Reminder

12/02 Mid-Term exam

Lecture 11

ODBC

Developing Desktop Applications
using VC$^{\#}$

ODBC

Database Connectivity

- How applications (written in C, C++, etc.) communicate with database to obtain / save data?
- In late 1990s, client-server application architecture (two-tier application architecture) appeared.
  - Each database vendor (Oracle, Sybase, IBM, …) provided API (application programming interfaces) to allow programs make queries to database.
  - Different APIs become a burden for applications developers.
- Solution: ODBC

Introduction to ODBC

- ODBC: Open DataBase Connectivity
  - Common API independent of *programming languages*, *database systems*, and *operating systems.*
  - Supported by most major DBMS (database management system) vendors.
- JDBC: Similar technology for Java environment

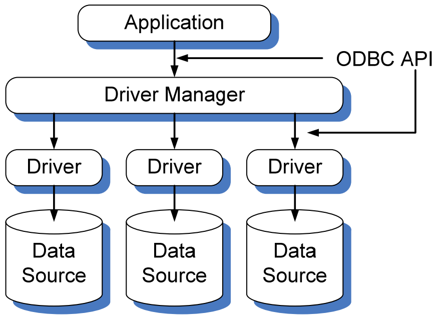
http://en.wikipedia.org/wiki/Open_Database_Connectivity

ODBC API

- APIs to
  - connect from an application (Web, Windows, other) to DBMS,
  - execute SQL statements (SQL-92 standard)
  - retrieve results
- Define standards for
  - Error codes
  - Make connection and log on to DBMS
  - Representation of data types
  - Methods for data type conversions
- Three levels of functionalities (core, level-1, level-2) to deal with simple and sophisticated interfaces.

ODBC Architecture

ODBC Architecture (1/2)



ODBC Architecture (2/2)

1. Application (Windows, Web)
   - Performs processing
   - Calls ODBC functions to submit SQL statements, retrieve results
2. Driver manager
   - Loads and unloads application-requested drivers
   - Processes some ODBC function calls (supervisory)
3. ODBC driver
   - Processes most ODBC function calls
   - Submits SQL requests to specific data source
     - Modifies application request to conform to data source SQL syntax
   - Returns results to application
4. Data source

Source: MIT 1.264 Lecture Notes

1. Application

- Request connection or session with data source
- Send SQL requests to data source
- Allocate storage areas and define formats for results of SQL requests
- Request results
- Process data and errors
- If application requires transaction processing, requests commit or rollback to accept or reject results of transaction
- Upon completion, terminate connection to data source

Source: MIT 1.264 Lecture Notes

2. Driver Manager

- Driver manager is dynamic link library (DLL) provided by Microsoft
- Loads and unloads ODBC drivers
- When application requests list of installed data source names, Driver Manager retrieves information from registry and returns list of data source names.
- Processes initialization calls, parameter validation and sequence validation for ODBC function calls

Source: MIT 1.264 Lecture Notes

3. Driver

- Driver is DLL (library) that implements ODBC function calls, written by Microsoft or database vendor
- Data conversion to ODBC standards
- Error code conversion to ODBC standards
- Transaction handling
- Access non-DBMS files such as Excel, text
  - Limited SQL support: SELECT, INSERT, CREATE, DROP only
- Wide range of functionality in different drivers
  - Check conformance levels: ODBC and SQL (not the same!)
  - ODBC API provides functions to determine capabilities

Source: MIT 1.264 Lecture Notes

ODBC Demonstration in Windows

ODBC Setup (1/3)

- MS-Access and MS-Excel can both connect to databases using ODBC
  - First, we need to setup DSN (data source name)
    - Be sure you have appropriate ODBC driver installed
  - On Windows XP/Vista, use
    - Control Panel → Administrative Tools → Data Sources
    - Alternatively, Start → run → odbcad32
  - We will use "user DSN" for our demonstration
    - User DSN: the DSN is visible only to the current user
    - System DSN: the DSN is visible to all users on the machine

ODBC Setup (2/3)

- Click on "add" → select appropriate ODBC driver (e.g. MySQL ODBC driver) → Finish
- Fill in the following info
  - Data source name: Example
  - Server: the IP or hostname of DBMS server
  - User: appropriate username
  - Password: appropriate password
  - Database: the database name
- The ODBC setup is complete

ODBC Setup (3/3)

- In applications (MS-Access)
  - Open
  - Files or type: ODBC Database
  - Switch to "Machine Data Source" tab
  - Choose the desired DSN
  - MS-Access will then prompt for "link tables"
    - Select all → OK
  - Done. Now we have Access connect to MS-SQL database server.

Excel and ODBC

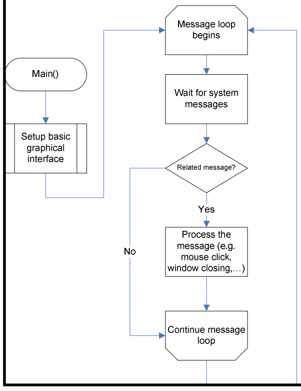
- We can also setup ODBC connections in Excel to plot data in database.
  - Excel 2007: Data→ From Other Sources → From Data Connection Wizard → ODBC DSN → ODBC data sources →
  - Excel 2003: Data → Import External Data →Import data → +Connect to New Data Source → ODBC DSN → Example → Table to be imported → Finish → Choose location to store the imported data

Developing Desktop Applications using VC$^{\#}$

Introduction to Visual $C^{\#}$

- $C^{\#}$ (pronounced as C-sharp) is a relatively new computer language designed and proposed by Microsoft to ISO to be a standard computer language.
  - A complete object-oriented computer language derived from both C^{++} and Java.
  - Used in the ".NET environment" (introduced in later lectures)
- Microsoft Visual Studio is an integrated development environment (IDE), and is great to build GUI applications
  - It is cumbersome and tedious to do GUI using programming languages like C, C++ without some framework, …
    - Need a message loop waiting for events to happen
    - Need event-handlers to 'handle' occurring events

Traditional GUI programming



GUI systems have many "messages" flowing in the system. These messages can be any of the following:

•Mouse click
•Mouse movement
•Key pressed
•Application closing
•Window maximizing
.
.
.

Therefore, traditionally GUI programmers need to setup a message loop constantly looking for interesting events.

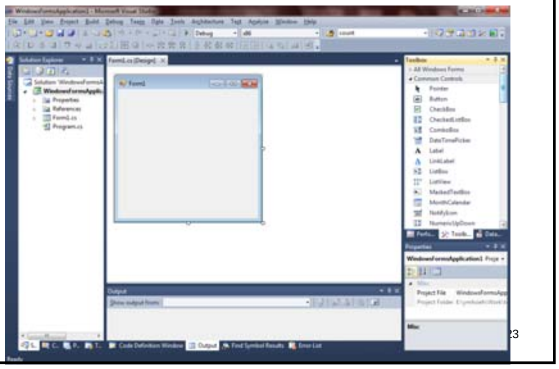
GUI Programming with Visual Studio Programming Environment

- Visual Studio hides the complexity of traditionally GUI programming by giving programmers a GUI builder, and generates the following code segments automatically
  - Message loops (invisible to programmers)
  - Main() (invisible to programmers)
  - Prototypes (heads and tails) of event handlers
    - Programmers need to fill in the blank for event handlers
- Therefore, Visual Studio can be used as a tool to rapidly create prototypes of GUI programs!

MS-Visual C# IDE

- Visual Studio 2010 Ultimate is to be used in the course
  - It is licensed under MSDN-AA purchased at department of construction engineering, and is only eligible for students who take courses in our department to use and keep.
- Difference between the "express", "professional", "premium", "ultimate" editions can be found at:
  - http://www.microsoft.com/visualstudio/en-us/products

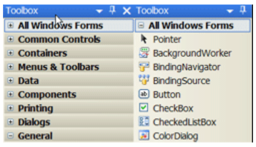
Microsoft Visual C# Express IDE



Coding Concepts

- Forms
  - An application window is considered as a form.
- Controls
  - An object to let user "control" the behavior of the application
  - Nearly everything you see in a window is a control.
- Forms and controls are all objects, and objects have
  - Properties: such as font, size, status, content, …
  - Methods: such as closing, maximizing, …
  - Events: onMouseClick, onOpening, onClosing, …
- In programs
  - someObject.property = [new value]
  - someObject.method(arg1, arg2, …)

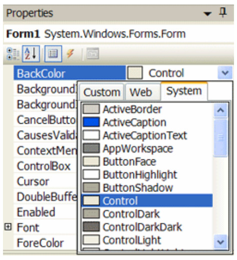
Toolbox



The Toolbox contains drag-and-drop controls and components to create your Windows applications. Controls are grouped into logically-named categories like Menus and Toolbars, Data, Common Dialogs and more. Adding controls to Windows Forms is as easy as clicking and dragging the control onto the form!

http://msdn.microsoft.com/vstudio/express/visualcsharp/features/visuallydesign/

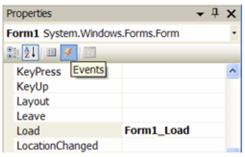
Property Window



The Property Window enables you to view and change the properties and events of components in your application. The Property Window is context-sensitive and will pre-populate menu options depending on the values you are changing. For example, changing the background color of a Windows form displays a color picker to easily change the selected value.

http://msdn.microsoft.com/vstudio/express/visualcsharp/features/visuallydesign/

Property Window

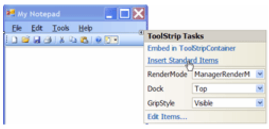


Load Form1_Load

You can also use the Properties Window to add or update a form and to control events by clicking on the “lightning” symbol at the top of the Property Window. The following diagram shows a list of events assigned to the Windows form. New events can be added by double-clicking on the name of the event.

http://msdn.microsoft.com/vstudio/express/visualcsharp/features/visuallydesign/

Toolstrip control



RenderMode ManagerRenderM

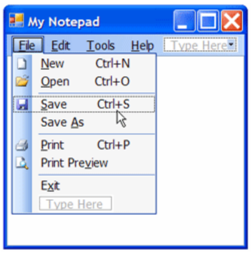
Dock Top

GripStyle Visible

Applications like Microsoft Office also take advantage of Toolstrip controls, which provide strips of buttons that can be docked to the edges of the window. With the ToolStrip control, you can build toolbars containing your choice of buttons, text boxes, combo boxes, and more. You can easily add standard menu items, such as the File Open and File Save icons, in the Toolstrip by selecting Insert Standard Items from the Toolstrip Tasks.

http://msdn.microsoft.com/vstudio/express/visualcsharp/features/visuallydesign/

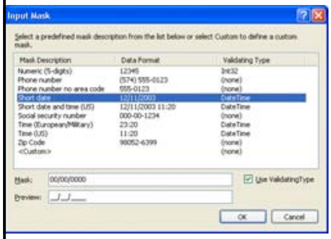
Menu control



The Menu and ContextMenuStrip controls enable you to easily add standard Microsoft Windows menus. As with the Toolstrip, select Insert Standard Items from the Menu Tasks to add the standard Windows menu options and icons.

http://msdn.microsoft.com/vstudio/express/visualcsharp/features/visuallydesign/

MaskedTextBox control



Select a predefined mask description from the list below or select Custom to define a custom mask.

Mask Description	Data Format	Validating Type
Numeric (5-digits)	12345	Int32
Phone number	(574) 555-0123	(none)
Phone number no area code	555-0123	(none)
Short date	12/11/2003	DateTime
Short date and time (US)	12/11/2003 11:20	DateTime
Social security number	000-00-1234	(none)
Time (European/Military)	23:20	DateTime
Time (US)	11:20	DateTime
Zip Code	98052-6399	(none)
<Custom>		(none)

Mask: 00/00/0000 ☑ Use ValidatingType

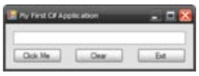
Preview: __/__/____

The MaskedTextBox control assists in validating user input, including date of birth, social security numbers, email addresses, and even your own custom data. The following diagram shows setting an input mask for a text box by selecting the data format and data type from a built-in list. You can choose to enforce the data type by checking the Use Validating Type check box.

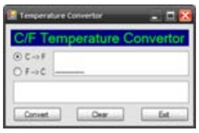
http://msdn.microsoft.com/vstudio/express/visualcsharp/features/visuallydesign/

Programming Demonstration

1. Hello World
   - Controls: Textbox, button
   - Properties: Text
   - Methods: Application.Exit();



2. Temperature Conversion
   - Controls: Label, RadioButton, Textbox, Button
   - Properties: Text, Checked
   - Methods:
     float.Parse()
     Application.Exit()
     float.toString();



Assignment #6

- In this assignment, we will now build our long-waited 2-tier application (client-server architecture) using VC$^{\#}$.
- You're required to develop the application with the following functions
  - Add/change/remove a book information in the database.
  - Add/change/remove a user in the trading system.
  - Add/change/remove a sale/buy advertisement in the system.
  - Add/change/remove a trading in the system.
  - Search for a used product in the trading system.
    - By at least four different methods (e.g. by user, by price, by program, …)
- The application should also have two extra functions not in the previous list, and in the requirements you designed.

Note

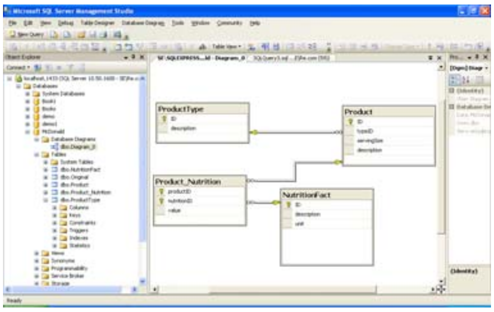
- In order to enable me testing your developed application, you need to make sure that your SQL server is accessible through public IP addresses (140.118.x.x)
- That also means when you setup your data source before you start developing application, you need to use real IP of your host machine and certain port so that your application can work across Internet. (to be a real two-tier application)
- Please be explorative regarding properties of controls that we have covered in the class.
- Please be very curious regarding controls that we did not mention in the class.

Data-aware Application

Data-aware controls

- There are controls (user-interface components) that have its content determined by database, and they are called data-aware controls.
- The following functions of a desktop applications is going to be built based on last week's database.
  - CRUD on product categories.
  - Show products of a specified category
  - Search for a product
  - *Show detailed nutrition fact for a given product*
  - *Add a new product*
  - *Delete a product*
  - *Add menu items*

Build relationships between tables



Make sure relationships between tables are built before proceed.