DB2 Development in .NET Environment

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Agenda

- Introducing to .NET
- Setup Environment
- DB2 .NET Data Provider
- Visual Studio .NET Add-ins
- Stinger Beta Program in .NET
- Demo
- Reference
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- Introducing to .NET
  
  Setup Environment
  
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What is .NET?

- .NET is a set of software technologies for connecting information, people, systems, and devices.
- It enables a high level of software integration through the use of Web services—small, discrete, building-block applications that connect to each other as well as to other, larger applications over the Internet.
.NET Platform 구조

- VB
- C++
- C#
- J#
- ...

Common Language Specification

ASP.NET
Windows Forms

Data and XML

Base Class Library

Common Language Runtime

Windows
COM+ Services

Visual Studio.NET
.NET Framework

Common Language Specification

ASP.NET

Windows Forms

Data and XML

Base Class Library

Common Language Runtime
Common Language Runtime

- .NET Framework Class Library Support
- Thread Support
- COM Marshaler
- Type Checker
- Exception Manager
- Security Engine
- Debugger
- MSIL to Native Compilers
- Code Manager
- Garbage Collection
- Class Loader
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Preparations

- OS (Windows 2000, xp pro, 2003)
  - Internet Information Service, COM+, MSMQ, WMI

- Visual Studio .NET (2003, Arch.)

- DB2 UDB v8 (AIX, HOST, Windows)

- Fixpack6
  - Visual Studio .NET Add-ins, DB2 .NET data provider

- Stinger (Fixpack7) – Opt.
DB2 UDB v8.16(Fixpack6) in .NET

- DB2 .NET Data Provider support for Microsoft .NET framework V1.1 and V1.0
- Side-by-side support for Visual Studio .NET 2002 and 2003
- Drag & drop support for WebForm and WinForm designers
- Tooling support for DB2 for z/OS and 390 V7, V6, and DB2 for Linux, UNIX, and Windows V8.1
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Logical Structure
Disconnected Mode

Dataset

System.Data

IBM.Data.DB2

Data Adapter

Table

Table

Table

Table

WinForm

WebForm

Mobile WebForm

ETC (WindowsCE, Service,...)
DB2 And Web Services

Web Container

Business Logic Container

HTTP Server

HTML/XML

firewall

Business Logic Container

http(s)
Managed Providers - 1

- Microsoft .NET Framework
  - OleDb provider, Odbc provider

- Microsoft Host Integration Server 2004
  - Invoke CICS, IMS
  - Support Mainframe transaction processing
  - Visual Studio .NET IDE integration is not available

- IBM DB2 UDB v8.1.2
  - 'DB2 .NET data provider'
  - DB2 UDB for z/OS, OS/390 V7
Managed Providers - 2

- **DataDirect Connect for .NET, Edition 2.0**
  - ‘DB2 Wire Protocol’
  - DB2 UDB for z/OS, OS/390 v7.1, AS/400 V4R5, V5R1, V5R2
  - Distributed transactions will not be supported.

- **Mono.Data.DB2Client**
  - ‘IBM DB2 CLI API’
  - Similar to the ODBC API
  - Compiles on Windows and Linux

- **Borland**
  - Data Provider (BDP) for .NET that ships with Borland® C# Builder™
  - Delphi™ 8 for the Microsoft® .NET Framework (abbreviated to "Delphi 8 for .NET")
DB2 .NET data provider connection example

- **Simple Connection String**
  - "Database=TEST;UID=db2admin; PWD=password;"

- **DB2 .NET data provider(System.Data.Db2Client)**
  - DB2Connection cn = new DB2Connection( "Database=TEST;UserID=db2admin; Password=password;Server=IS500" );
  - DB2Command cmd = new DB2Command("SELECT COUNT(*) FROM EMP01", cn);
  - int count = Convert.ToInt32(cmd.ExecuteScalar());
# DB2 UDB Connection String

<table>
<thead>
<tr>
<th>Keyword</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Database</em></td>
<td>database alias (for cataloged database)</td>
</tr>
<tr>
<td><em>User ID / UID</em></td>
<td>user ID</td>
</tr>
<tr>
<td><em>Password / PWD</em></td>
<td>password</td>
</tr>
<tr>
<td>Server</td>
<td>server name with optional port number for direct connection (&lt;server name/ip address&gt;[::&lt;port&gt;])</td>
</tr>
<tr>
<td>Connect Timeout / Timeout</td>
<td>Connection Timeout(seconds)</td>
</tr>
<tr>
<td>Pooling</td>
<td>connection pooling switch (true/false, default is true)</td>
</tr>
<tr>
<td>Min Pool Size</td>
<td>minimum pool size, default is 0</td>
</tr>
<tr>
<td>Max Pool Size</td>
<td>maximum pool size, default is no maximum</td>
</tr>
</tbody>
</table>
| Connection Reset   | True – this particular connection will be put into the connection pool when it is closed  
                     | False – this particular connection will not be put into the connection pool when it is closed |
| Connection Lifetime| the amount of time (seconds) that the connection can remain idle in the connection pool, default is 15 seconds |
| Enlist             | True – Enlistment to Distributed Transaction Coordinator (DTC) is allowed (this will only enlist if a COM+ transaction is in progress at connect time) – default  
                     | False – Enlistment to Distributed Transaction Coordinator (DTC) is not allowed  |
Unmanaged Providers

- OleDb
  - Accessing through OleDb provider
  - iSeries Access V5R2 with ServicePack 2 over
- Odbc
  - Accessing through Odbc driver
  - iSeries
Unmanaged Providers connection examples

- **OleDb provider(System.Data.OleDb)**
  - OleDbConnection cn = new OleDbConnection( "Provider=IBMDA400.1;Data Source=TEST;User ID=db2user;Password=db2user;Default Collection =SAMPLEDB");
  - TCP/IP: "Provider=DB2OLEDB;Network Transport Library=TCPIP;Network Address=XXX.XXX.XXX.XXX;Initial Catalog=MyCtlg;Package Collection =MyPkgCol;Default Schema=Schema;User ID=MyUser;Password=MyPW"
  - APPC: "Provider=DB2OLEDB;APPC Local LU Alias=MyAlias;APPC Remote LU Alias =MyRemote;Initial Catalog=MyCtlg;Package Collection=MyPkgCol;Default Schema=Schema;UserID=MyUser;Password=MyPW"

- **Odbc driver(System.Data.Odbc)**
  - OdbcConnection cn = new OdbcConnection( "DSN=TestODBC; UID=db2user; PWD=db2user;DBQ=SAMPLEDB");
public DataSet GetDataDB2( bool bPool )
{
    DataSet ds = null;
    string connString = "Database=toolsdb;UID=myuser;PWD=mypassword;";

    if ( bPool )
    {
        Console.WriteLine("Connection Pooling ON ...");
        connString = connString + "pooling=true;Min pool size=100";
    }
    else
    {
        Console.WriteLine("Connection Pooling OFF ...");
        connString = connString + "pooling=false";
    }

    try
    {
        ds = new DataSet();
        DB2Connection Conn = new DB2Connection(connString);
        Conn.Open();

        DB2DataAdapter adapter = new DB2DataAdapter(m_connText, Conn);
        Console.WriteLine("SQL to DB2 : " + m_connText);
        adapter.Fill(ds, "Table1");

        Conn.Close();
    }
    catch (Exception e)
    {
        throw e;
    }

    return ds;
}
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지원되는 DB2 서버 및 시스템 요구사항

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<tr>
<th>지원되는 DB2 서버</th>
<th>클라이언트 시스템 요구사항</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Windows용 DB2 Universal Database, 버전 8.1</td>
</tr>
<tr>
<td>z/OS 또는 OS/390용 DB2 Universal Database, 버전 7 및 8</td>
<td>Microsoft Visual Studio .NET 2002, 2003</td>
</tr>
<tr>
<td></td>
<td>Windows용 DB2 Universal Database, 버전 8.1</td>
</tr>
</tbody>
</table>
Unmanaged Providers

- IBM Explorer
- IBM Projects (DB2 Database Project)
- DB2 SQL Editor
- DB2 .NET Data Provider tools
- Dynamic Help for DB2 Add-Ins
- DB2 Tools menu Add-in
IBM Explorer

- Visual Studio .NET Server Explorer와 동일한 형태로 DB2관련 objects만 표시
- database schema를 불러와서 database connections 생성 허용
- Editor에 드래그앤드롭으로 소스코드를 살펴볼 수 있다.
- Tables의 내용 불러볼 수 있다.
IBM Explorer
Data Connections

- 여러 개의 database 연결을 관리할 수 있다.
- Database의 설정을 변경하고 관리할 수 있다.
- Database의 schema 설정을 변경하거나 보여줄 수 있는 범위를 지정할 수 있다.
- 여러 Application에서 제공되는 designer에 드래그앤드롭으로 database component를 생성하고 코드를 자동으로 생성해 준다.
New Project Type

- The DB2 Database Project
  - Visual Studio .NET named DB2 Database Project folder
    - 다중 설정 지원
    - Procedures, Functions, and generic scripts folders
    - Scripts build order dialogue
    - Visual Source Safe를 통한 Source control 관리, 프로젝트 협업 가능
New Project Type

- **SQL Procedures script folder**
  - DB2 SQL SP에 관련된 DDL 작성
  - DB2 SQL Procedure wizard를 통해 손쉽게 procedure 작성 가능

- **SQL Functions script folder**
  - DB2 SQL UDF에 관련된 DDL 작성
  - DB2 SQL User Defined Function wizard로 손쉽게 table, scalar functions script 작성 가능
New Project Type

- 일반적인 script folder
  - triggers, tables, views 등의 DB2 DDL/DML 포함
SQL Editor

- Visual Studio .NET editor와 통합된 환경으로 동일 기능 지원
- The DB2 SQL Editor에서 지원되는 기능
  - DB2 SQL syntax highlighting (colorized SQL)
  - DB2 SQL statement completion via Visual Studio .NET IntelliSense
    - Object names
    - Column names
    - Parameters
Tools Add-In

- Toolbar나 도구 메뉴에 DB2 Centers 포함
  - Development Center
  - Control Center
  - Replication Center
  - Command Center
  - Task Center
  - Health Center
  - Journal
DB2 Data Provider Tools

- IBM Explorer에서 드래그앤드롭으로 추가
  - DB2 Data Adapter Wizard 설정
    - DB2 connection과 command text 설정
  - 연결문자열을 위한 Custom editor
  - 실행명령문을 위한 Custom editor
Help

IBM Help – DB2 Database Project and DB2 Data Connections

- Visual Studio .NET help 기능에 포함
- 검색, 목차 등 다양한 도움 제공
- 동적 도움말 지원
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Stinger – the next release of DB2 UDB

- Stinger is the next release of DB2 UDB, and it's chock full of new features that cut the time-to-value for your on demand solutions.

- It will feature enhancements for application development, vast improvements in lights-out operation and manageability, high availability, security, and a whole lot more.

- the nickname for the preview of the next release of DB2 UDB for Linux, UNIX®, and Windows®. -> Fixpack7(v8.1.7)
New Features in VS.NET

- **DB2 Class Library Project**
  - Business Logic Layer
  - DB2 Class Template (reference assembly, using DB2 .NET provider)

- **CLR Procedure Wizard**
  - .NET-based stored procedure
CLR Stored Procedure

- Build DB2 server side logic in any .NET programming language (e.g., C#, Visual Basic .NET)
- DB2 server-side logic executes as managed code
- Server side logic can include SQL, OS, .NET and other calls
- Use DB2 add-ins for Visual Studio .NET to build, test, debug, and deploy
using System;
using IBM.Data.DB2;

namespace DB2ClassLibrary1
{
    /// <summary>
    /// Summary description for DB2Class.
    /// This class and method can be used as the basis for a DB2 CLR procedure.
    /// For more information on creating and deploying DB2 CLR procedures visit:
    /// http://www.ibm.com/software/data/developer
    /// </summary>
    public class DB2Class1
    {
        public static void DB2Procedure1(
            string inParm1,
            ref string inoutParm2,
            out string outParm3)
        {
            // Create new command object from connection context
            DB2Command myCommand = DB2Context.CreateCommand();
            // TODO: Insert your code here
        }
    }
Supported Platform

- AIX, LINUX, WINDOWS

- DB2 "Stinger" Beta: AIX server and documentation
- DB2 Information Center (online documentation) for Windows (32-bit)
- DB2 Enterprise Server for Windows (32-bit)
- DB2 Express Server for Windows (32-bit)
- DB2 Spatial Extender for Windows (32-bit)
- DB2 Runtime Clients and Merge Modules for Windows (32-bit) in a variety of languages
- DB2 Connect Personal Edition for Windows (32-bit)
- DB2 Embedded Application Server for Windows (32-bit)
- DB2 Mobility on Demand for Windows (32-bit): includes clients for embedded devices
- DB2 Administration Client Windows (32-bit)
- DB2 Application Development Client for Windows (32-bit)
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DEMO Scenario

- DB2DataAccess Class Library – DB2 Server Access Agent
- XML Web Service – DB2 Data Web Service Provider
- ASP.NET Web Application – Web Service Consumer
- Windows Application – Web Service Client 1
- Mobile Web Application – Web Service Client 2
DEMO Scenario Diagram

- **DB2 Server**
- **DB2 Server Access Agent**
- **DB2 Data Web Service Provider**
- **Windows Web Service Client 1**
- **Mobile Web Service Client 2**
- **Web Service Consumer**
- **Web Browser Client**
Demo
Demo

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**Table: Demo**

<table>
<thead>
<tr>
<th>EMPNO</th>
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<tbody>
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<td>1985-01-01 02:03:00</td>
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<table>
<thead>
<tr>
<th>JOB</th>
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<th>SALARY</th>
<th>BONUS</th>
<th>COMM</th>
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<tr>
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<td>1933-08-24 12:00:00</td>
<td>52750.00</td>
<td>1000.00</td>
<td>4220.00</td>
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</tbody>
</table>
### Demo

#### MainForm - [LOB 처리 예제]

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<td>3475</td>
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<td>000700</td>
<td>EVA</td>
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<td>1980-03-3</td>
<td>MANAGER</td>
<td>16</td>
<td>F</td>
</tr>
</tbody>
</table>

#### Shania Twain

- Man! I Feel Like A Woman!
- Up!
- Honey, I'm Home
- She's Not Just A Pretty Face
- Forever And For Always
- Ka-Ching!
- When You Kiss Me
- Don't Be Stupid (you know I love you)
- That Don't Impress Me Much

인덱스가 배열 범위를 벗어났습니다.
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# DB2 .NET Data Provider Samples

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<th>Visual Basic Sample</th>
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</thead>
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<td>DbAuth.cs</td>
<td>DbAuth.vb</td>
</tr>
<tr>
<td>How to use a DB2DataAdapter with the DB2 .NET Data Provider</td>
<td>DbDatAdp.cs</td>
<td>DbDatAdp.vb</td>
</tr>
<tr>
<td>How to set up and use DataTable and DataColumn mappings</td>
<td>DbDatMap.cs</td>
<td>DbDatMap.vb</td>
</tr>
<tr>
<td>How to add existing constraints to a DataSet</td>
<td>DbDsetCn.cs</td>
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</tr>
<tr>
<td>How to use DB2DataAdapter events: RowUpdating and RowUpdated</td>
<td>DbEvent.cs</td>
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</tr>
<tr>
<td>How to use a database with the DB2 .Net Data Provider</td>
<td>DbUse.cs</td>
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</tr>
<tr>
<td>How to obtain a single value from a database</td>
<td>DbValue.cs</td>
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<tr>
<td>How to use the LOB data type with the DB2 .Net Data Provider</td>
<td>DtLob.cs</td>
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</tr>
<tr>
<td>Call different types of stored procedures from SpServer.java</td>
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<tr>
<td>How to call a stored procedure that has a return value</td>
<td>SpReturn.cs</td>
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<tr>
<td>How to create, use and drop table constraints</td>
<td>TbConstr.cs</td>
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</tr>
<tr>
<td>How to get information about a table</td>
<td>TblInfo.cs</td>
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<tr>
<td>How to grant, display and revoke privileges on a table</td>
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<tr>
<td>How to use triggers on a table with the DB2 .Net Data Provider</td>
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<td>TbTrig.vb</td>
</tr>
<tr>
<td>How to manipulate table data with the DB2 .Net Data Provider</td>
<td>TbUse.cs</td>
<td>TbUse.vb</td>
</tr>
</tbody>
</table>

Reference – Stinger Beta Program

- Stinger Beta Download

- Stinger Newsgroup
  - news://news.software.ibm.com/ibm.software.db2.udb.beta
Reference – Examples

- Creating and Linking LOBs in a Data Application for Microsoft .NET using DB2 Universal Database

- IBM DB2 Development Add-Ins for Visual Studio .NET

- DB2 Database Project for Visual Studio .NET
Reference – Examples

- **DB2 Development Add-In Technical Preview**

- **Developing DB2 CLR Procedures in VS.NET**

- **Developing DB2 schema using IBM Explorer in VS.NET**

- **Developing Re-usable Data Adapters in VS.NET**

- **Developing DB2 UDB Database Projects in VS.NET**
Reference – .NET

- DB2 and .NET Framework
- Latest DB2 FixPaks and clients(v8.1.5)
Reference – C# Sample Source

- **C# Sample**
Q & A