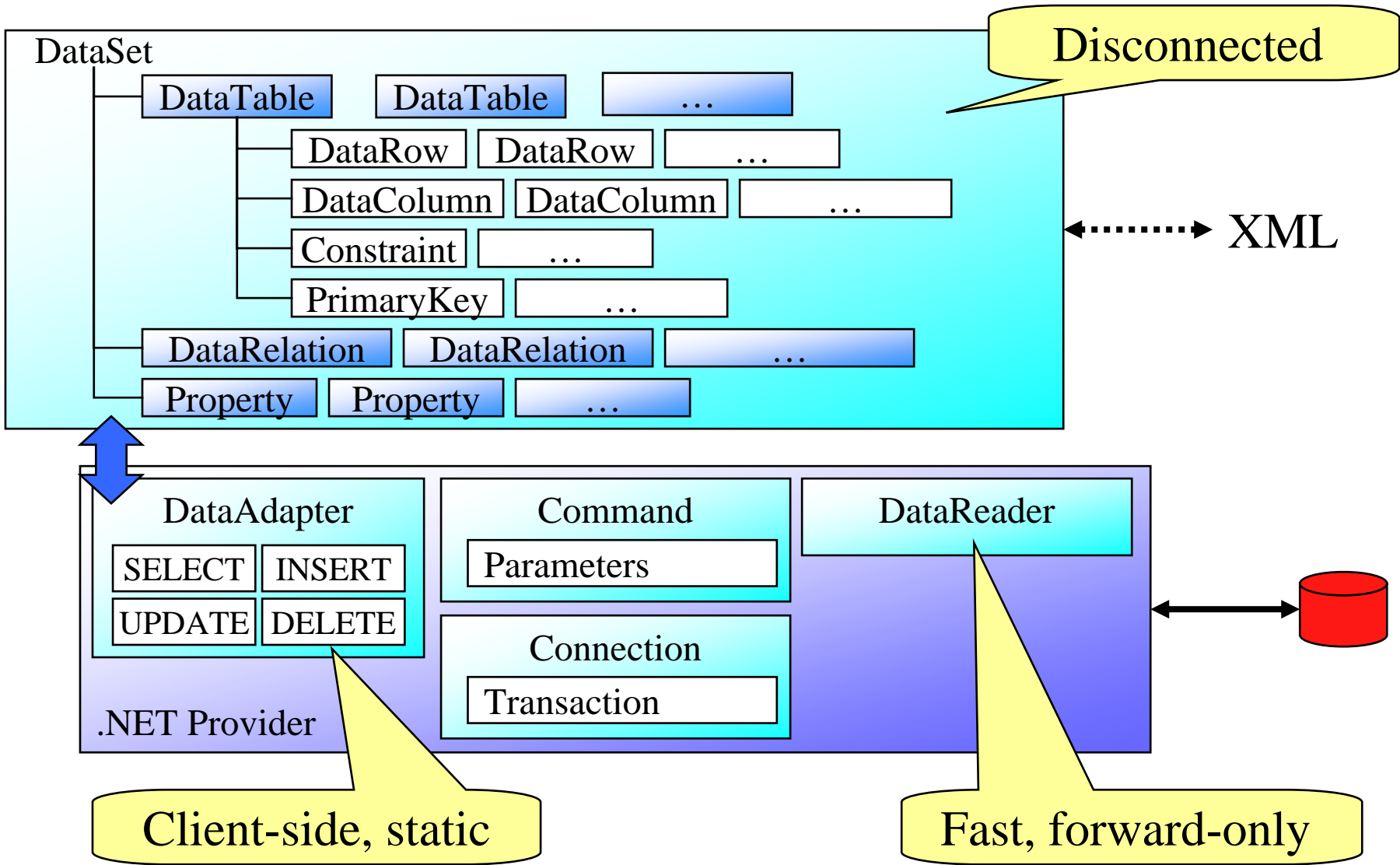
Agenda

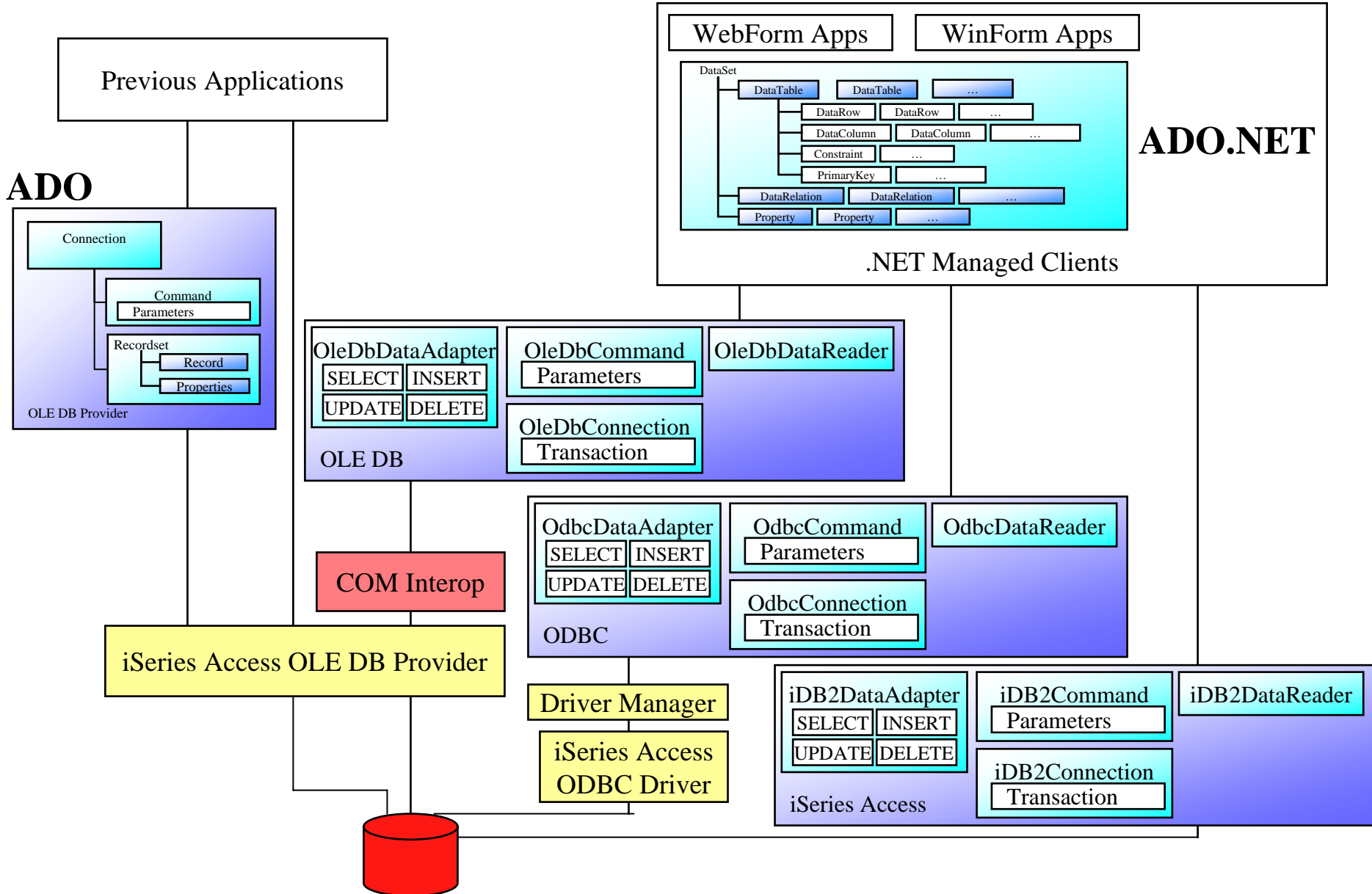
- Overview of .NET
- **ADO.NET**
- iSeries Access and DB2 Connect in .NET Environment
- iSeries Access .NET Provider Notes
- Example Code
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ADO



ADO.NET





ADO Options for System i5

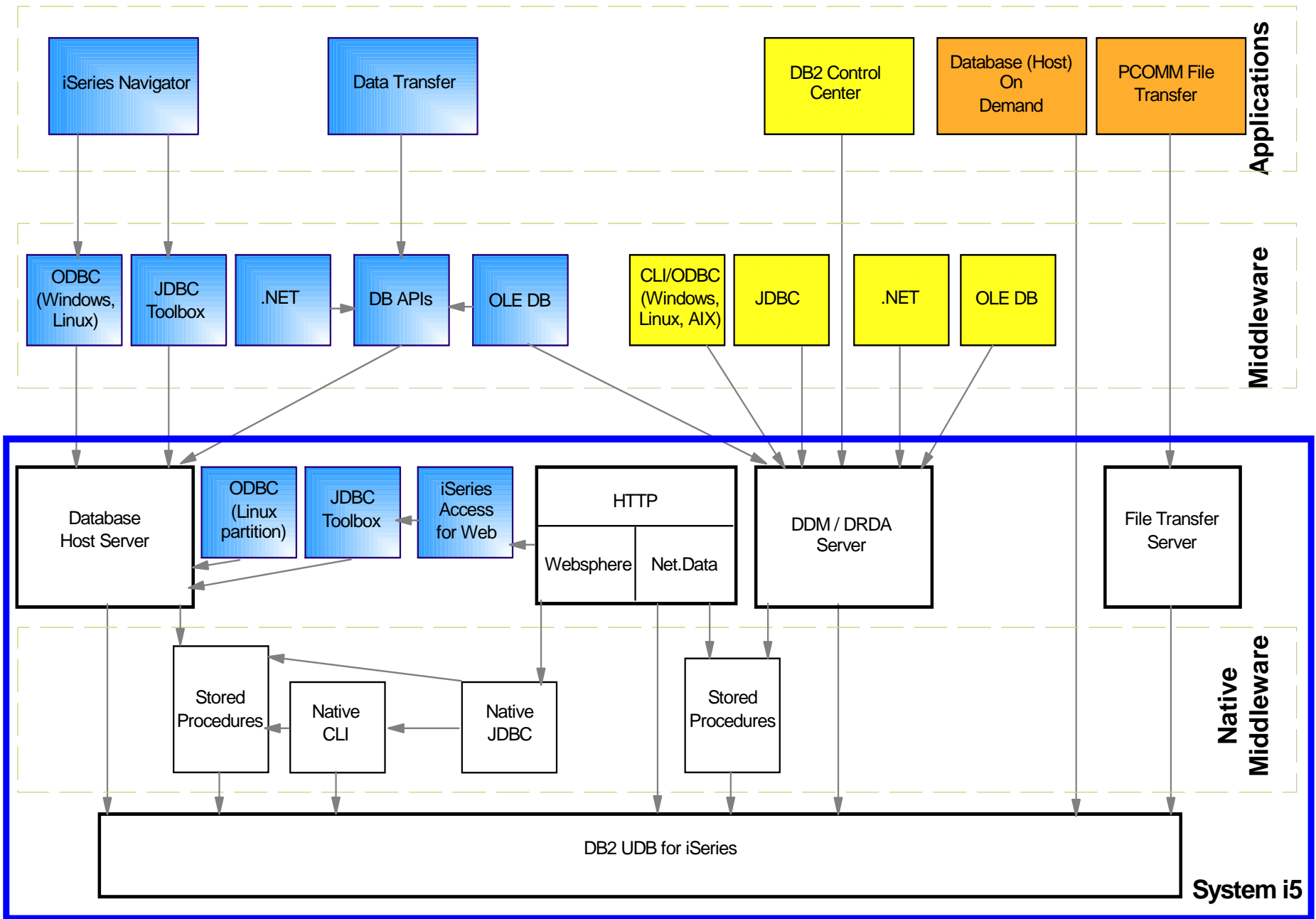
- OLE DB providers
 - iSeries Access OLE DB Provider (IBMDA400, IBMDASQL, IBMDARLA)
 - IBM OLE DB Provider for DB2 (IBMDADB2)
- OLE DB provider for ODBC (MSDASQL)
 - iSeries Access ODBC driver
 - DB2 CLI/ODBC driver

ADO.NET Options for System i5

- Native managed providers
 - V5R3+ iSeries Access .NET provider
 - DB2 V8.2 (Stinger) .NET provider
- OLE DB managed provider (System.Data.OleDb)
 - iSeries Access OLE DB provider
 - IBM OLE DB provider for DB2
- ODBC managed provider (System.Data.Odbc / Microsoft.Data.Odbc)
 - iSeries Access ODBC driver
 - DB2 CLI/ODBC driver

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- Overview of .NET
- ADO.NET
- [iSeries Access and DB2 Connect in .NET Environment](#)
- iSeries Access .NET Provider Notes
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OWNER:

 iSeries Access

 DB2 V8.2

 iSeries function

 Other

What is in the iSeries Access .NET Provider?

Supported

- SQL (INSERT, UPDATE, DELETE, SELECT)
- Commitment Control
- Connection Pooling
- SQL naming
- Unicode
- Threads
- IASPs (multiple databases)
- Stored Procedure Support
- iSeries-specific Properties
- User-Defined Types

Requires V5R3 SI15176 service pack:

- System Naming (/)
- Large Objects (LOBs)

Not supported

- Distributed Transactions
- Package Support
- Data links
- Record Level Access
- CMD/PGM Call
- Data Queues

What is in the DB2 V8.2 .NET Provider?

Supported

- SQL (INSERT, UPDATE, DELETE, SELECT)
- Commitment Control
- Connection Pooling
- SQL Naming
- Unicode
- Threads
- IASPs (multiple databases)
- Stored Procedure Support
- Large Objects (LOBs)
- Distributed Transactions
- Accessing Data on Other DB2 Boxes
- Visual Studio .NET Add-ins
- ADO.NET 2.0 Support (Need FP10)

Not supported

- System Naming (/)
- Package Support
- Data links
- User-Defined Types
- Record Level Access
- CMD/PGM Call
- Data Queues

DB2 Connect for iSeries

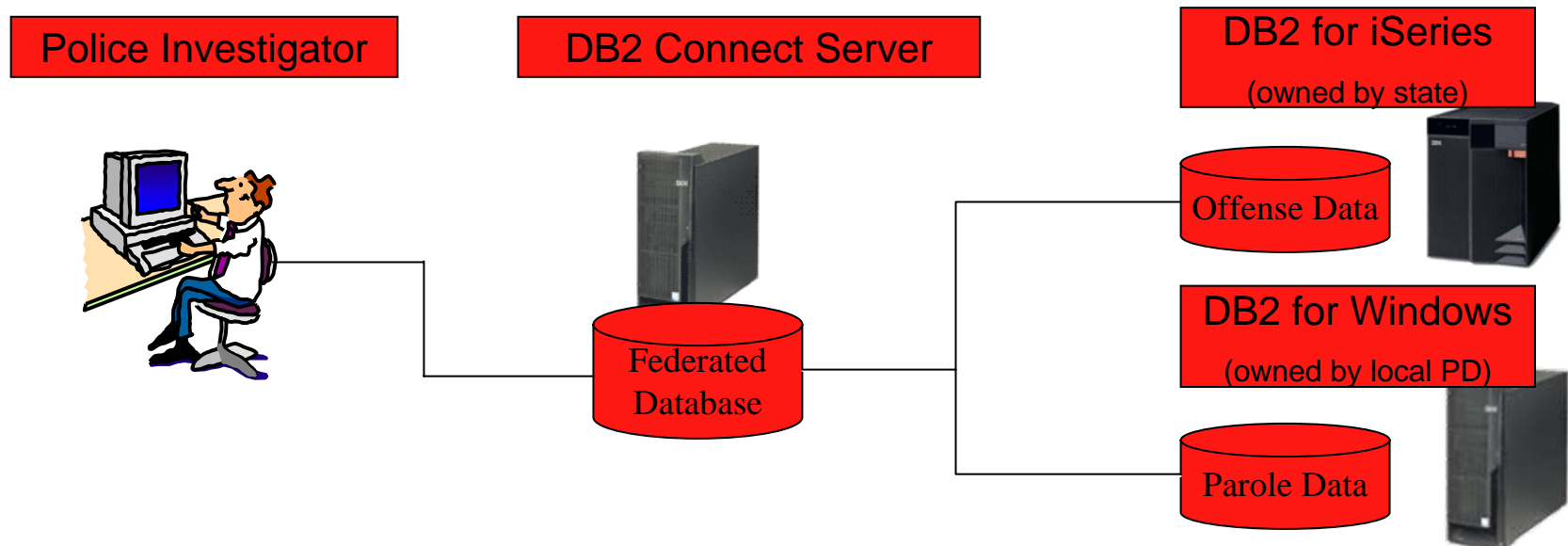
Data Integration

- With a single SQL request
 - Joining DB2 tables from multiple System i5 servers/partitions
 - Joining data from DB2 UDB for iSeries & DB2 distributed databases
 - Joining data from DB2 UDB for iSeries and zSeries databases when coupled with other DB2 Connect offering
 - Access to DB2 UDB for iSeries and non-IBM data sources like Oracle, SQL Server, Sybase etc. when coupled with WebSphere Information Integrator
- Extends System i5 data to mobile devices
- **Simplified Application Development**
- Integration of .NET applications (and Java and PHP)
 - Easy access to DB2 UDB for iSeries from Visual Studio
- Access to multiple DB2 family application programming interfaces

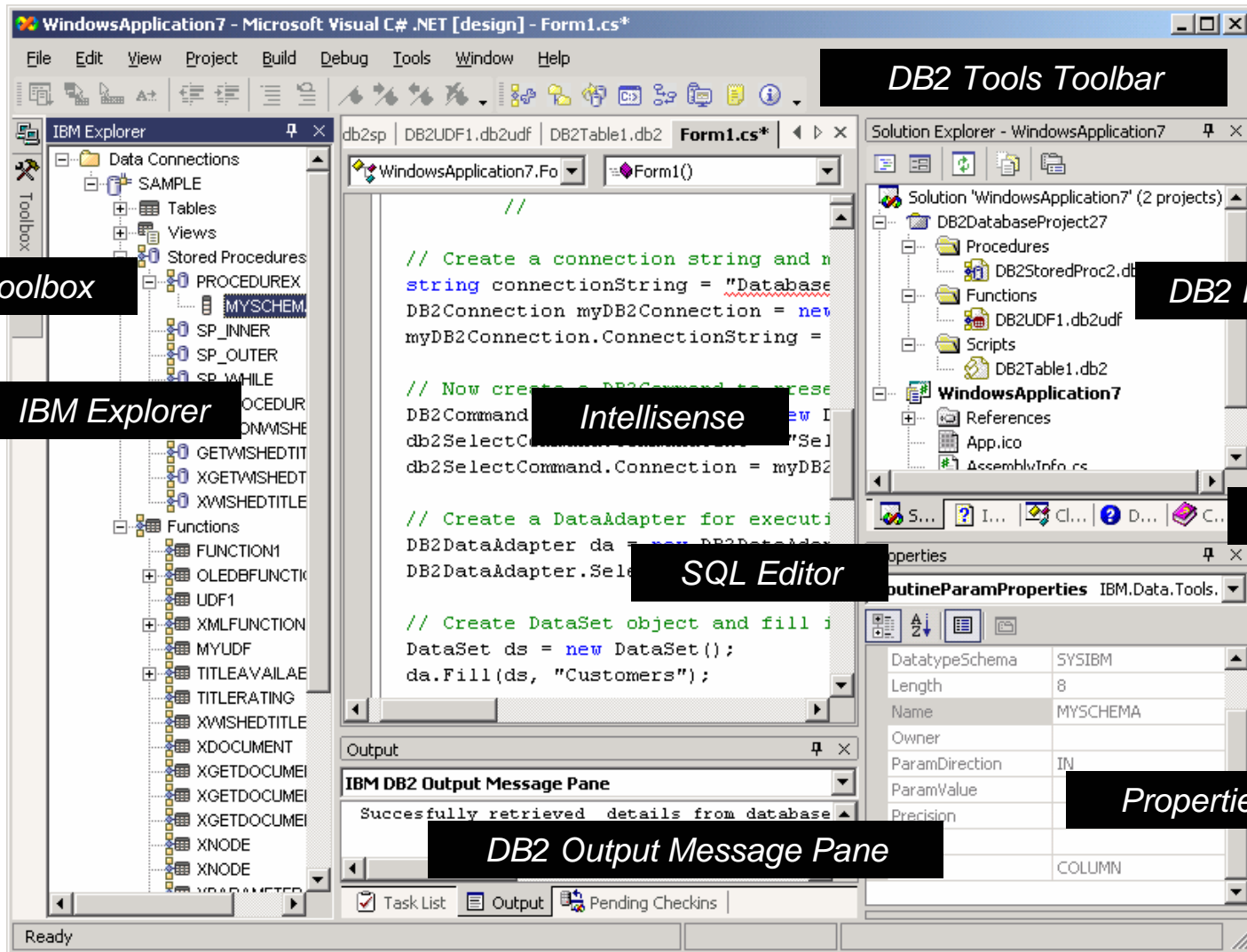
Example use of DB2 Connect Federated Database

The police investigator wants to get the information on felons in their area

- Conviction history records are managed by the State authorities and are stored on a DB2 for iSeries database.
- Current parole records including address information and are managed by the local police department and are stored in DB2 for Windows
- DB2 Connect Federated Database function allows police investigator to submit a single query that joins criminal records data from the state database against current residency data for parolees.



DB2 Add-ins for Visual Studio .NET



Toolbox

IBM Explorer

DB2 Tools Toolbar

Intellisense

DB2 Projects

Dynamic Help

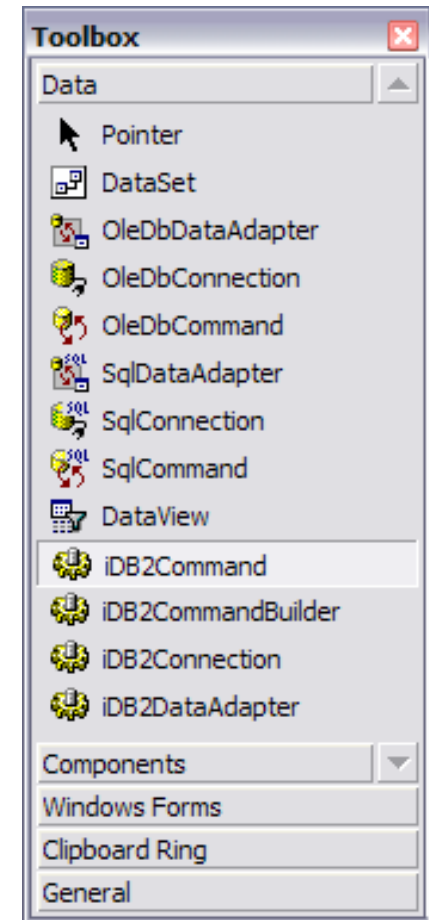
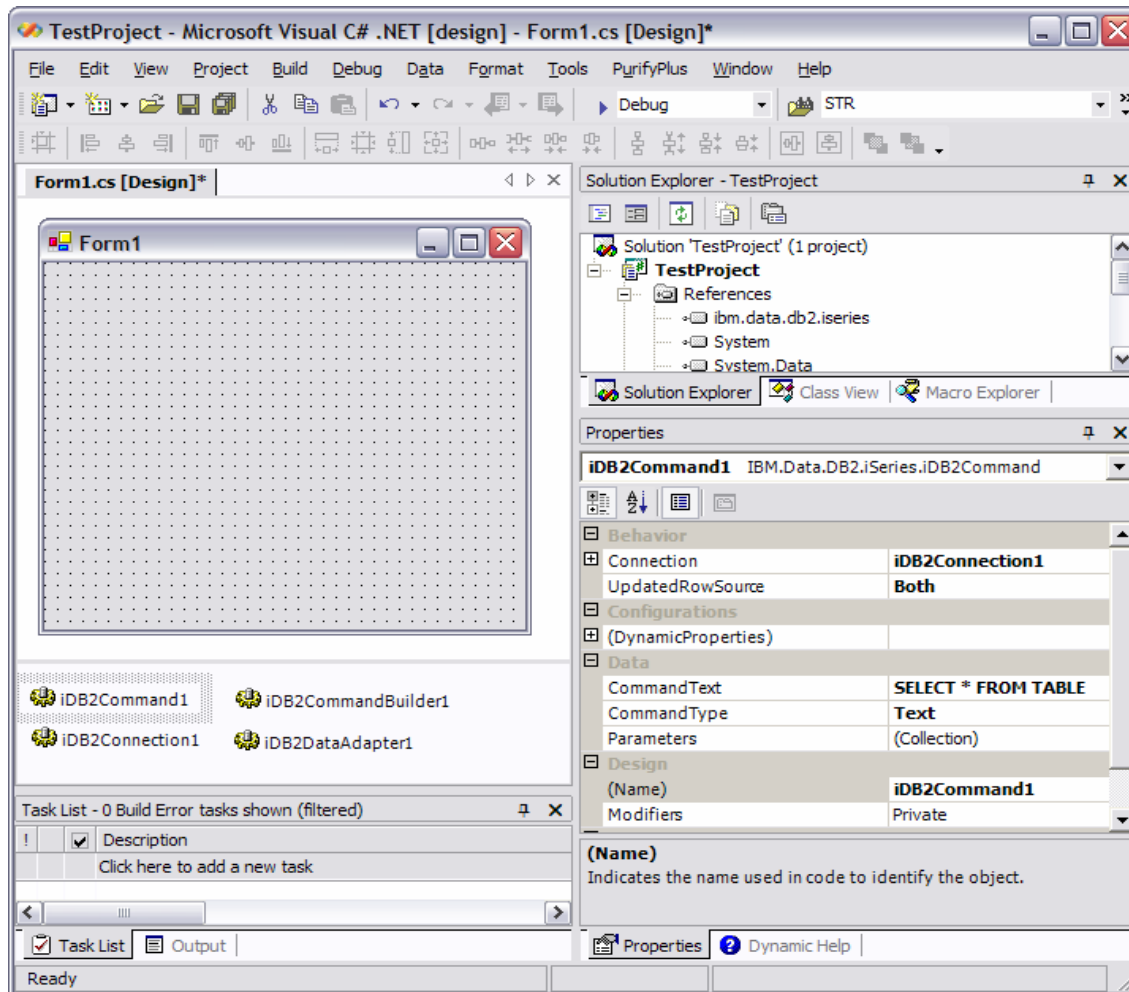
SQL Editor

Properties

DB2 Output Message Pane



iSeries Access - Visual Studio .NET Integration



Agenda

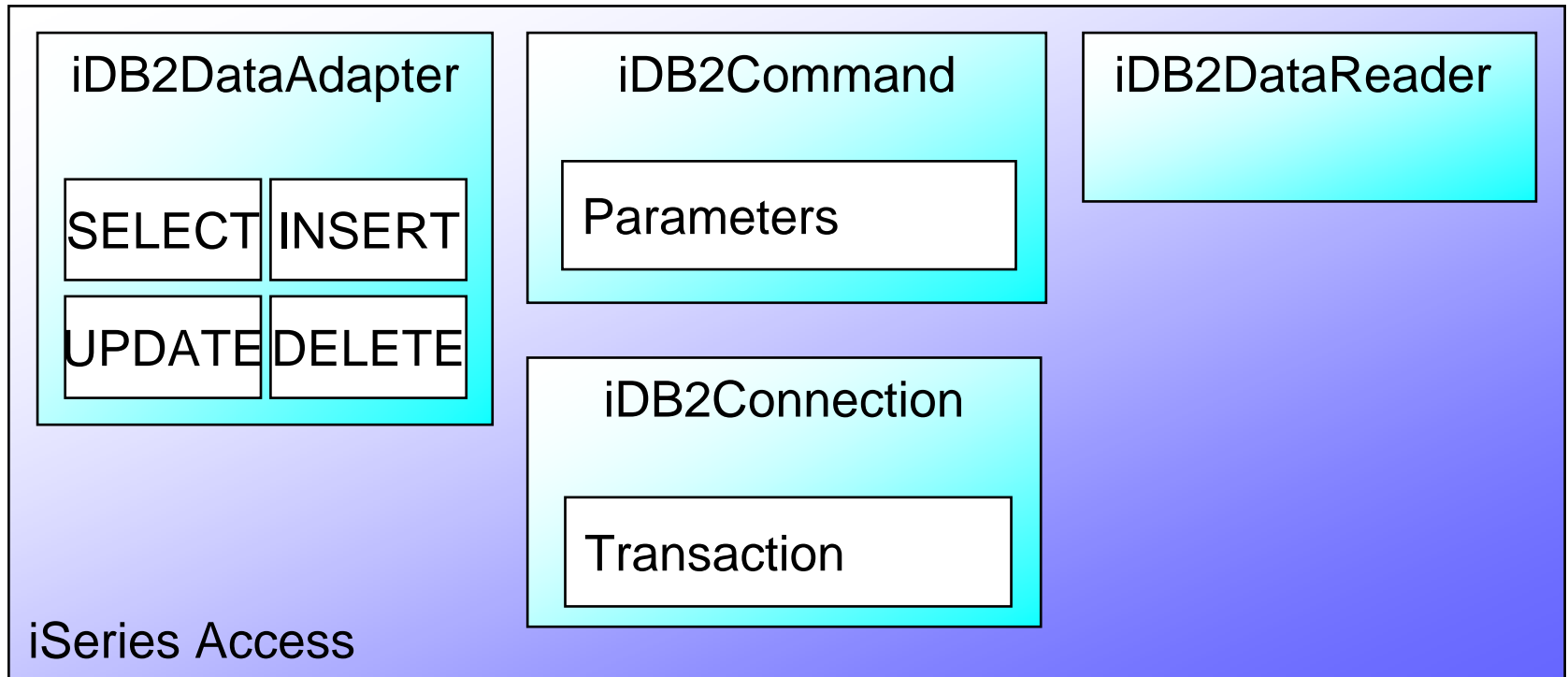
- Overview of .NET
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iSeries Access .NET Provider Notes

- Documentation
 - .NET Technical Reference - cwbmptch.hlp
 - Found in ..\IBM\Client Access\Mri2924 directory

- Tracing
 - CWBMPTRC

iSeries Access .NET Provider - Class Notes



Connections

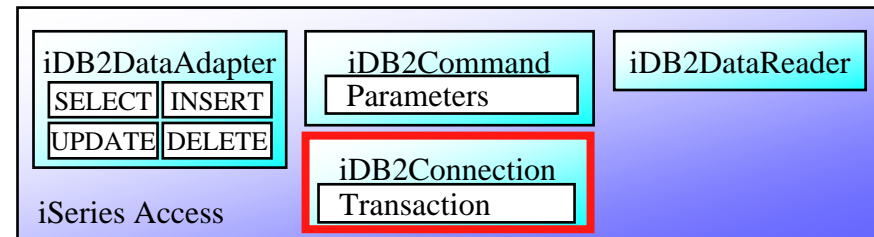
iDB2Connection

Properties:

- ConnectionString

Methods:

- BeginTransaction
- CreateCommand
- Open
- Close



Connections (Additional Properties)

iDB2Connection

Properties:

- Pooling
- DefaultCollection
- LibraryList
- DataCompression

- State
- ServerVersion
- JobName

Transactions

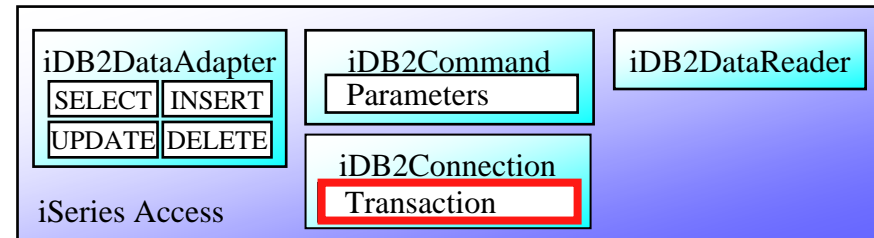
iDB2Transaction

Properties:

- Connection
- IsolationLevel

Methods:

- Commit
- Rollback



Commands

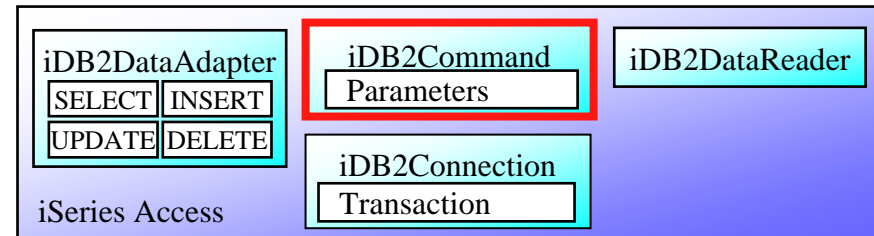
iDB2Command

Properties:

- CommandText
- CommandType
- Parameters
- Connection
- Transaction

Methods:

- Prepare
- CreateParameter
- DeriveParameters
- ExecuteNonQuery
- ExecuteReader
- ExecuteScalar



Parameters

iDB2ParameterCollection

Properties:

- Item
- Count

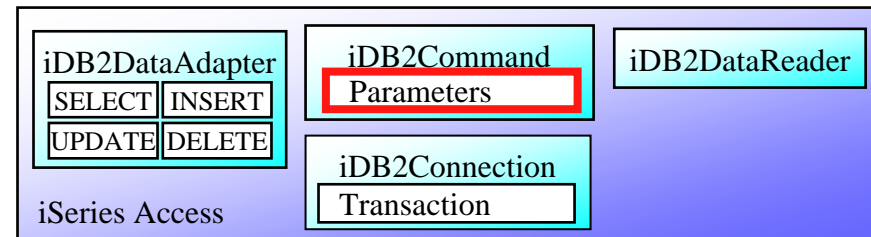
Methods:

- Add
- Clear

iDB2Parameter

Properties:

- iDB2Type
 - Enum of iDB2 Data Types
- Direction
- IsNullable
- ParameterName
- Value



DataReader

iDB2DataReader

Properties:

- FieldCount
- Item
- RecordsAffected

Methods:

- Close
- NextResult
- Read
- IsDBNull
- GetName
- GetFieldType
- GetAAA 's
 - AAA is the Data Type

iDB2DataAdapter

SELECT INSERT

UPDATE DELETE

iSeries Access

iDB2Command

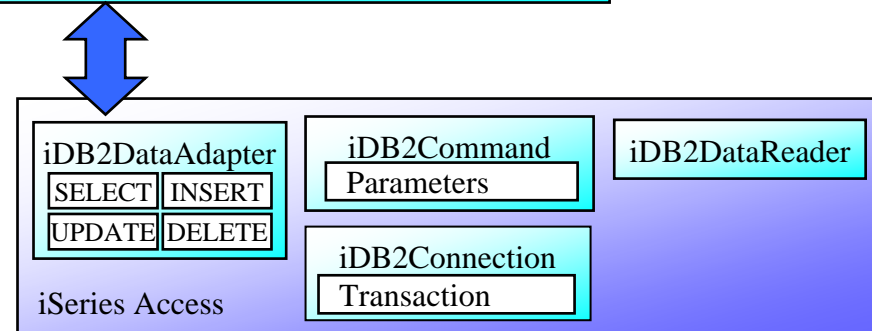
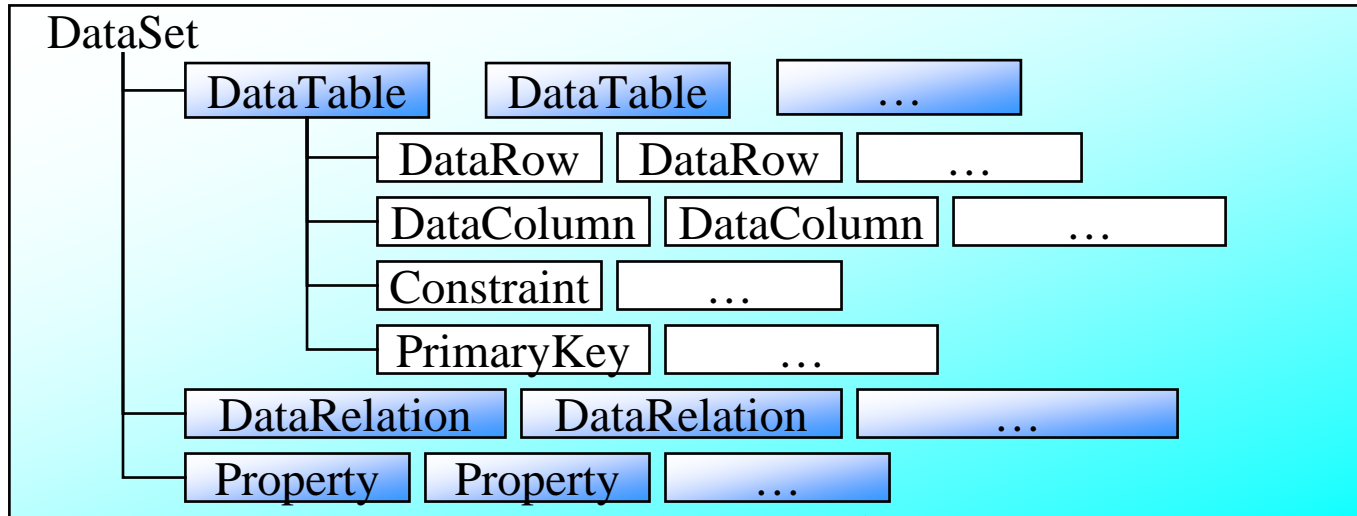
Parameters

iDB2Connection

Transaction

iDB2DataReader

DataAdapter and CommandBuilder



DataAdapter

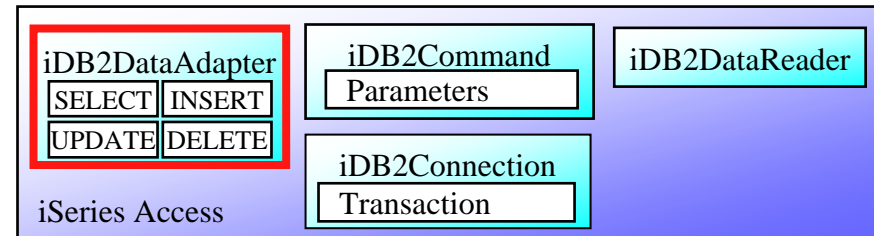
iDB2DataAdapter

Properties:

- SelectCommand
- InsertCommand
- UpdateCommand
- DeleteCommand

Methods:

- Fill
- FillSchema
- Update



CommandBuilder

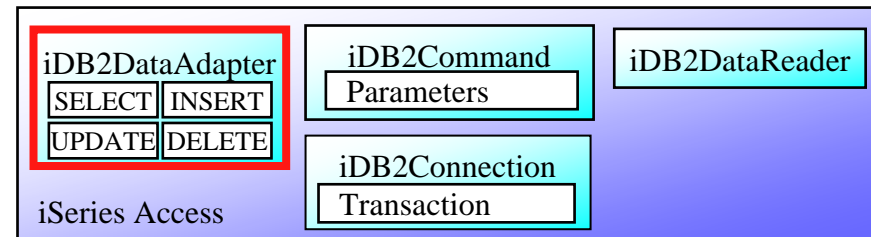
iDB2CommandBuilder

Properties:

- DataAdapter

Methods:

- DeriveParameters
- GetDeleteCommand
- GetInsertCommand
- GetUpdateCommand
- RefreshSchema



Error Handling

iDB2Exception

Properties:

- Errors
- Messages

iDB2ErrorCollection

Properties:

- Count
- Item

iDB2Error

Properties:

- Message

iDB2DataAdapter

SELECT	INSERT
UPDATE	DELETE

iSeries Access

iDB2Command

Parameters

iDB2Connection

Transaction

iDB2DataReader

V5R4 iSeries Access .NET Enhancements

- Support for LOB data types (also PTF'd into v5r3)
- Support for LibraryList and System naming (also PTF'd into v5r3)
- Support for translated IntelliSense
- Allow Date/Time/Timestamp data as strings instead of as DateTime
- Allow decimal/numeric data to be treated as strings instead of as Decimal. This enables applications to work with large decimal data.
- Allow CHAR FOR BIT DATA to be treated as translatable strings

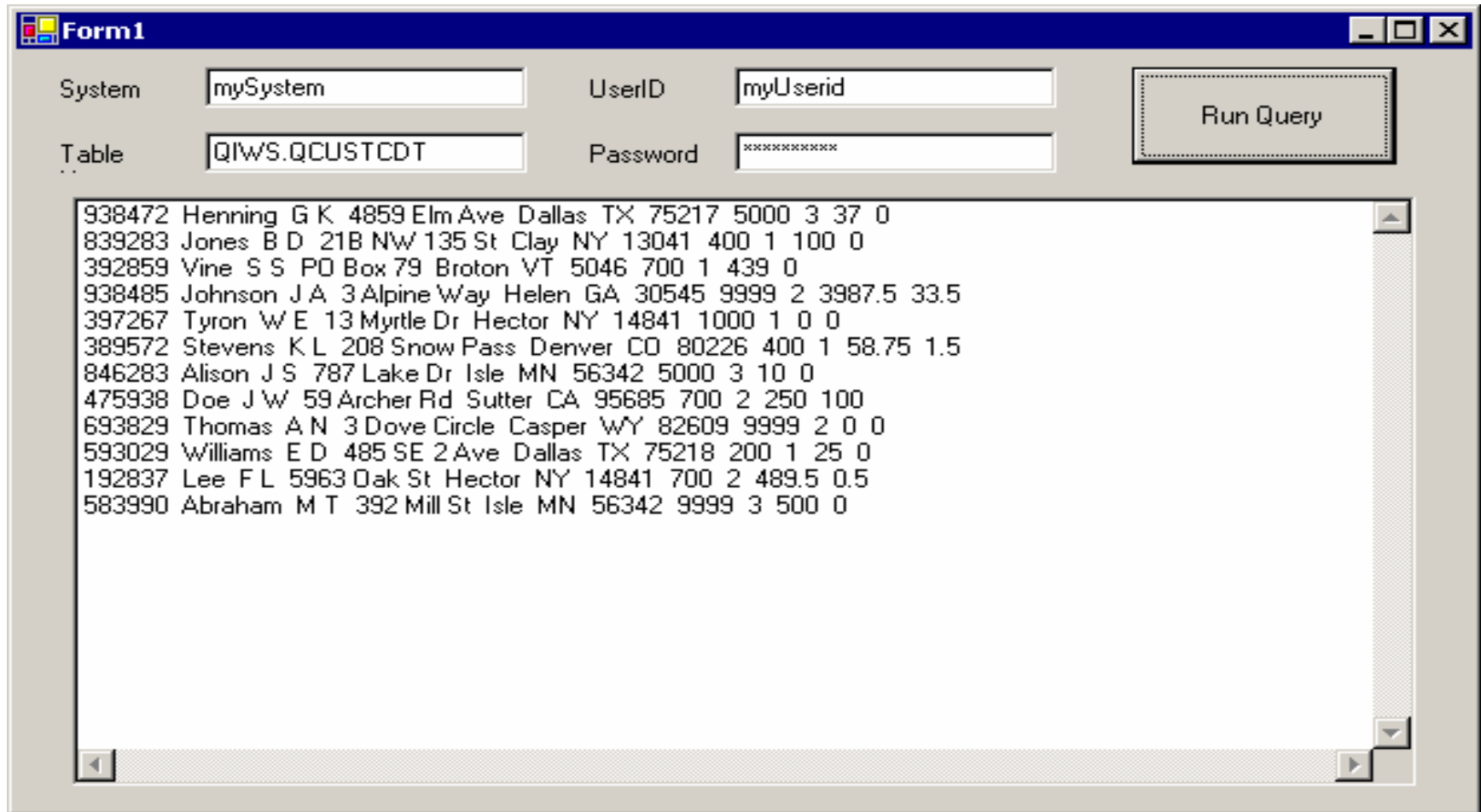
V5R4 iSeries Access .NET Enhancements

- Support for 128-byte column names
- Support for passing an eWLM correlator to the host
- Support for enhanced STRTRC command for tracing host server
- New ConnectionString option CheckConnectionOnOpen for pooled connections
- New ConnectionString option QueryOptimizeGoal
- 2 MB SQL statements

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Example #1: Basic Class Usage



Form1

System: mySystem UserID: myUserid

Table: QIWS.QCUSTCDT Password: *****

Run Query

```
938472 Henning G K 4859 Elm Ave Dallas TX 75217 5000 3 37 0
839283 Jones B D 218 NW 135 St Clay NY 13041 400 1 100 0
392859 Vine S S PO Box 79 Broton VT 5046 700 1 439 0
938485 Johnson J A 3 Alpine Way Helen GA 30545 9999 2 3987.5 33.5
397267 Tyron W E 13 Myrtle Dr Hector NY 14841 1000 1 0 0
389572 Stevens K L 208 Snow Pass Denver CO 80226 400 1 58.75 1.5
846283 Alison J S 787 Lake Dr Isle MN 56342 5000 3 10 0
475938 Doe J W 59 Archer Rd Sutter CA 95685 700 2 250 100
693829 Thomas A N 3 Dove Circle Casper WY 82609 9999 2 0 0
593029 Williams E D 485 SE 2 Ave Dallas TX 75218 200 1 25 0
192837 Lee F L 5963 Oak St Hector NY 14841 700 2 489.5 0.5
583990 Abraham M T 392 Mill St Isle MN 56342 9999 3 500 0
```

Example #1: Basic Class Usage - Code

```
private void RunQueryButton_Click(object sender, System.EventArgs e)
{
    ResultsBox.Items.Clear();
    iDB2Connection myConn = new iDB2Connection();
    myConn.ConnectionString = "DataSource=" + SystemBox.Text +
        ";UserID=" + UseridBox.Text +
        ";Password=" + PasswordBox.Text;

    try
    {
        myConn.Open();

        iDB2Command myCmd = new iDB2Command(TableBox.Text, myConn);
        myCmd.CommandType = CommandType.TableDirect;
        iDB2DataReader myDR = myCmd.ExecuteReader();

        String dataRowString = "";

        int fieldcount = myDR.FieldCount, counter = 0;
```

Example #1: Basic Class Usage - Code (part 2)

```
while( dr.Read() )
{
    while( counter < fieldcount )
    {
        dataRowString += myDR.GetValue(counter).ToString() + " ";
        counter++;
    }

    ResultsBox.Items.Add(dataRowString);
    dataRowString = "";

    counter = 0;
}

myConn.Close();
}
catch( Exception myException )
{
    ResultsBox.Items.Add(myException.Message);
}
}
```

Example #2: Data Transfer

Add reference to cwbx.dll

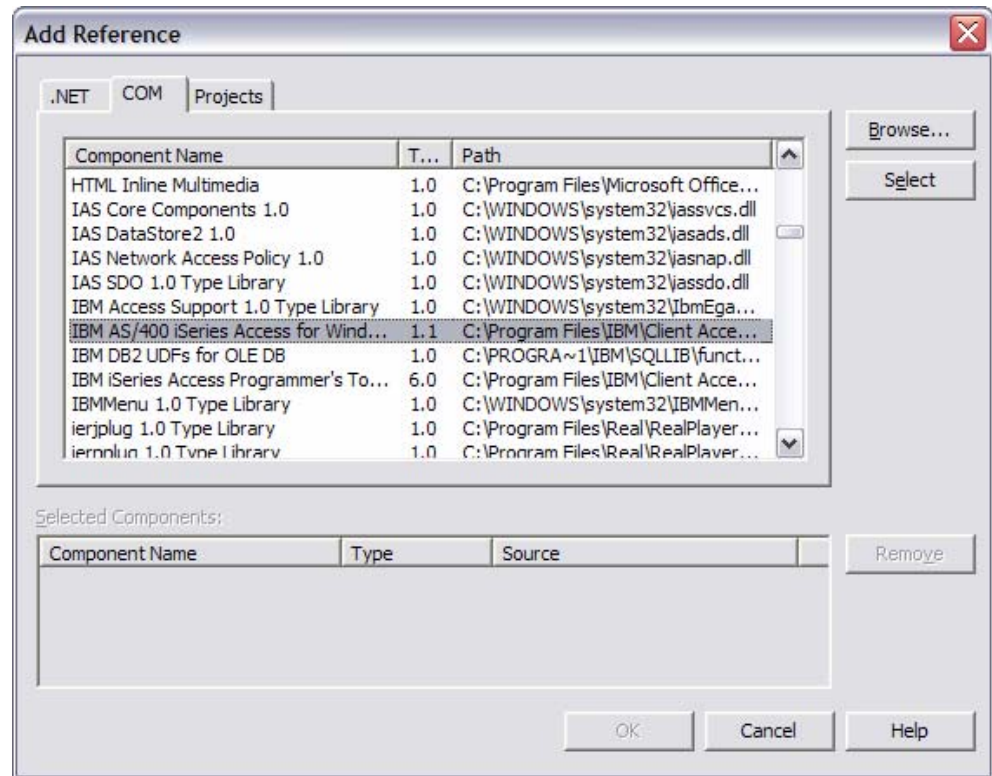
In Visual Studio, go to:

Project menu ->

Add Reference ... ->

COM tab ->

IBM AS/400 iSeries Access for
Windows ActiveX Object Library



Example #2: Data Transfer (code)

```
cwbx.DatabaseDownloadRequest myrequest = new cwbx.DatabaseDownloadRequestClass();  
cwbx.AS400System mySystem = new cwbx.AS400SystemClass();
```

```
mySystem.Define( "MySystemName" );  
mySystem.UserID = "MyUserid";  
mySystem.Password = "MyPassword";
```

```
myrequest.system = mySystem;  
myrequest.AS400File.Name = "QIWS/QCUSTCDT";  
myrequest.pcFile.Name = "C:\\mycust.xls";  
myrequest.pcFile.FileType = cwbx.cwbdtFileTypeEnum.cwbdtBIFF8;
```

```
myrequest.Download();
```

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ADO.NET Performance

	DB2 for iSeries .NET Provider	DB2 LUW .NET Provider	ODBC "bridge" provider	OLE DB "bridge" provider over IBMDASQL
INSERT	13.81	18.23	26.32	14.39
UPDATE	14.14	17.92	28.21	14.76
SELECT	0.3	0.26	0.39	0.55
FAST DELETE	0.11	1.00	0.1	0.1
DELETE	11.82	18.31	19.57	10.39

Performance Coding Tips

- Use Parameters instead of literal values in SQL statements
 - INSERT INTO MYTABLE VALUES (@PARAM1)
 - INSERT INTO MYTABLE VALUES ('abcde')
- Build SQL queries to retrieve only the data you need
- Reuse Command objects with the same CommandText

Performance Coding Tips

- With LOBs...
 - Use a DataReader or the Command's ExecuteScalar method
 - Avoid using a DataAdapter
- ConnectionPooling
- DataCompression connection property

Other Coding Tips

- Call an object's Close or Dispose method when finished with it
- Call IsDBNull method of iDB2DataReader before calling a Get method
- Make sure to handle Exceptions

Session Title: System i Access in the .NET World

Session ID: 420219

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Speaker: Brent Nelson

System i Access for Windows sessions:

21CA	420017	System i Access for Windows: What's New in V5R4
22CA	409159	System i Access for Windows Data Transfer: Tips & Techniques
26CC	403971	System i Access for Windows: Security & Communications Tips
31CA	406172	PC5250 Emulation: Everything You Need To Know
32CA	401918	Performance Tune System i Access ODBC
33CA	420219	System i Access in the .NET World
35LA/ 36LA	410160	OPEN LAB: System i Access for Windows with the Experts
52CB	402066	Administration of System i Access for Windows

System i Access for Linux session:

25CA	480144	Creating the System i Linux Desktop
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Appendix

- ADO.NET Comparisons to Other DB Access Models
- Additional DB2 Connect Information
- References to More Information

.NET versus J2EE

- Multiple languages(>25?)
 - 1 IL
 - 1 platform today (Windows)
 - Dynamic web: ASP.NET
 - Database access: ADO.NET
- 1 language
 - 1 IL
 - Multiple platforms (JVM)
 - Dynamic web: JSPs
 - Database access: JDBC SQL/J

.NET versus COM

- Designed to build Internet Applications
- “Managed” by the .NET runtime
- Common Language Runtime (like JVM)
- Can call COM objects through COM Interop bridge
- Modified to work in Internet App world
- “Unmanaged”
- Standard DLLs
- Windows still based on COM

Mapping of ADO Objects to ADO.NET

ADO object	Corresponding ADO.NET object
Command	iDB2Command
Command.Parameters collection	iDB2Command.Parameters (iDB2ParameterCollection)
Command.Properties collection	iDB2Command properties
Connection	iDB2Connection
Connection.Errors collection	iDB2Exception.Errors (iDB2ErrorCollection)
Connection.Properties collection	iDB2Connection properties
Error	iDB2Error (item in an iDB2ErrorCollection)
Field	DataColumn of a DataRow or column of a DataReader
Field.Properties collection	Column metadata returned from the DataReader's GetSchemaTable method or the DataAdapter's FillSchema method
Parameter	iDB2Parameter
Record	DataRow of a DataTable or "current" row of a DataReader
Record.Fields collection	DataColumns of a DataRow or columns of a DataReader
Recordset	iDB2DataReader for read-only forward-only, iDB2DataAdapter with DataTable for updatable
Recordset.Fields collection	DataColumns of a DataRow or columns of a DataReader
Recordset.Properties collection	iDB2DataReader properties or iDB2DataAdapter properties

NOTE: This table taken from the "Integrating DB2 Universal Database for iSeries with Microsoft ADO .NET" Redbook at: <http://www.redbooks.ibm.com/abstracts/sq246440.html?Open>

DB2 Connect Add-ins / Plug-ins

- **Microsoft programmer:** DB2 add-ins for Visual Studio .NET make building complete DB2 applications a natural experience for VS.NET users. No .NET programmer should be without these!
- **Java programmer:** IBM WebSphere Studio/RAD plug-ins allow Java programmers to build DB2 applications within the Java IDE
- **PHP programmer:** comprehensive PHP service and support for developers with Zend Core
 - Zend Core enables PHP application use of all DB2 server environments (including eServer iSeries and zSeries via DB2 Connect).
- **Database programmer:** Development Center, an Integrated Development Environment (IDE) for building server-side objects that does not require knowledge of a programming language

DB2 Mobility on Demand

(included with DB2 Connect for iSeries)

**POS -
Mobile Devices**



Enter an Order

DB2 Connect for iSeries
running on
Linux, Unix or Windows

Sync
Server



DB2 UDB
for
iSeries



Occasionally Connected
DB2
Mobile

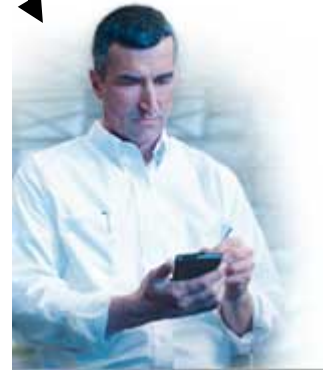
Always Connected WIFI
HTML, XHTML, WAP, WML, J2ME,
.NET Compact Framework etc.

DB2
Mobile



Proactive Medicine

**Manage
Inventory**



For more information...

- V5R4 iSeries Access .NET provider
 - <http://www-1.ibm.com/servers/eserver/series/access/>
 - NET Technical Reference - cwbmptch.hlp
 - Found in ..\IBM\Client Access\Mri2924 directory
- DB2 V8.2 (Stinger) .NET provider
 - <http://www.ibm.com/software/data/db2/db2connect>
- Using iSeries Access through .NET
 - Info APAR II13341 Using IBMDA400:
 - <http://www.ibm.com/servers/eserver/series/access/caiixe1.htm>
 - Scroll to the OLE DB section look for “Using managed providers in the .NET framework for accessing DB2 data on AS/400 or iSeries servers”

For more information...

- .NET Redbook - IBM Form Number: SG24-6440-00
 - <http://www.redbooks.ibm.com/abstracts/sg246440.html?Open>
- MC Press Online Articles
 - “.NET Integration with DB2 UDB for iSeries”
 - <http://www.mcpressonline.com/mc/.6b1993b7>
 - “Cut Your Development Effort with DB2 Development Add-in for .NET”
 - <http://www.mcpressonline.com/mc?1@179.6ILTcSo2wi9.93070@.6b21a8f0!sectionID=.5bfbae77>
- IBM Article – “A Detailed Look at DB2 Stinger .NET CLR Routines”
 - <http://www-128.ibm.com/developerworks/db2/library/techarticle/dm-0406evans/index.html>
- IBM White Paper – “Building Web services in a flash”
 - <http://www-03.ibm.com/servers/enable/site/education/wp/e102/>

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Performance is based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput or performance improvements equivalent to the ratios stated here.

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