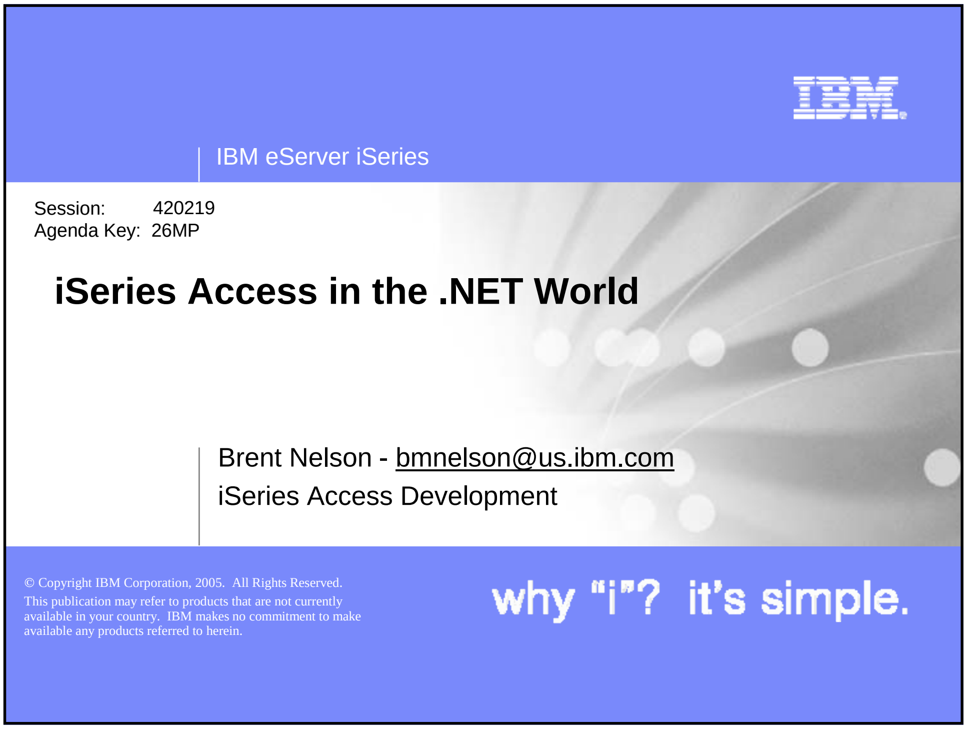


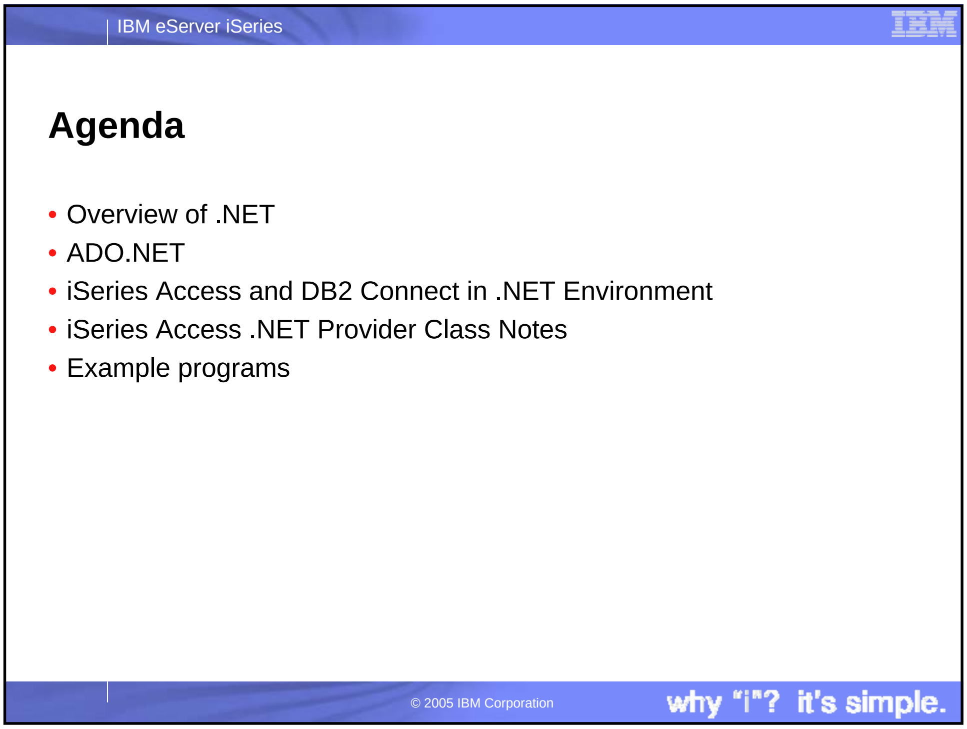
IBM eServer iSeries

Session: 420219
Agenda Key: 26MP

iSeries Access in the .NET World

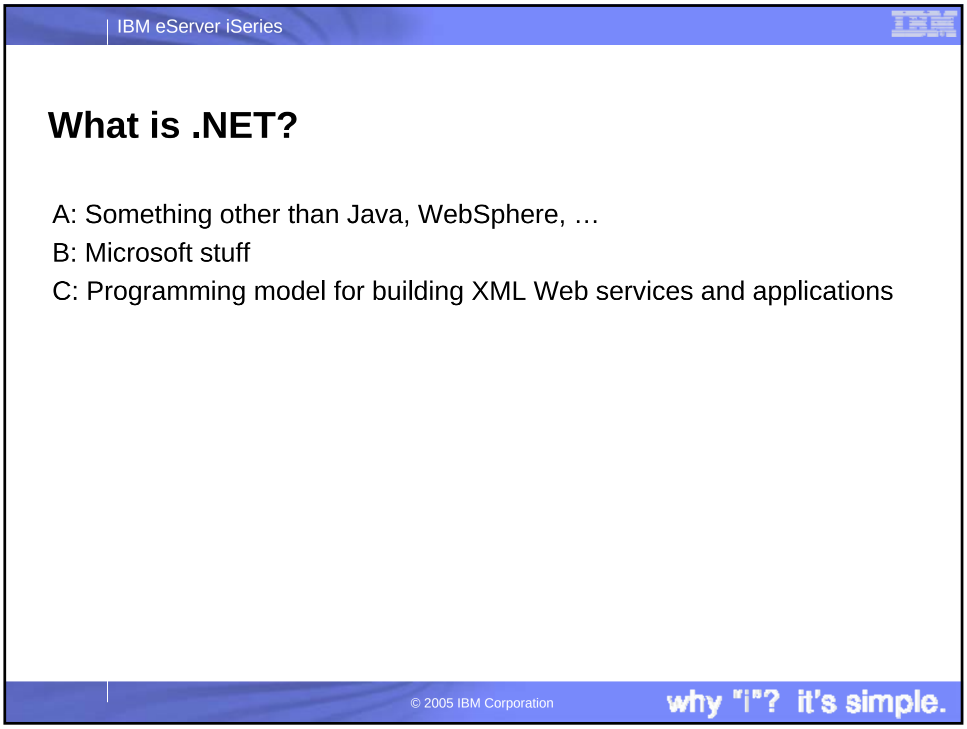
Brent Nelson - bmnelson@us.ibm.com
iSeries Access Development

why "i"? it's simple.



Agenda

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

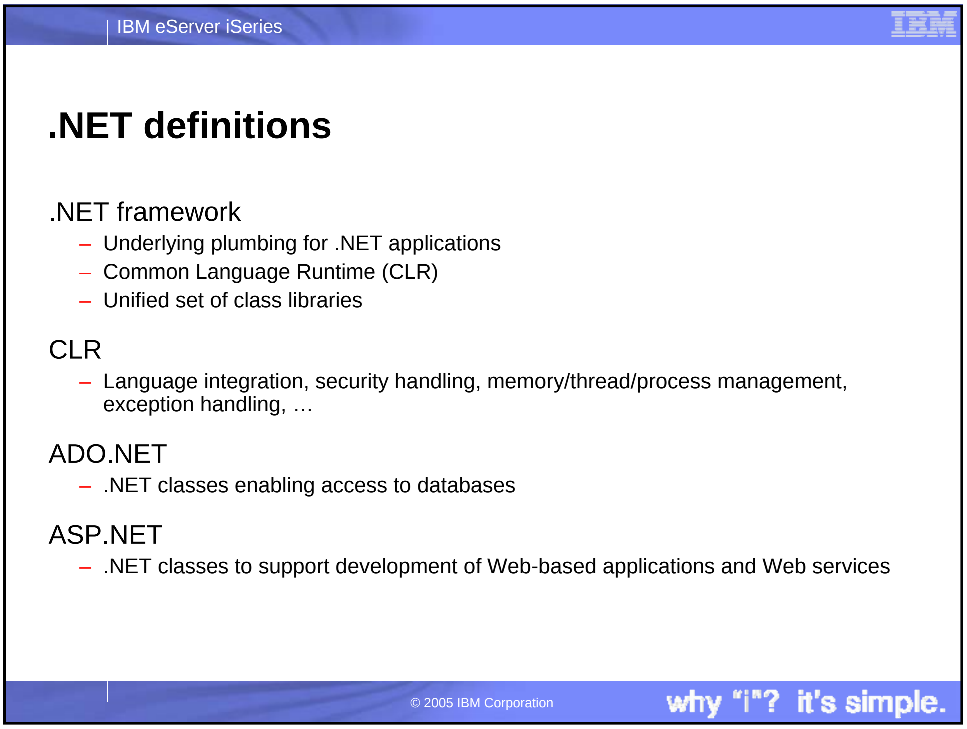


What is .NET?

A: Something other than Java, WebSphere, …

B: Microsoft stuff

C: Programming model for building XML Web services and applications



.NET definitions

.NET framework

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

CLR

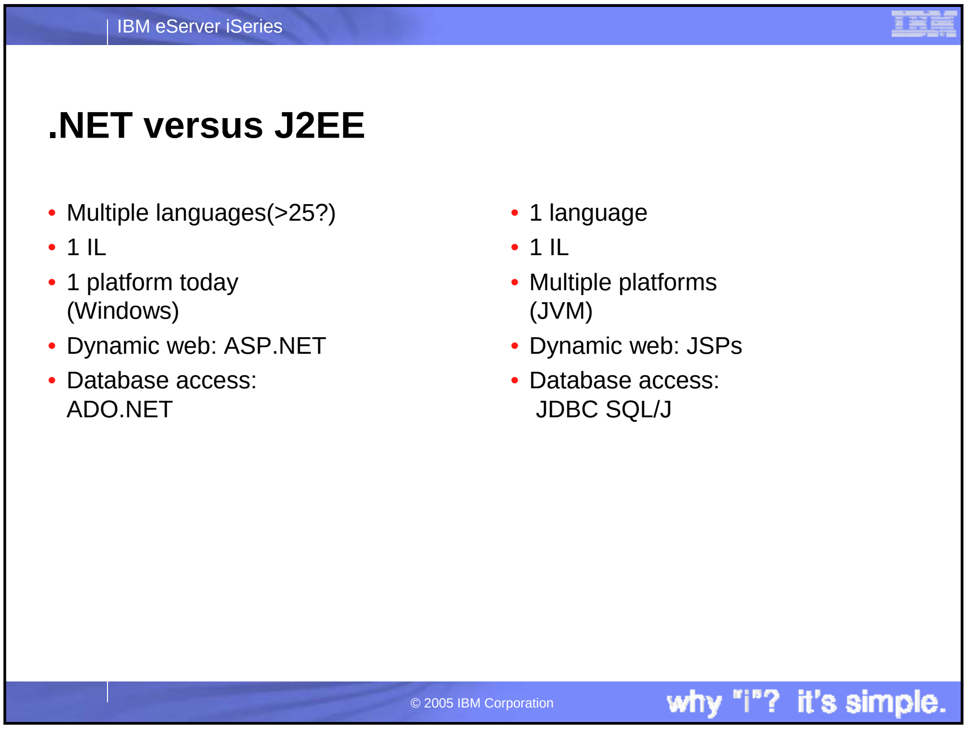
- Language integration, security handling, memory/thread/process management, exception handling, …

ADO.NET

- .NET classes enabling access to databases

ASP.NET

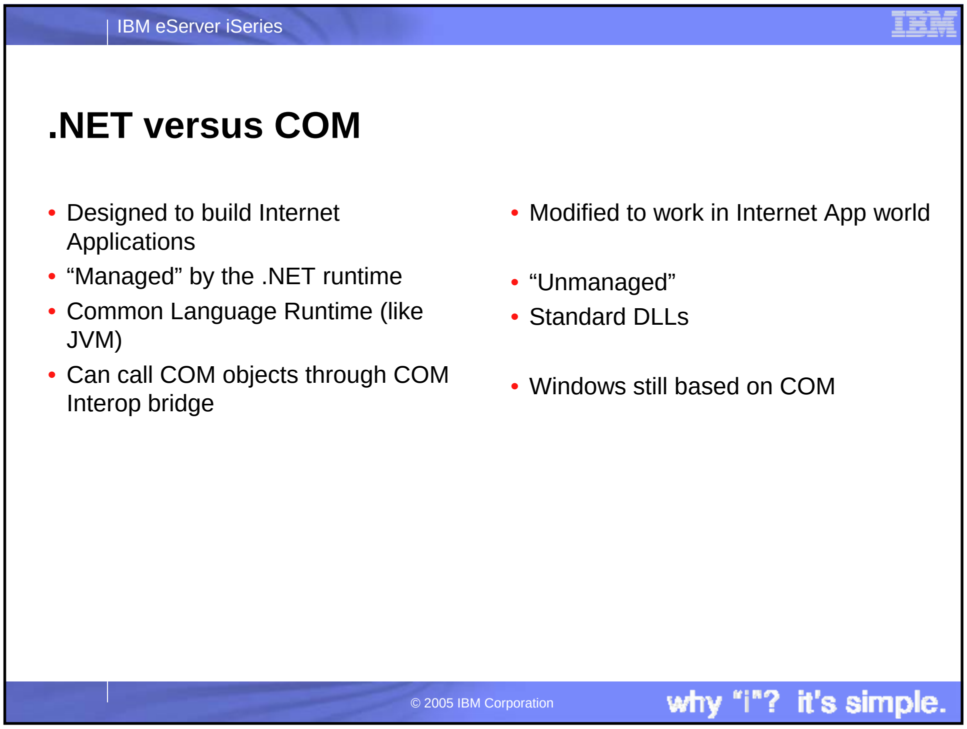
- .NET classes to support development of Web-based applications and Web services



.NET versus J2EE

- Multiple languages(>25?)
- 1 IL
- 1 platform today (Windows)
- Dynamic web: ASP.NET
- Database access: ADO.NET

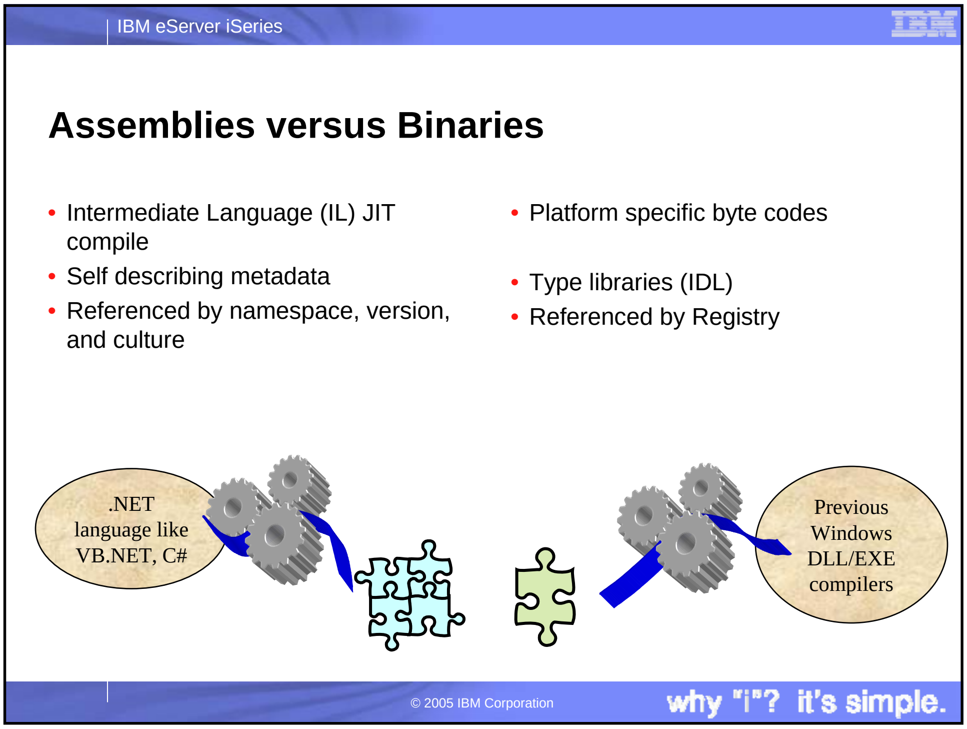
- 1 language
- 1 IL
- Multiple platforms (JVM)
- Dynamic web: JSPs
- Database access: JDBC SQL/J



.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



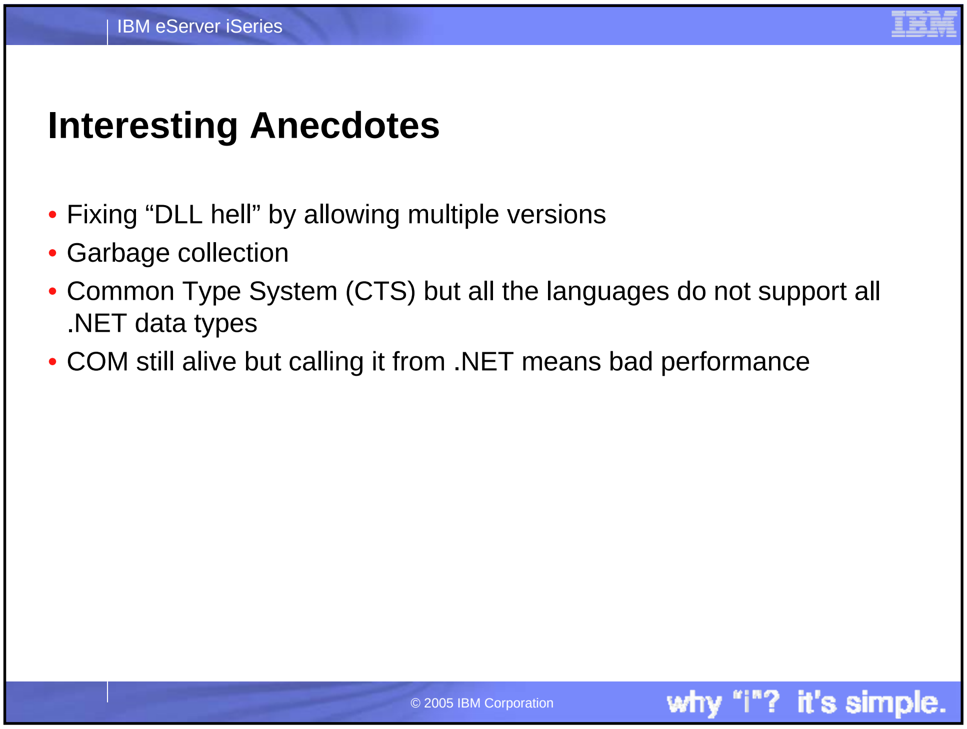
Assemblies versus Binaries

- Intermediate Language (IL) JIT compile
- Self describing metadata
- Referenced by namespace, version, and culture

- Platform specific byte codes
- Type libraries (IDL)
- Referenced by Registry

.NET language like VB.NET, C#

Previous Windows DLL/EXE compilers

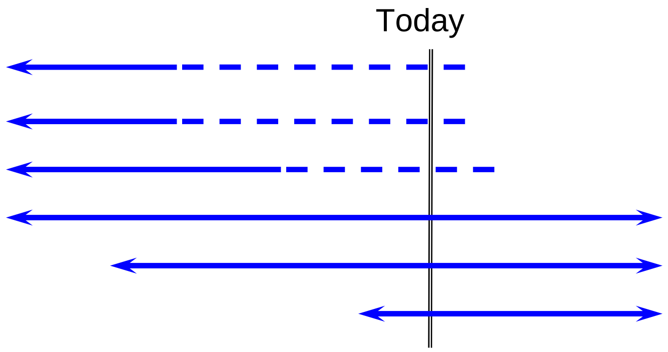


Interesting Anecdotes

- Fixing “DLL hell” by allowing multiple versions
- 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

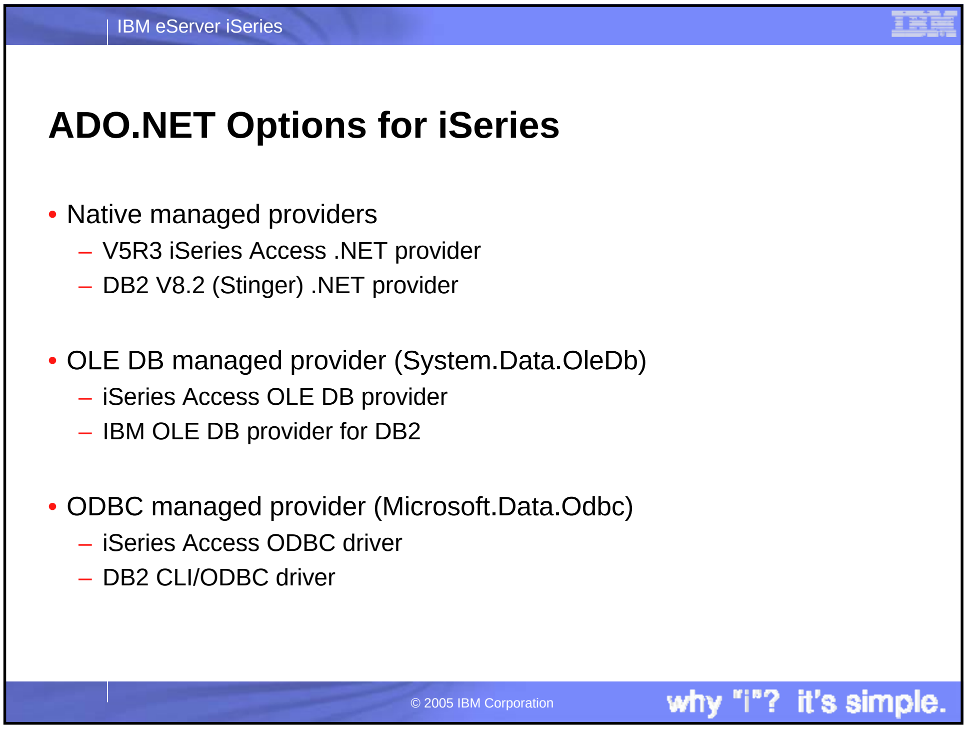
Microsoft Technology Roadmap

- DB-Library
- ESQL
- DAO
- ODBC
- ADO/OLE DB
- ADO.NET



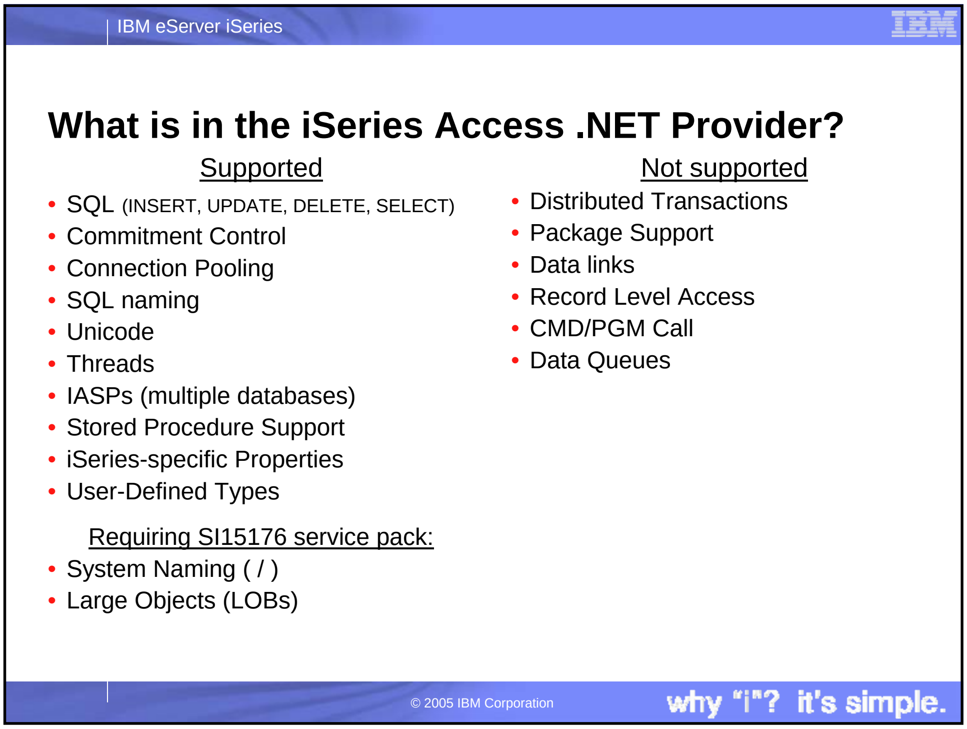
ADO Options for iSeries

- 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 iSeries

- 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 (Microsoft.Data.Odbc)
  - iSeries Access ODBC driver
  - DB2 CLI/ODBC driver



What is in the iSeries Access .NET Provider?

Supported

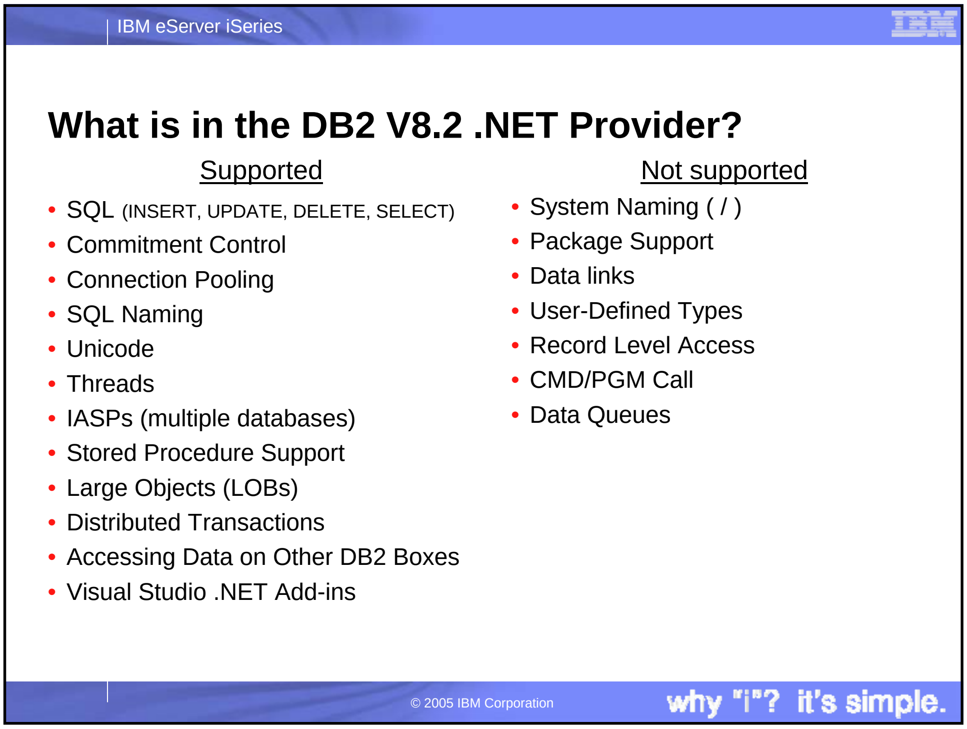
- SQL (INSERT, UPDATE, DELETE, SELECT)
- Commitment Control
- Connection Pooling
- SQL naming
- Unicode
- Threads
- IASPs (multiple databases)
- Stored Procedure Support
- iSeries-specific Properties
- User-Defined Types

Requiring SI15176 service pack:

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

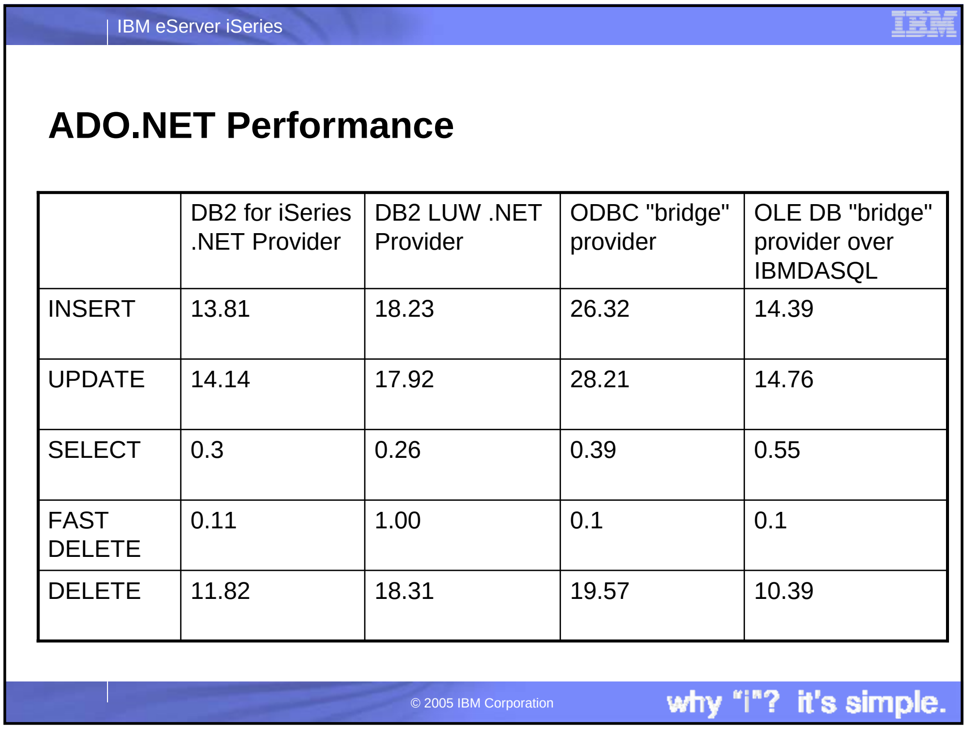
Not supported

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



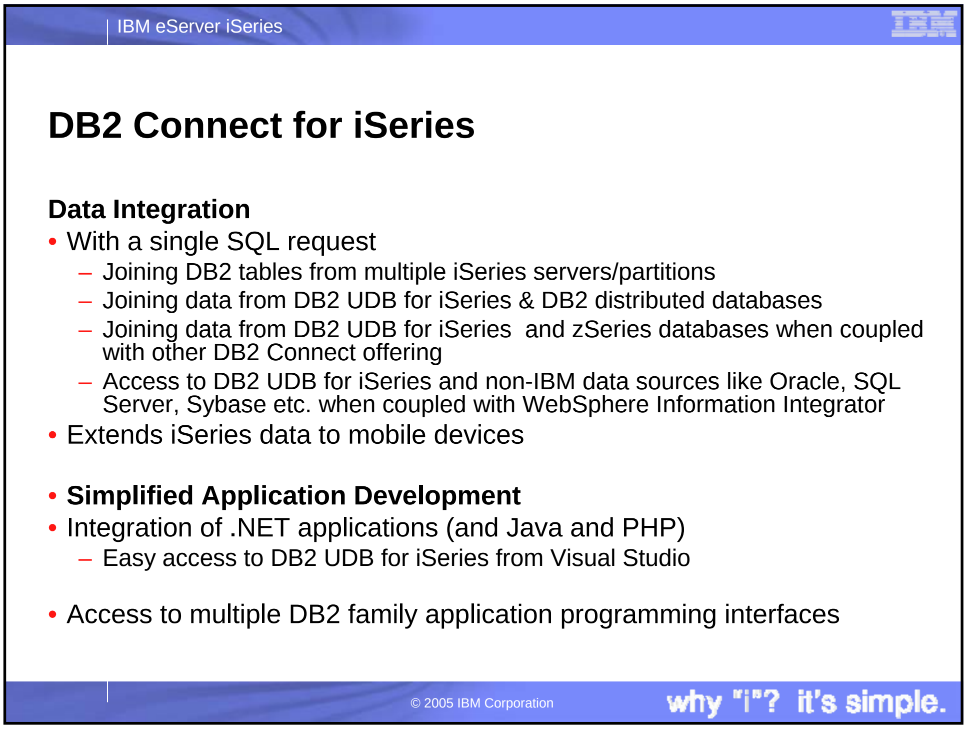
What is in the DB2 V8.2 .NET Provider?

Supported	Not supported
SQL (INSERT, UPDATE, DELETE, SELECT)	System Naming (/)
Commitment Control	Package Support
Connection Pooling	Data links
SQL Naming	User-Defined Types
Unicode	Record Level Access
Threads	CMD/PGM Call
IASPs (multiple databases)	Data Queues
Stored Procedure Support	
Large Objects (LOBs)	
Distributed Transactions	
Accessing Data on Other DB2 Boxes	
Visual Studio .NET Add-ins	



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



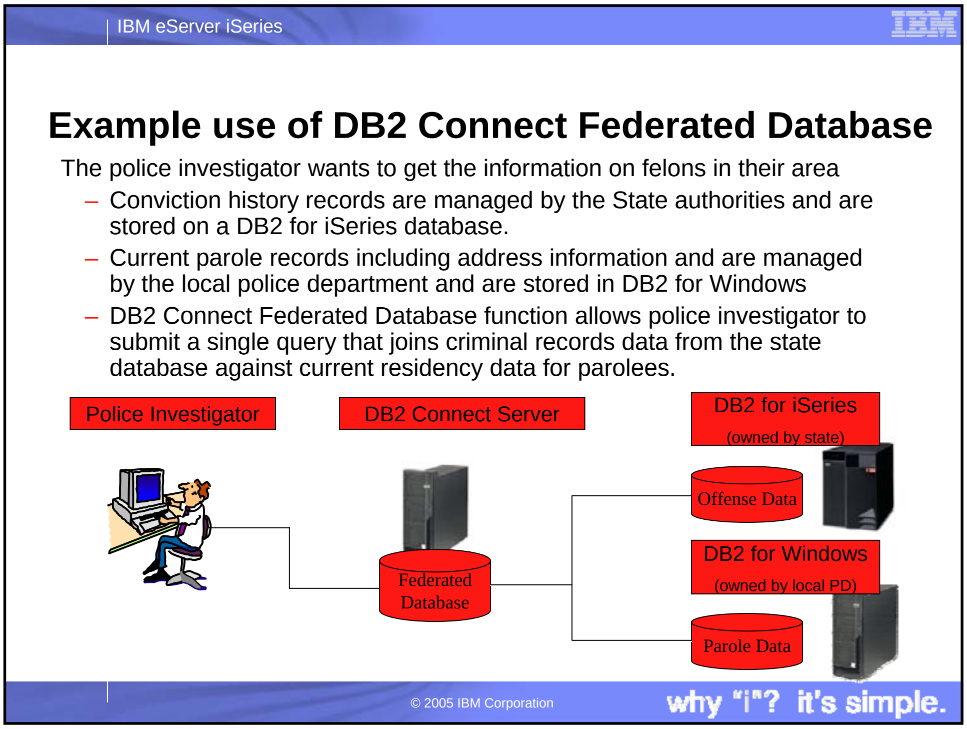
DB2 Connect for iSeries

Data Integration

- With a single SQL request
  - Joining DB2 tables from multiple iSeries 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 iSeries 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.

Police Investigator

DB2 Connect Server

DB2 for iSeries
(owned by state)

Offense Data

Federated Database

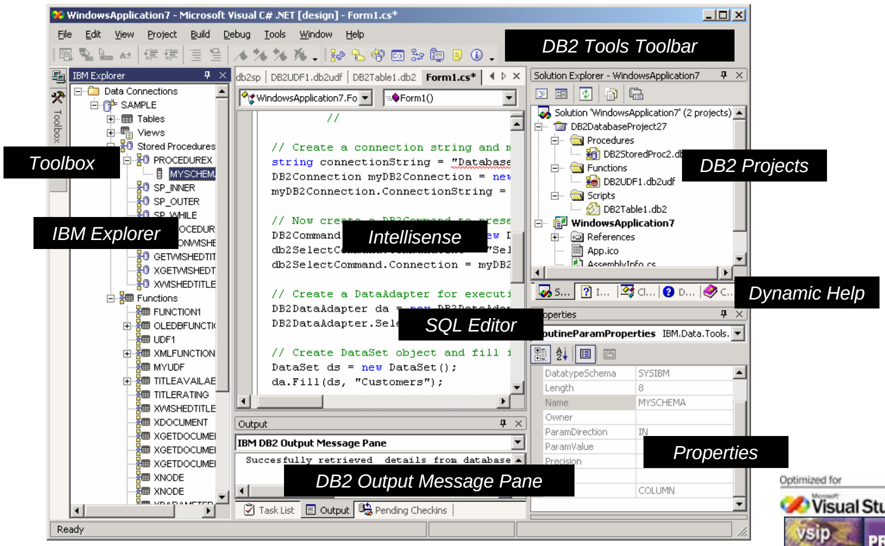
DB2 for Windows
(owned by local PD)

Parole Data

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 add-ins for Visual Studio .NET



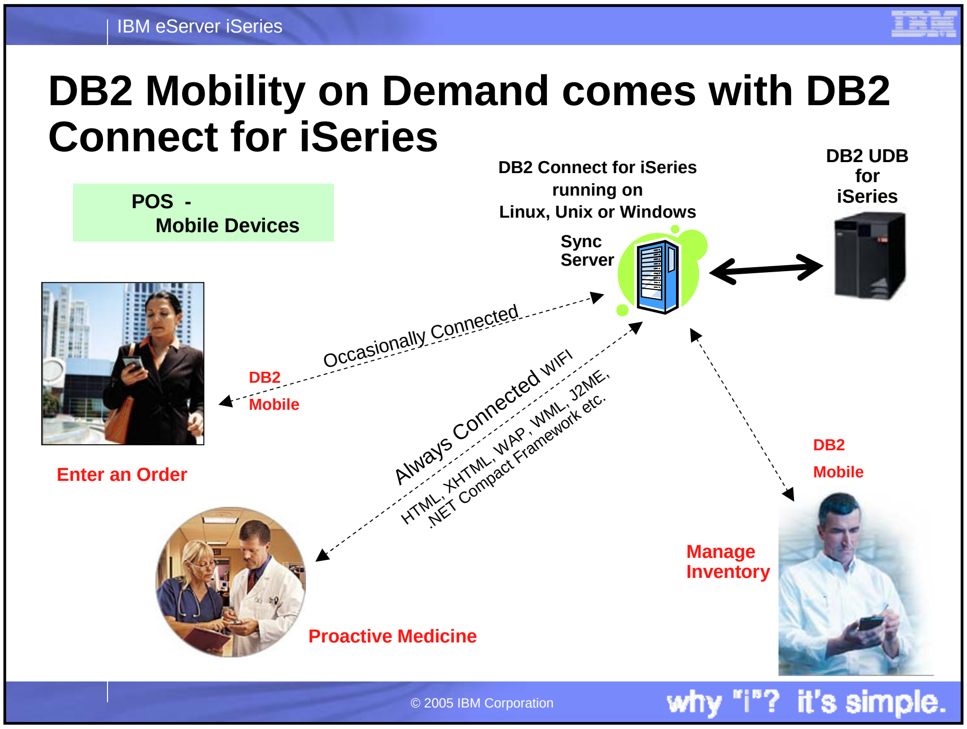
```
        //

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

// Now create a DB2Command to prese
DB2Command                        ew I
db2SelectC                        "Sel
db2SelectCommand.Connection = myDB2

// Create a DataAdapter for executi
DB2DataAdapter da = new DB2DataAdap
DB2DataAdapter.Sele

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

```
Succesfully retrieved  details from database
```

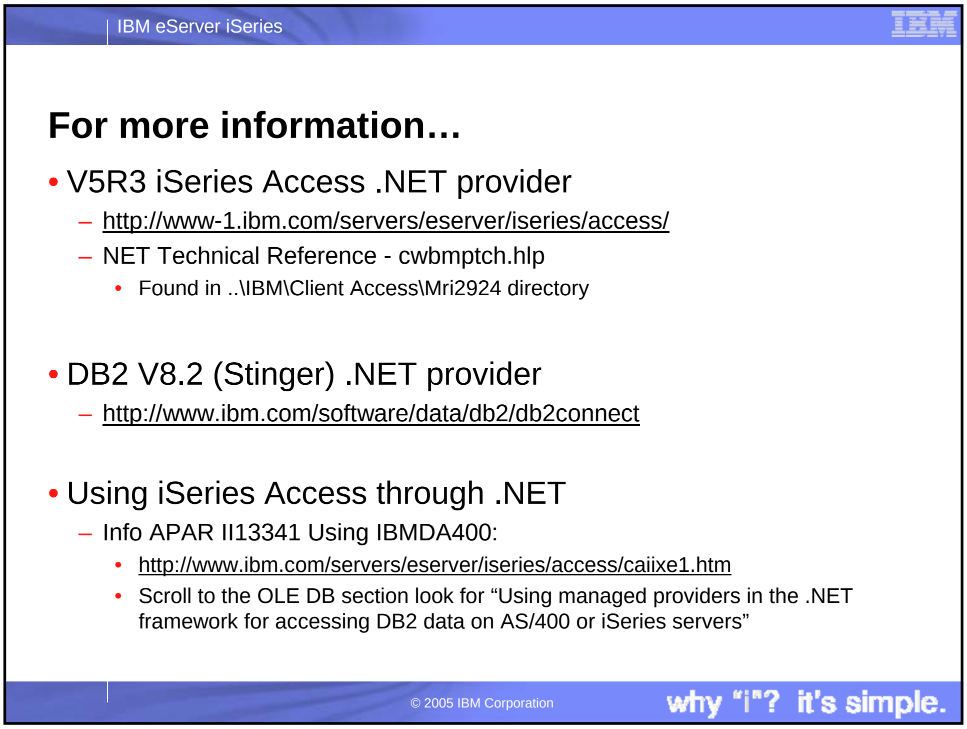
DatatypeSchema	SYSIBM
Length	8
Name	MYSCHEMA
Owner	
ParamDirection	IN
ParamValue	
Precision	
	COLUMN

Optimized for Visual Studio .net

vsip Summit PREMIER Support

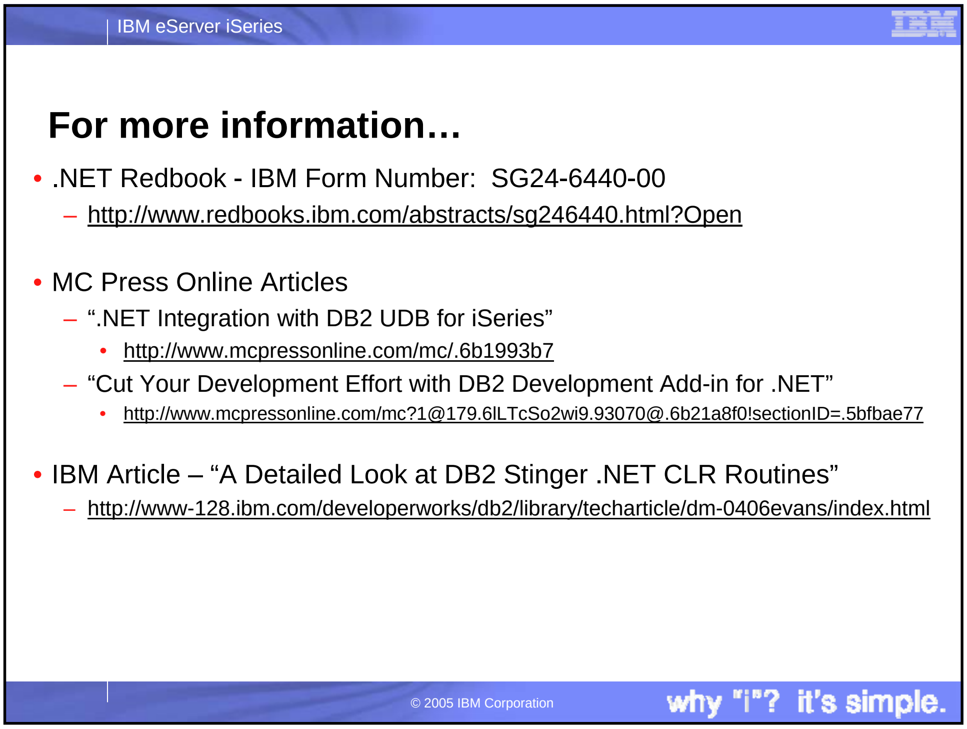


DB2 Mobility on Demand comes with DB2 Connect for iSeries



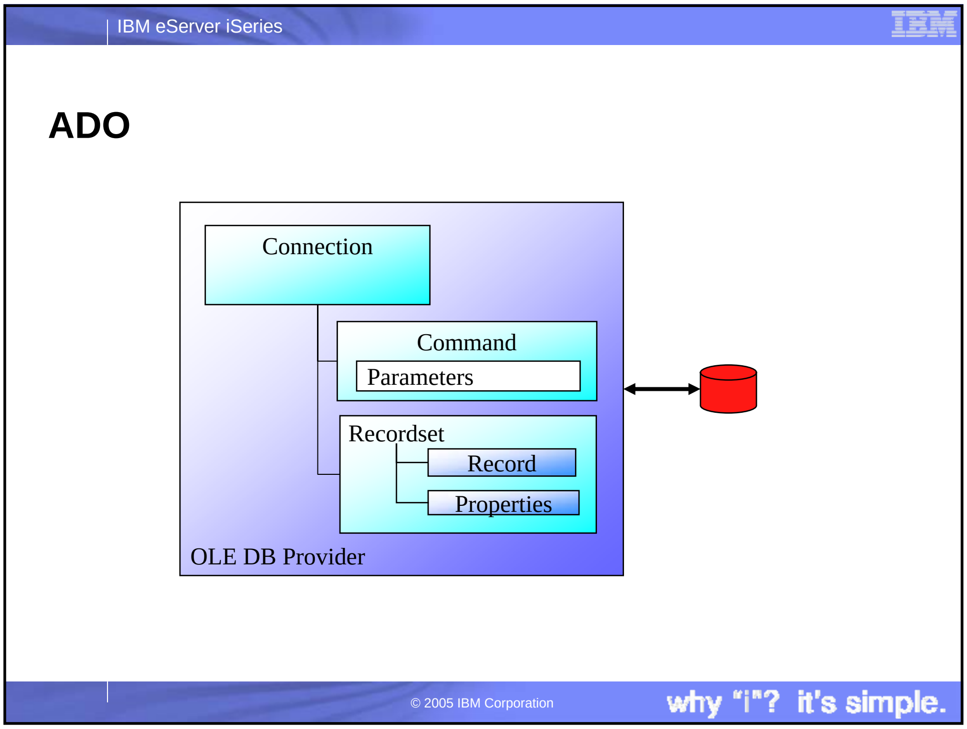
For more information…

- V5R3 iSeries Access .NET provider
  - http://www-1.ibm.com/servers/eserver/iseries/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/iseries/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”



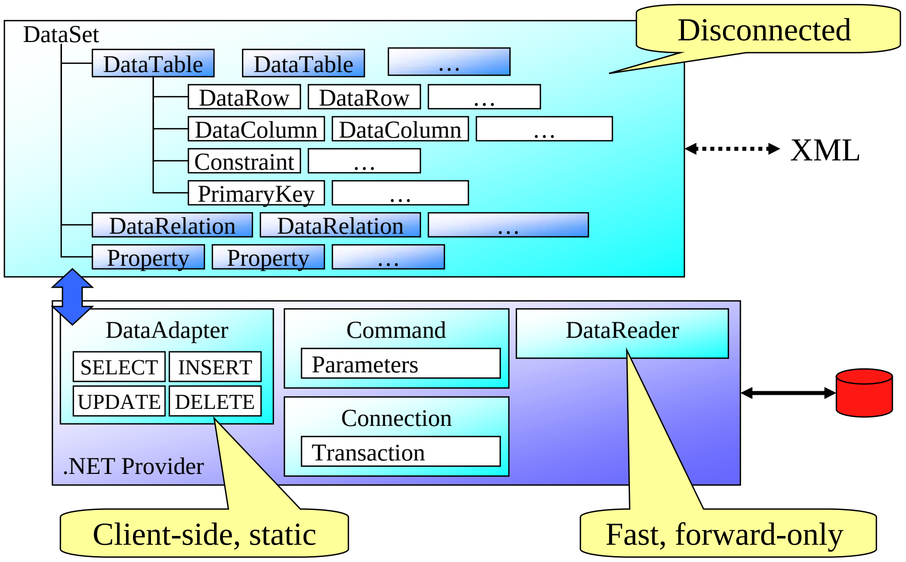
For more information…

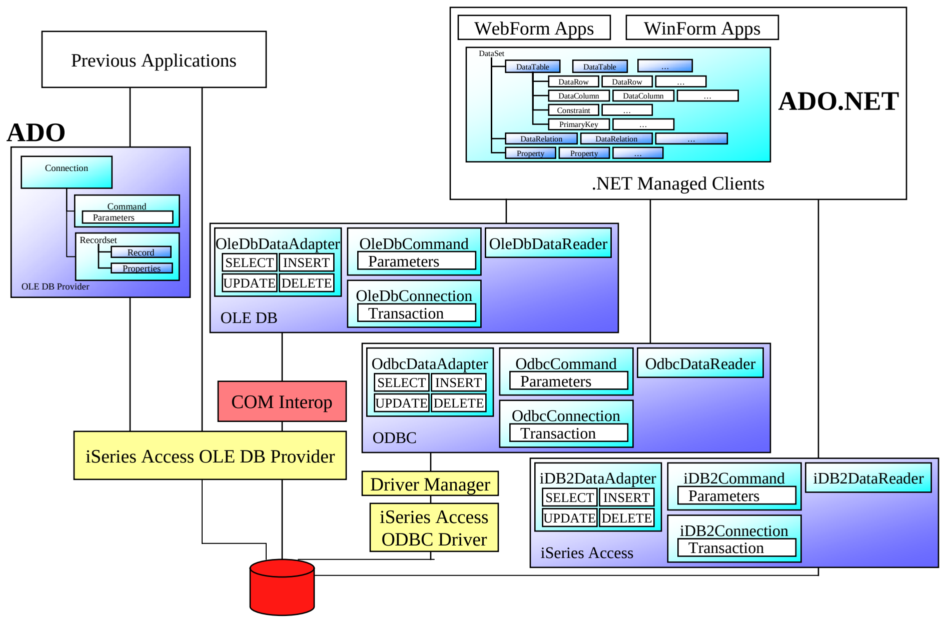
- .NET Redbook - IBM Form Number: SG24-6440-00
  - http://www.redbooks.ibm.com/abstracts/sg246440.html?Open
- MC Press Online Articles
  - ".NET Integration with DB2 UDB for iSeries"
    - http://www.mcpressonline.com/mc/.6b1993b7
  - "Cut Your Development Effort with DB2 Development Add-in for .NET"
    - http://www.mcpressonline.com/mc?1@179.6lLTcSo2wi9.93070@.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

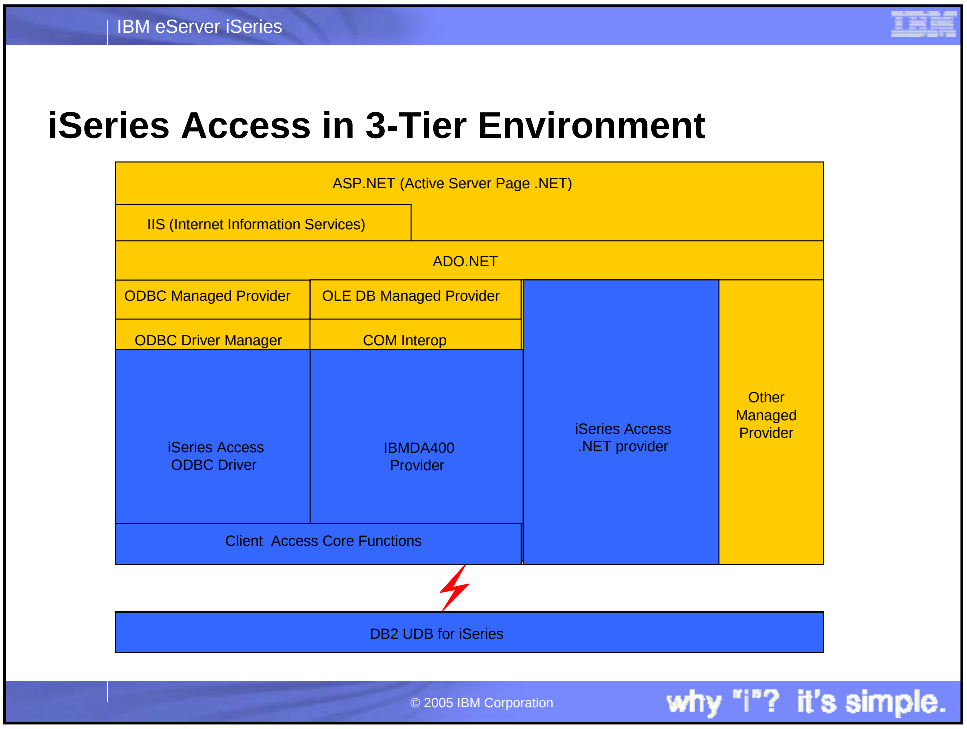


ADO

ADO.NET


Disconnected
DataSet
DataTable
DataTable
…
DataRow
DataRow
…
DataColumn
DataColumn
…
Constraint
…
PrimaryKey
…
DataRelation
DataRelation
…
Property
Property
…
XML
DataAdapter
SELECT
INSERT
UPDATE
DELETE
Command
Parameters
Connection
Transaction
DataReader
.NET Provider
Client-side, static
Fast, forward-only


Previous Applications
ADO
Connection
Command
Parameters
Recordset
Record
Properties
OLE DB Provider
WebForm Apps
WinForm Apps
DataSet
DataTable
DataTable
…
DataRow
DataRow
…
DataColumn
DataColumn
…
Constraint
…
PrimaryKey
…
DataRelation
DataRelation
…
Property
Property
…
ADO.NET
.NET Managed Clients
OleDbDataAdapter
SELECT
INSERT
UPDATE
DELETE
OleDbCommand
Parameters
OleDbDataReader
OleDbConnection
Transaction
OLE DB
OdbcDataAdapter
SELECT
INSERT
UPDATE
DELETE
OdbcCommand
Parameters
OdbcDataReader
OdbcConnection
Transaction
ODBC
COM Interop
iSeries Access OLE DB Provider
Driver Manager
iSeries Access ODBC Driver
iDB2DataAdapter
SELECT
INSERT
UPDATE
DELETE
iDB2Command
Parameters
iDB2DataReader
iDB2Connection
Transaction
iSeries Access



iSeries Access in 3-Tier Environment

ASP.NET (Active Server Page .NET)

IIS (Internet Information Services)

ADO.NET

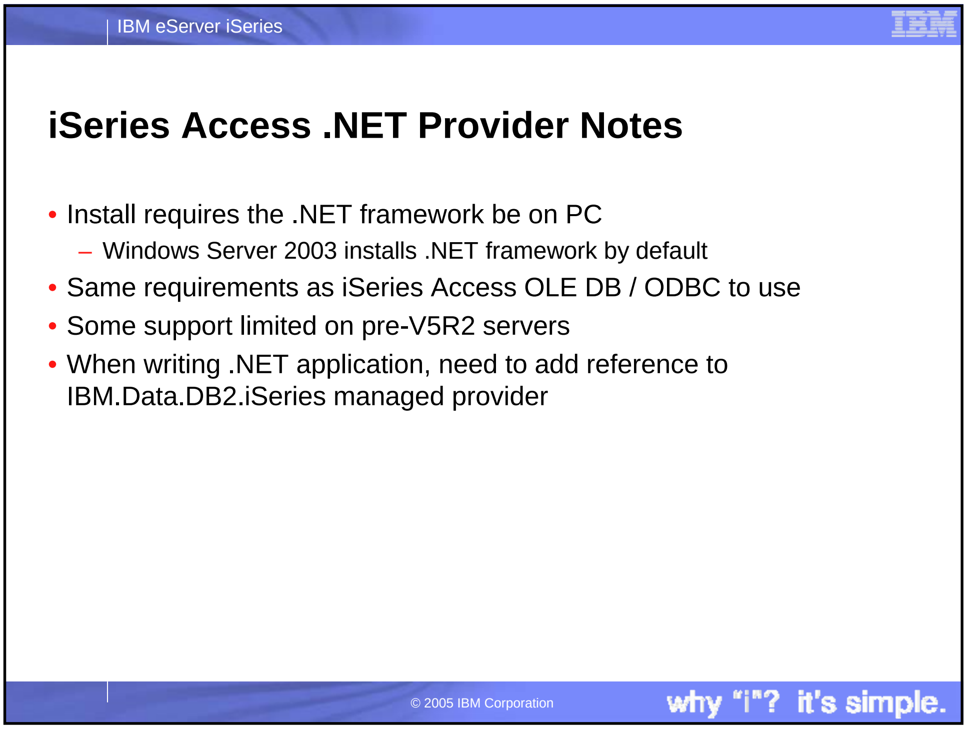
ODBC Managed Provider | OLE DB Managed Provider

ODBC Driver Manager | COM Interop

iSeries Access ODBC Driver | IBMDA400 Provider | iSeries Access .NET provider | Other Managed Provider

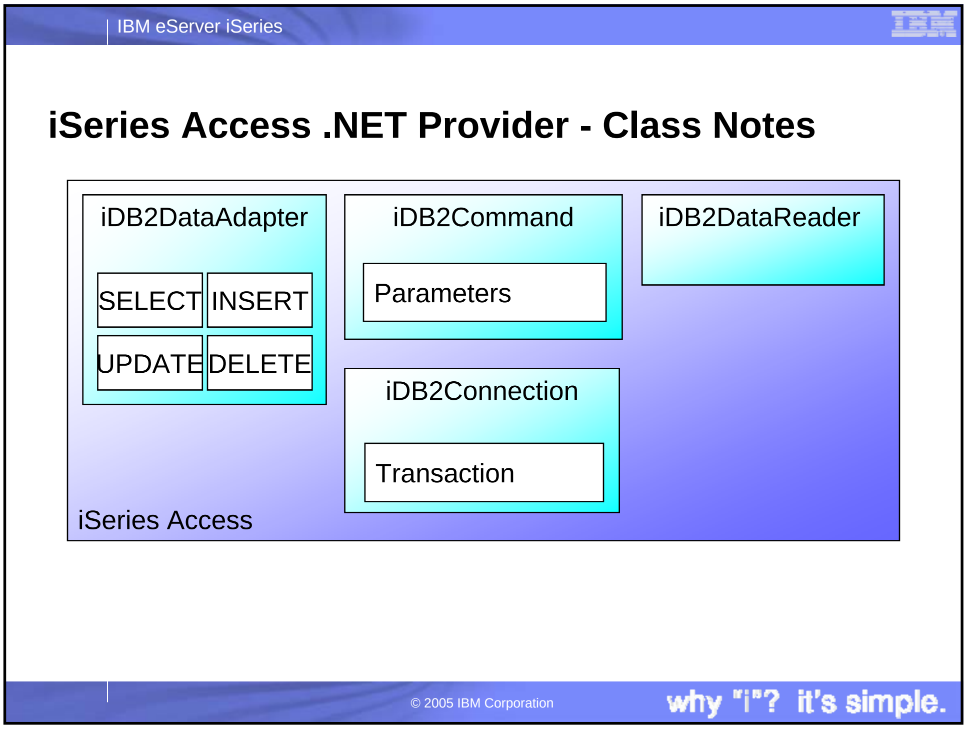
Client Access Core Functions

DB2 UDB for iSeries



iSeries Access .NET Provider Notes

- Install requires the .NET framework be on PC
  - Windows Server 2003 installs .NET framework by default
- Same requirements as iSeries Access OLE DB / ODBC to use
- Some support limited on pre-V5R2 servers
- When writing .NET application, need to add reference to IBM.Data.DB2.iSeries managed provider



iSeries Access .NET Provider - Class Notes

iDB2DataAdapter

SELECT INSERT

UPDATE DELETE

iDB2Command

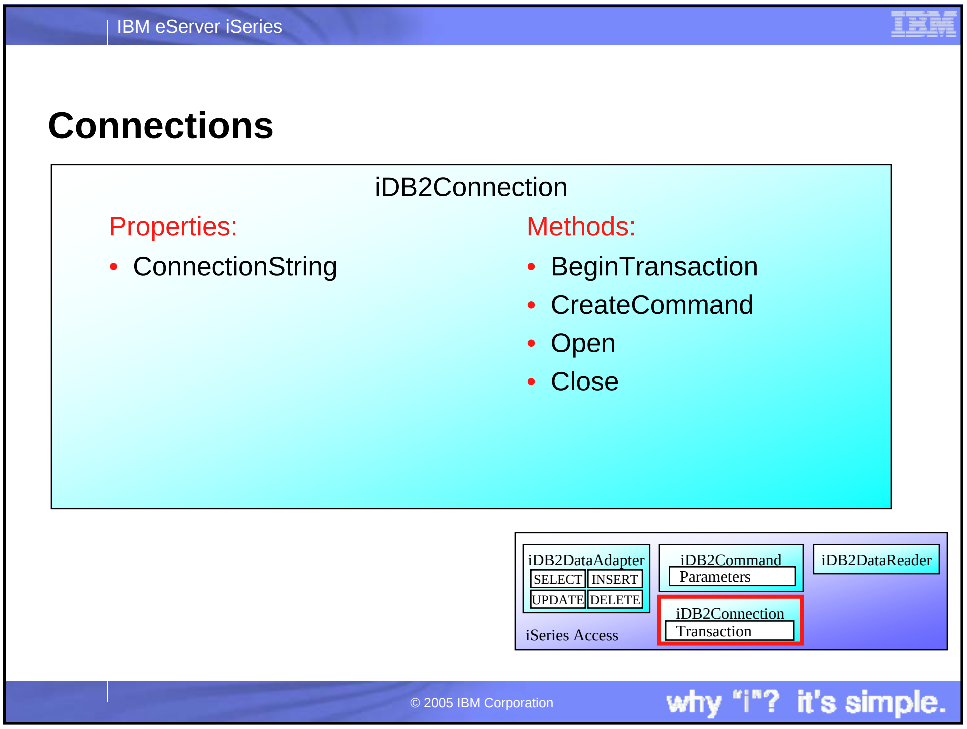
Parameters

iDB2DataReader

iDB2Connection

Transaction

iSeries Access



Connections

iDB2Connection

Properties:

- ConnectionString

Methods:

- BeginTransaction
- CreateCommand
- Open
- Close

Connections (Additional Properties)

iDB2Connection

Properties:

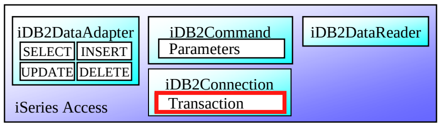
- Pooling
- DefaultCollection
- LibraryList
- DataCompression

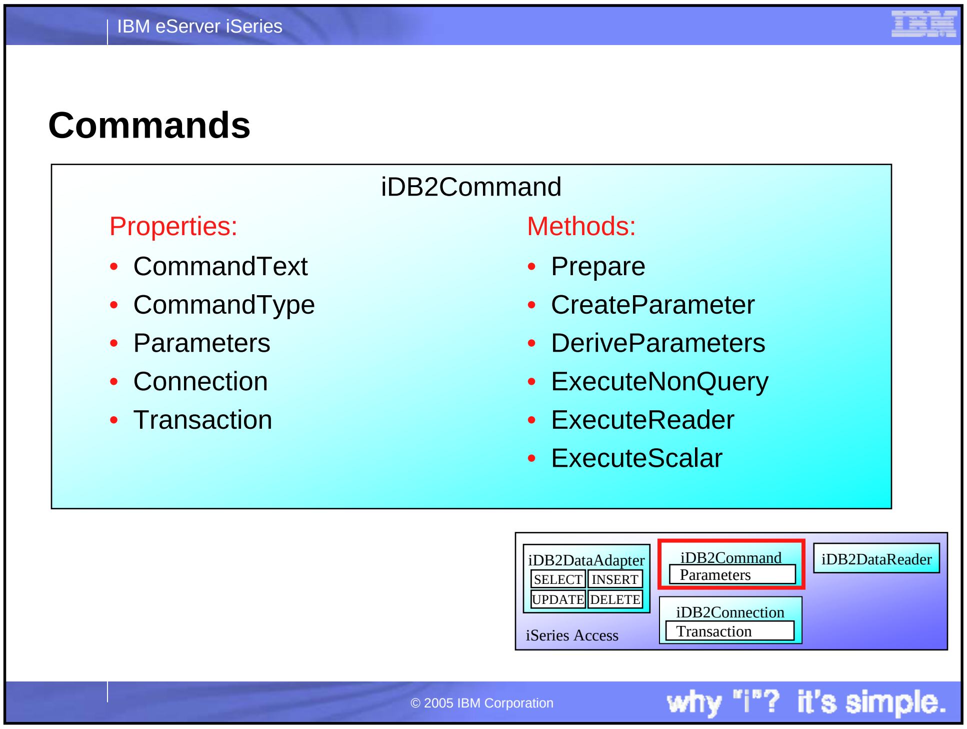
- State
- ServerVersion
- JobName

Transactions

iDB2Transaction

Properties:	Methods:
• Connection	• Commit
• IsolationLevel	• Rollback





Commands

iDB2Command

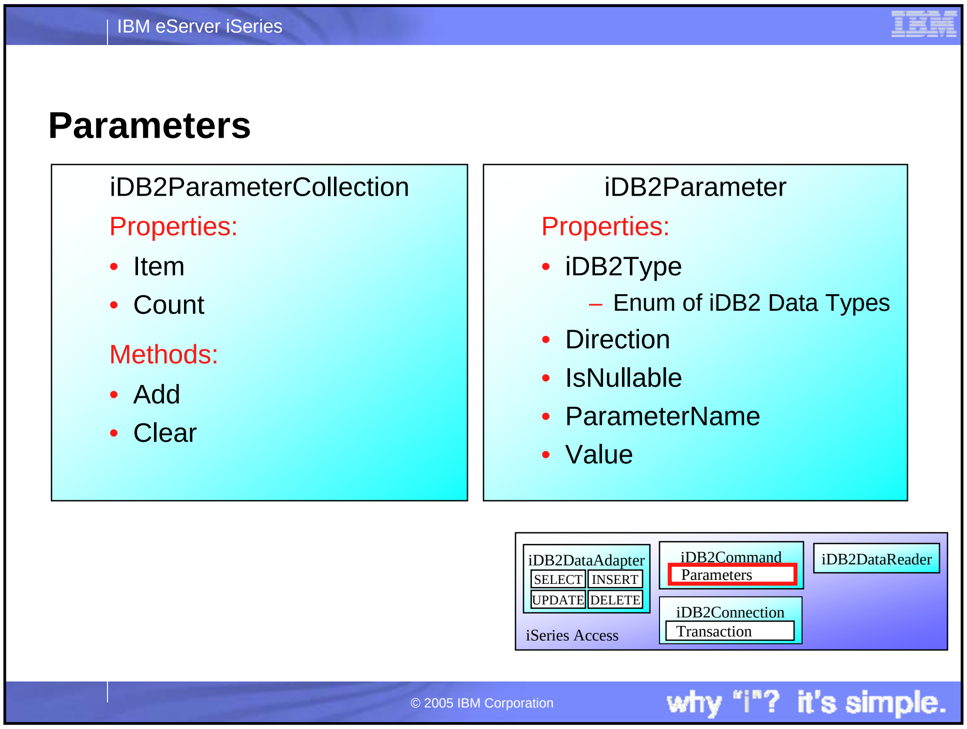
Properties:

- CommandText
- CommandType
- Parameters
- Connection
- Transaction

Methods:

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

iDB2DataAdapter
SELECT INSERT
UPDATE DELETE
iDB2Command
Parameters
iDB2DataReader
iDB2Connection
Transaction
iSeries Access



Parameters

iDB2ParameterCollection

Properties:

- Item
- Count

Methods:

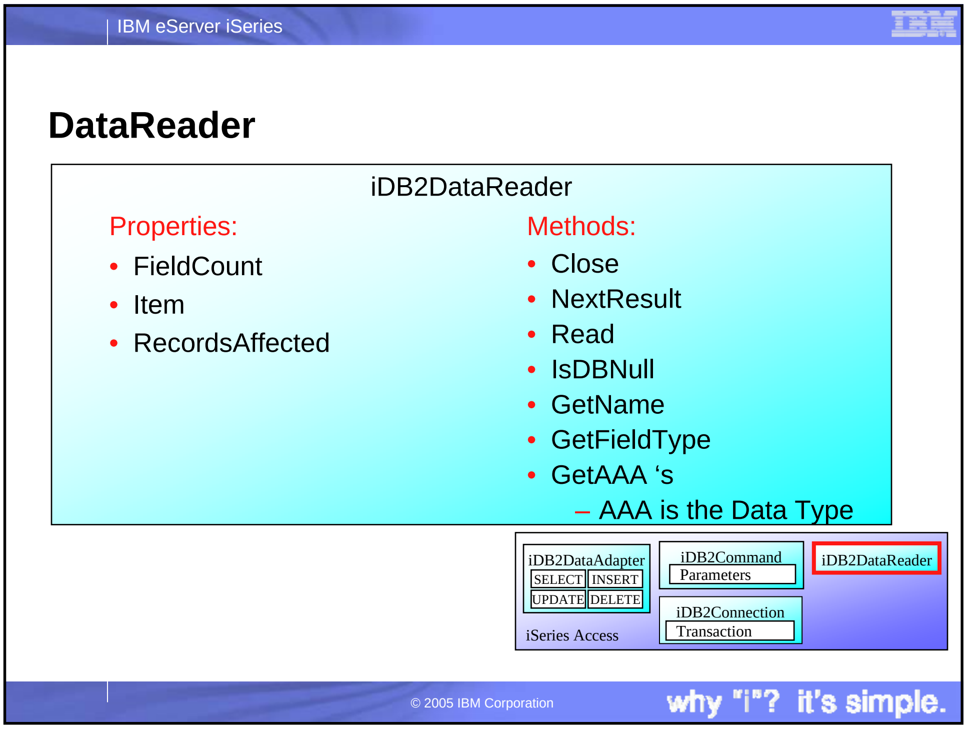
- Add
- Clear

iDB2Parameter

Properties:

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

iDB2DataAdapter
SELECT INSERT
UPDATE DELETE
iDB2Command
Parameters
iDB2DataReader
iDB2Connection
Transaction
iSeries Access



DataReader

iDB2DataReader

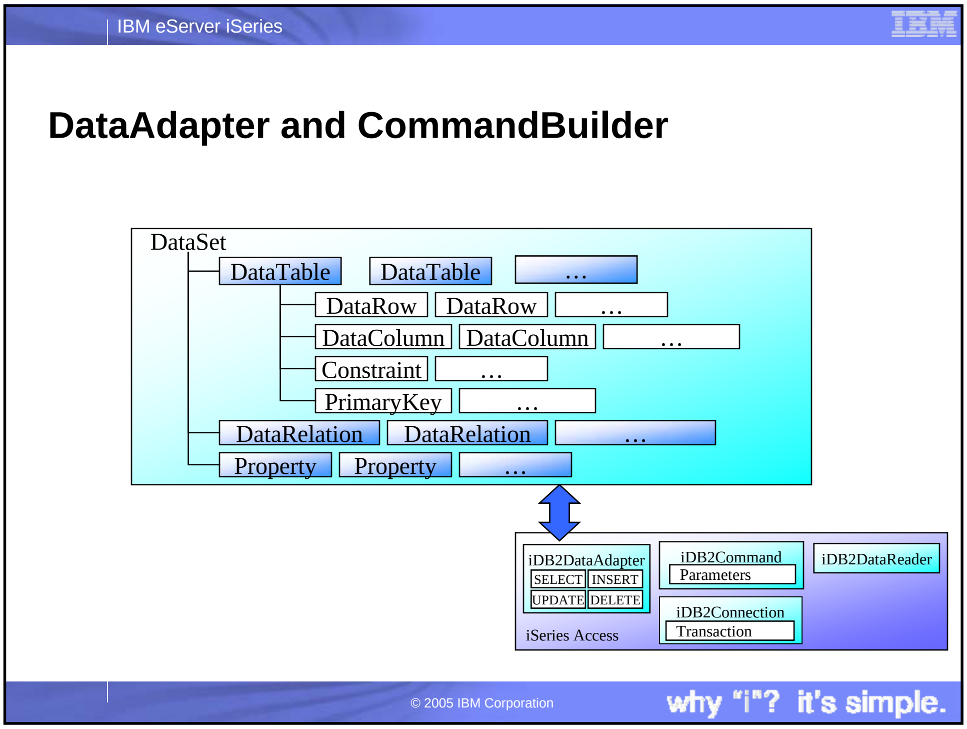
Properties:

- FieldCount
- Item
- RecordsAffected

Methods:

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

iDB2DataAdapter
SELECT
INSERT
UPDATE
DELETE
iDB2Command
Parameters
iDB2DataReader
iDB2Connection
Transaction
iSeries Access



DataAdapter and CommandBuilder

DataAdapter

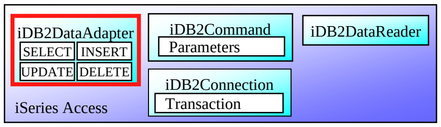
iDB2DataAdapter

Properties:

- SelectCommand
- InsertCommand
- UpdateCommand
- DeleteCommand

Methods:

- Fill
- FillSchema
- Update



CommandBuilder

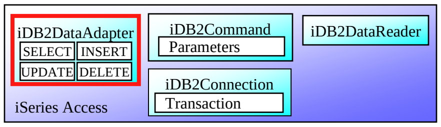
iDB2CommandBuilder

Properties:

- DataAdapter

Methods:

- DeriveParameters
- GetDeleteCommand
- GetInsertCommand
- GetUpdateCommand
- RefreshSchema



Error Handling

iDB2Exception

Properties:

- Errors
- Messages

iDB2ErrorCollection

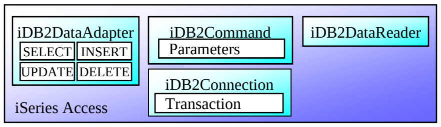
Properties:

- Count
- Item

iDB2Error

Properties:

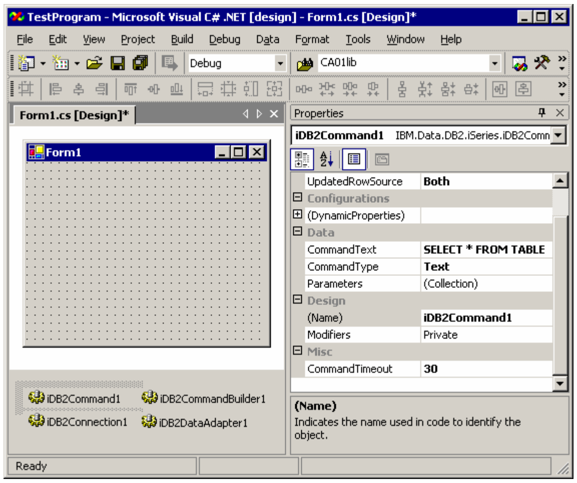
- Message



Coding Tips

- Use Parameters instead of literal values in SQL statements
  - INSERT INTO MYTABLE VALUES (?)
  - INSERT INTO MYTABLE VALUES (‘abcde’)
- Build SQL queries to retrieve only the data you need
- Reuse Command objects with the same CommandText
- With LOBs…
  - Use a DataReader or the Command’s ExecuteScalar method
  - Avoid using a DataAdapter
- Call an object’s Close or Dispose method when finished with it
- Make sure to handle Exceptions

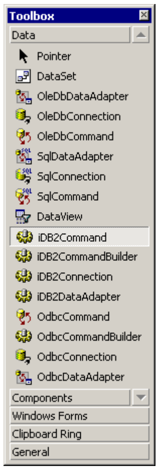
iSeries Access - Visual Studio .NET Integration


TestProgram - Microsoft Visual C# .NET [design] - Form1.cs [Design]*
File Edit View Project Build Debug Data Format Tools Window Help
Debug
CA01lib
Form1.cs [Design]*
Form1
iDB2Command1
iDB2CommandBuilder1
iDB2Connection1
iDB2DataAdapter1
Properties
Ready

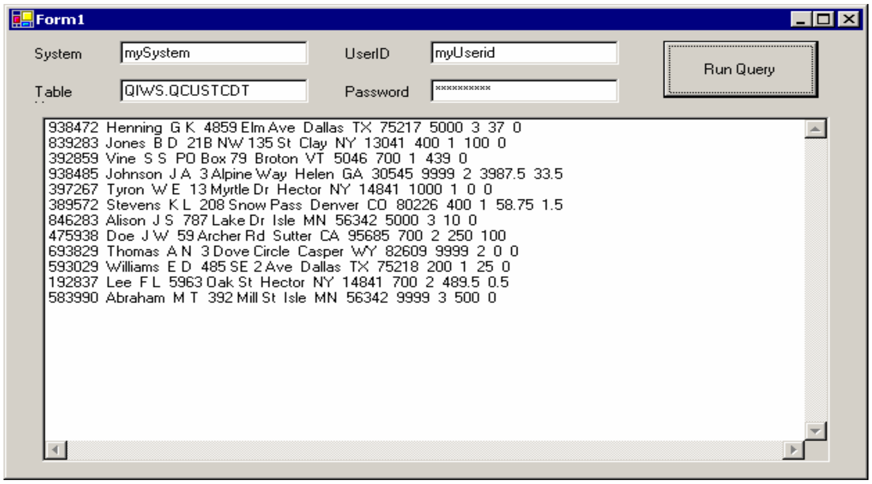
iDB2Command1 IBM.Data.DB2.iSeries.iDB2Comm

UpdatedRowSource	Both
⊟ Configurations	
⊞ (DynamicProperties)	
⊟ Data	
CommandText	SELECT * FROM TABLE
CommandType	Text
Parameters	(Collection)
⊟ Design	
(Name)	iDB2Command1
Modifiers	Private
⊟ Misc	
CommandTimeout	30

(Name)
Indicates the name used in code to identify the object.

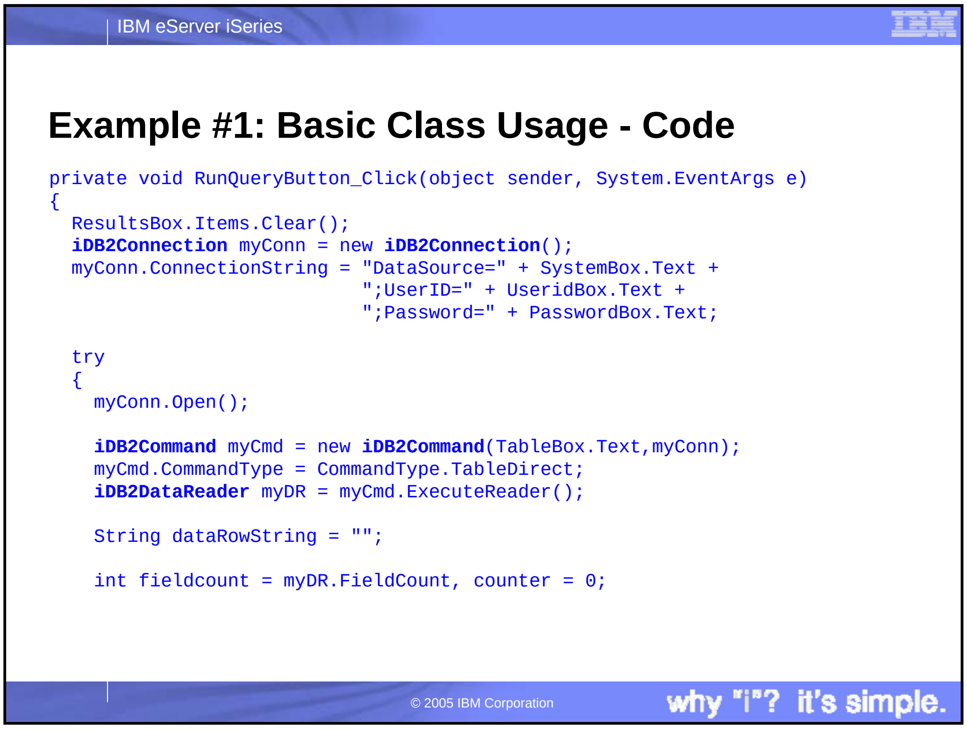


Example #1: Basic Class Usage



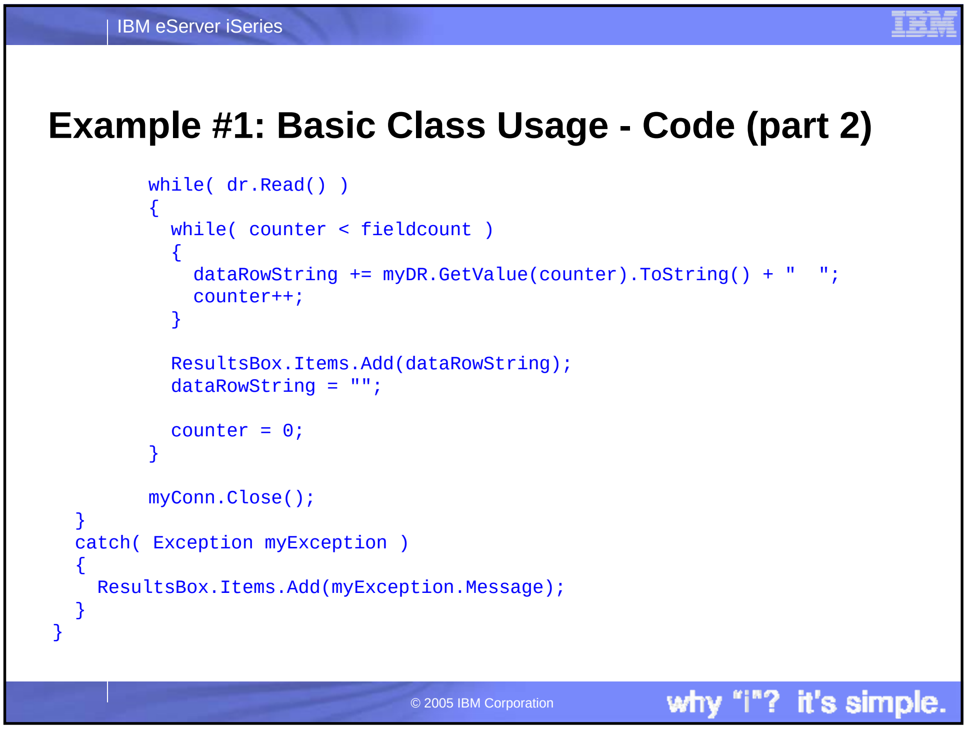
System	mySystem	UserID	myUserid
Table	QIWS.QCUSTCDT	Password	**********

```
938472  Henning  G K  4859 Elm Ave  Dallas  TX  75217  5000  3  37  0
839283  Jones  B D  21B 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
```



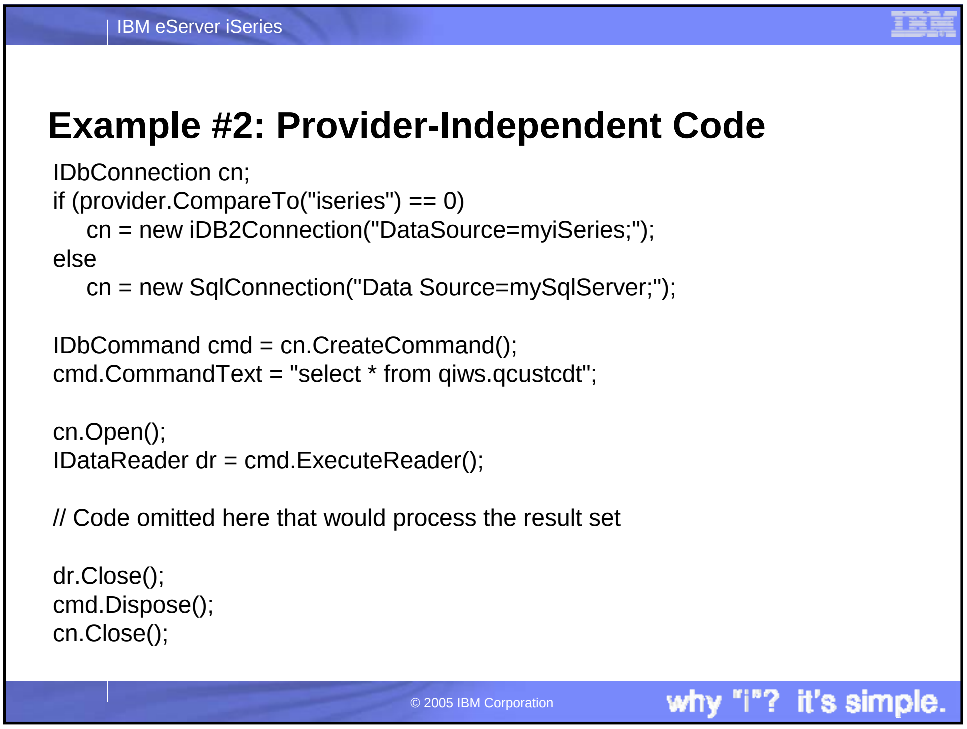
Example #1: Basic Class Usage - Code

```
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;
```



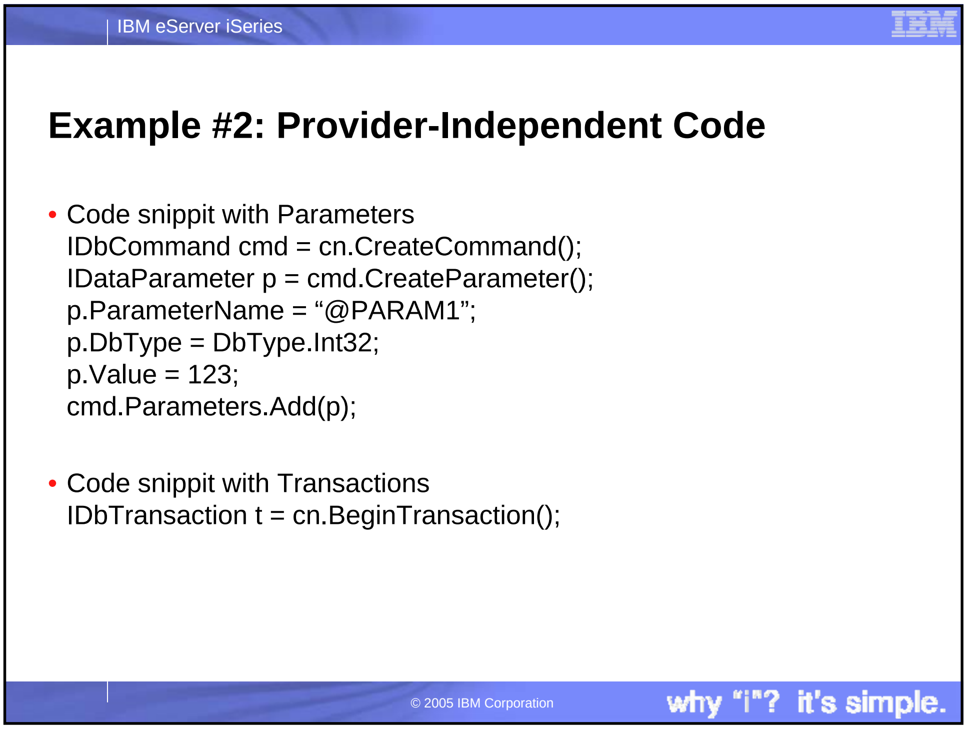
Example #1: Basic Class Usage - Code (part 2)

```
        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: Provider-Independent Code

```
IDbConnection cn;
if (provider.CompareTo("iseries") == 0)
    cn = new iDB2Connection("DataSource=myiSeries;");
else
    cn = new SqlConnection("Data Source=mySqlServer;");

IDbCommand cmd = cn.CreateCommand();
cmd.CommandText = "select * from qiws.qcustcdt";

cn.Open();
IDataReader dr = cmd.ExecuteReader();

// Code omitted here that would process the result set

dr.Close();
cmd.Dispose();
cn.Close();
```



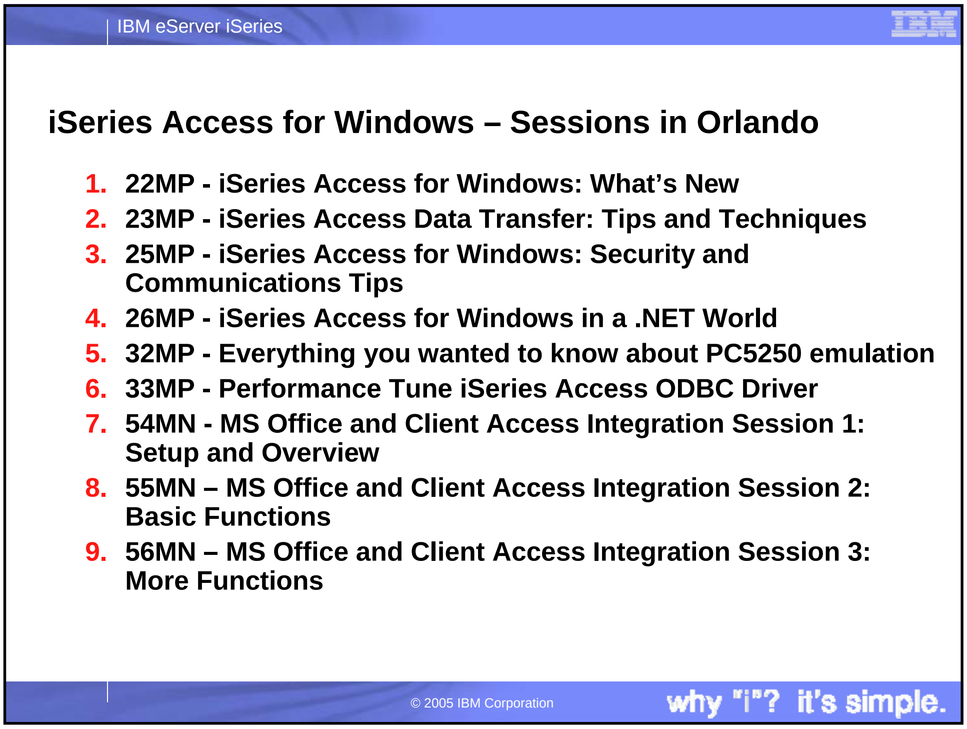
Example #2: Provider-Independent Code

- Code snippit with Parameters

```
IDbCommand cmd = cn.CreateCommand();
IDataParameter p = cmd.CreateParameter();
p.ParameterName = “@PARAM1”;
p.DbType = DbType.Int32;
p.Value = 123;
cmd.Parameters.Add(p);
```

- Code snippit with Transactions

```
IDbTransaction t = cn.BeginTransaction();
```



IBM eServer iSeries

iSeries Access for Windows – Sessions in Orlando

1. 22MP - iSeries Access for Windows: What's New
2. 23MP - iSeries Access Data Transfer: Tips and Techniques
3. 25MP - iSeries Access for Windows: Security and Communications Tips
4. 26MP - iSeries Access for Windows in a .NET World
5. 32MP - Everything you wanted to know about PC5250 emulation
6. 33MP - Performance Tune iSeries Access ODBC Driver
7. 54MN - MS Office and Client Access Integration Session 1: Setup and Overview
8. 55MN – MS Office and Client Access Integration Session 2: Basic Functions
9. 56MN – MS Office and Client Access Integration Session 3: More Functions

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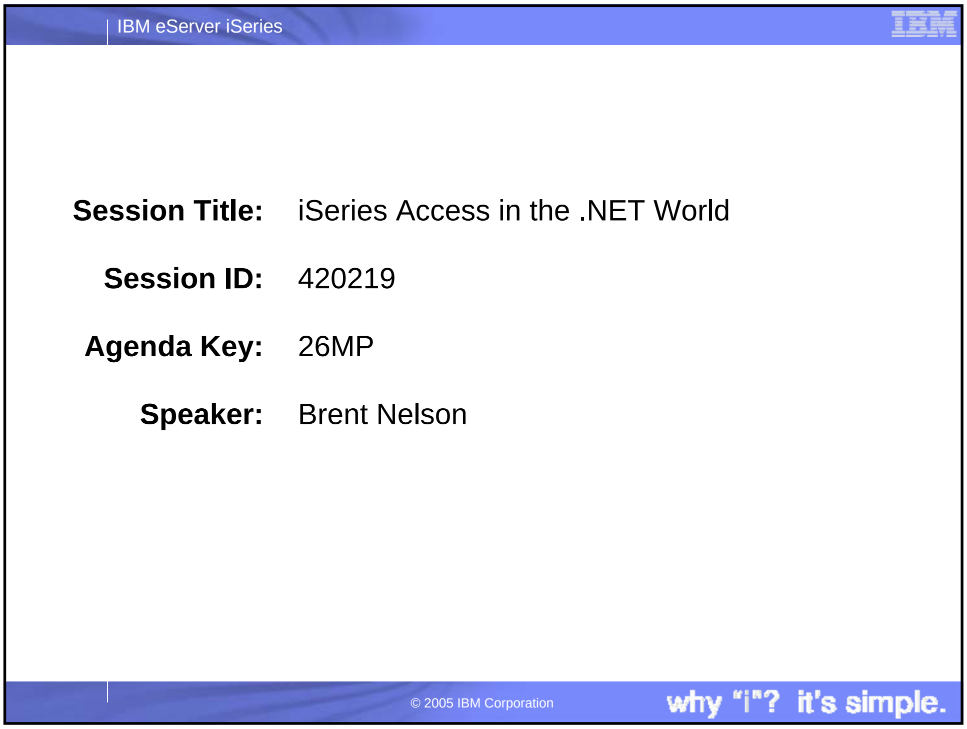
why "i"? it's simple.



IBM eServer iSeries

Session Title: iSeries Access in the .NET World

Session ID: 420219

Agenda Key: 26MP

Speaker: Brent Nelson

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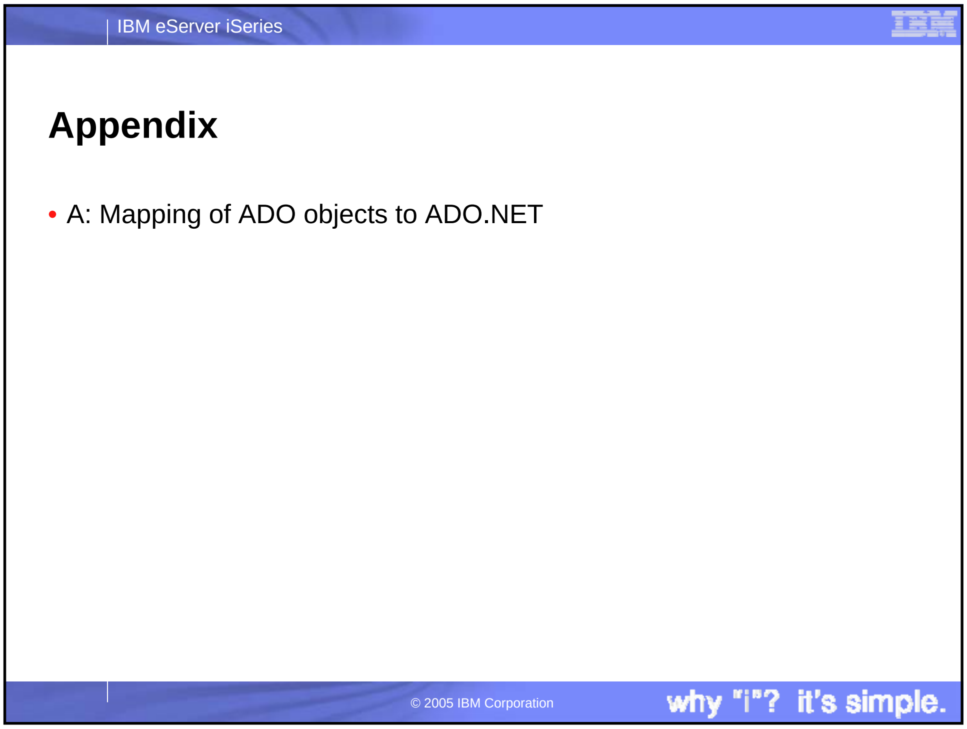
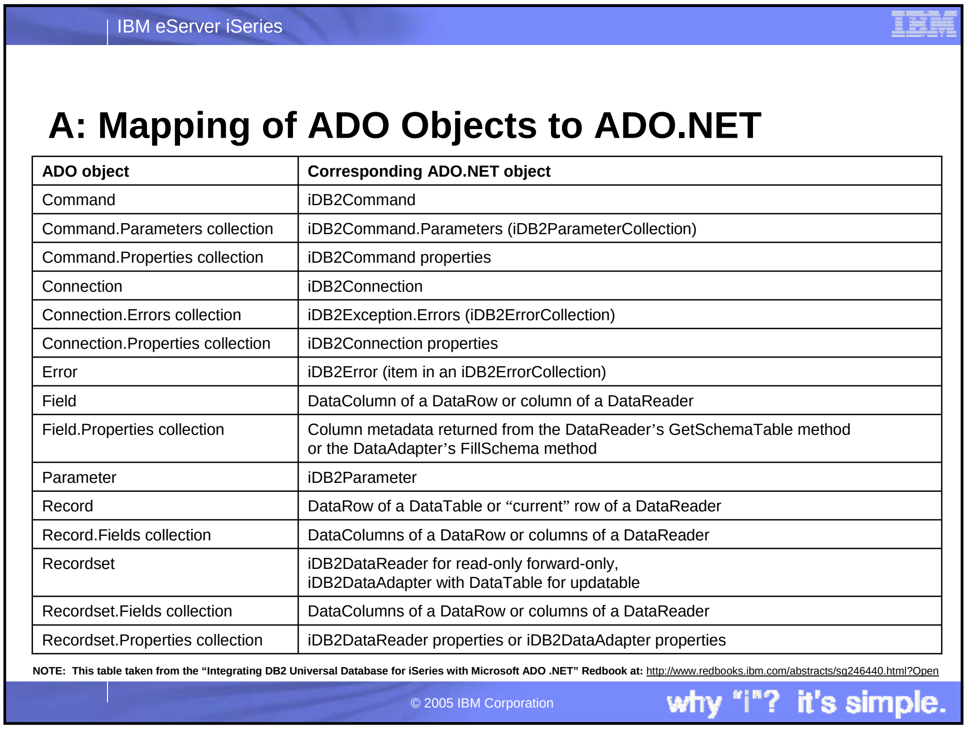


Appendix

- A: Mapping of ADO objects to ADO.NET

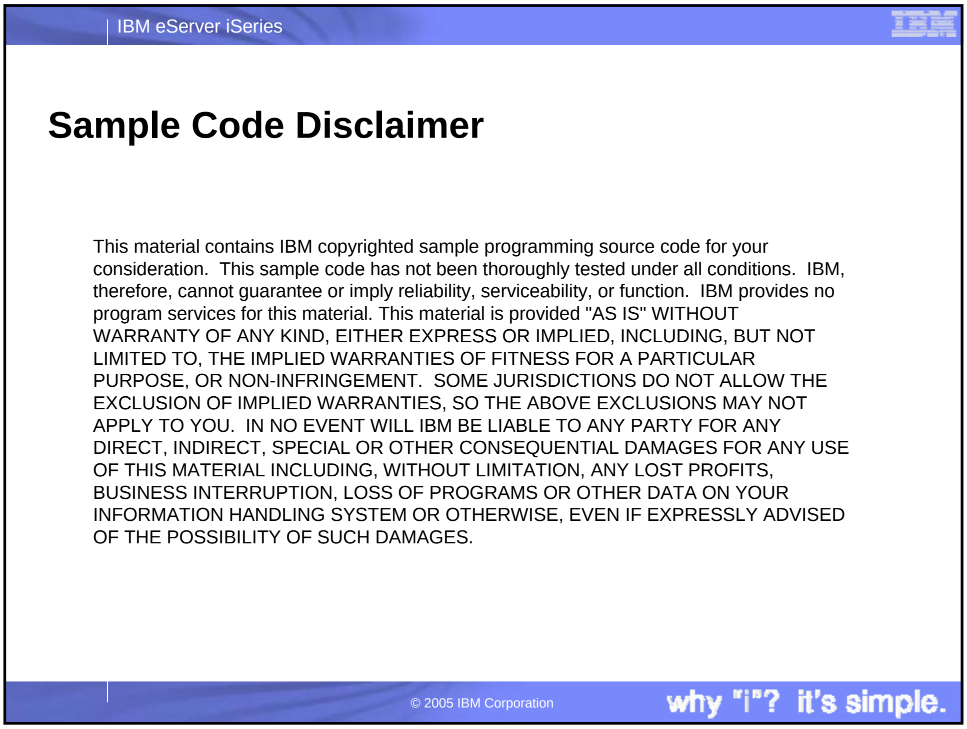
why "i"? it's simple.



A: 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/sg246440.html?Open



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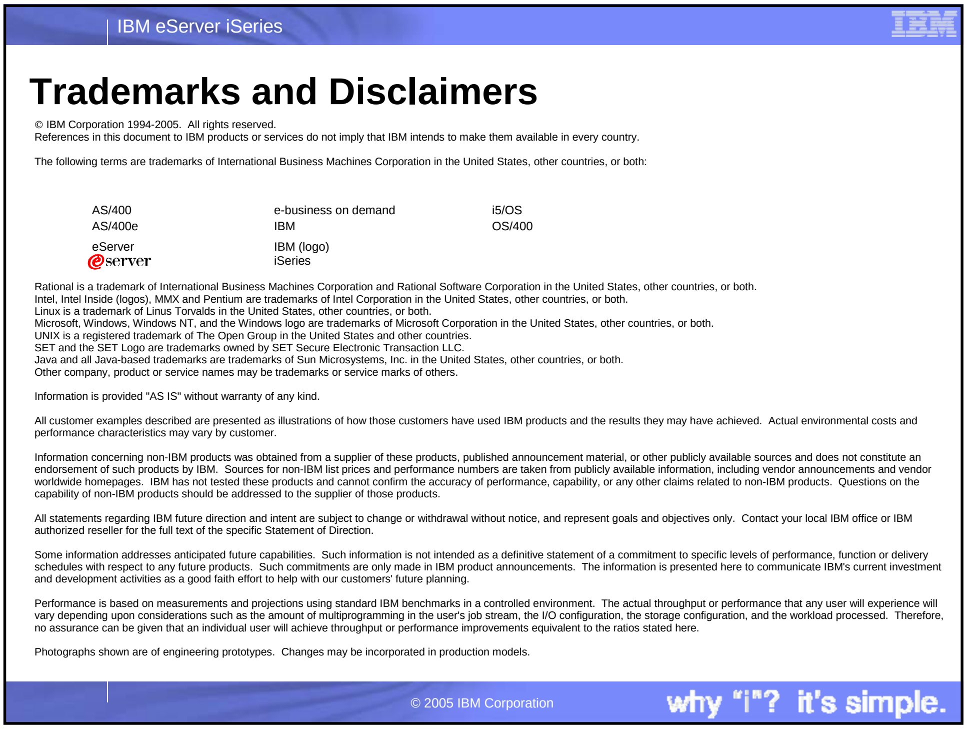

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