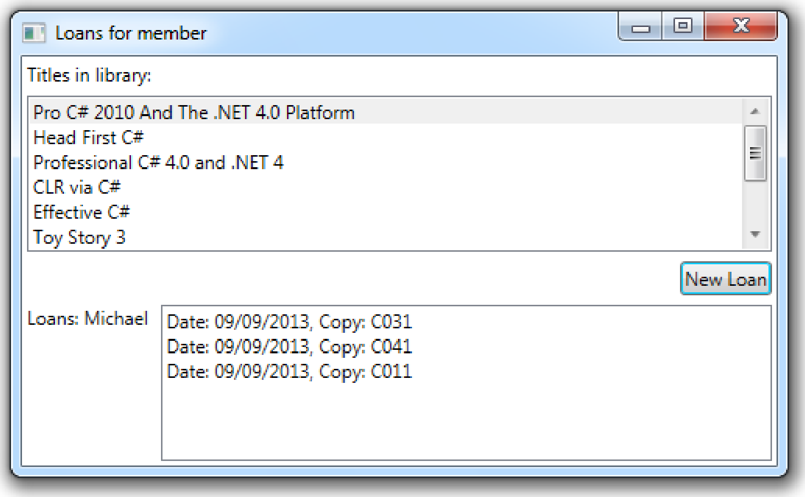
LAB 8: Library system application

Getting started

In this lab you will finally get to create the graphical user interface for an application. You will use the library system model from the previous lab, and build a window using Windows Presentation Foundation (WPF) which allows you to view all the titles in the library catalog and create loans for a specific library member:


Loans for member

Titles in library:

Pro C# 2010 And The .NET 4.0 Platform
Head First C#
Professional C# 4.0 and .NET 4
CLR via C#
Effective C#
Toy Story 3

New Loan

Loans: Michael

Date: 09/09/2013, Copy: C031
Date: 09/09/2013, Copy: C041
Date: 09/09/2013, Copy: C011

This is not really a complete library application, but it is enough to practice the techniques for building a GUI. This interface might represent a window within a full library application which meets the following functional requirements:

Functional requirements:

1. When the window opens a list of all titles in the library should be shown for selection
2. When the window opens the name of the current user should be shown
3. The system should allow the user to select a title, and should create a new loan for that title for the current user if there is an available copy
4. An error message should be shown when the user attempts to create a loan if no copies of the selected title are available

The full system would have a larger set of functional requirements including these..You will develop the application to meet these requirements in tasks 2 to 5, once you have constructed the basic window layout in task 1. In task 6 you will test the application, and in task 7 you will examine a web-based version of the application which uses the same model classes.

Task 1: Window layout with XAML

Open the project:

1. Start a VM which has Visual Studio 2012 installed, and start Visual Studio.

2. Download the file *lab8.zip* from GCULearn, and extract the contents.

3. In Visual Studio, open the *LibraryGUI* solution inside the *LibraryGUI* folder. This solution contains two projects:

   - **Library** – the model classes from the previous lab
   - **LibraryGUI** – a WPF project, which contains one window, defined in *MainWindow.xaml*

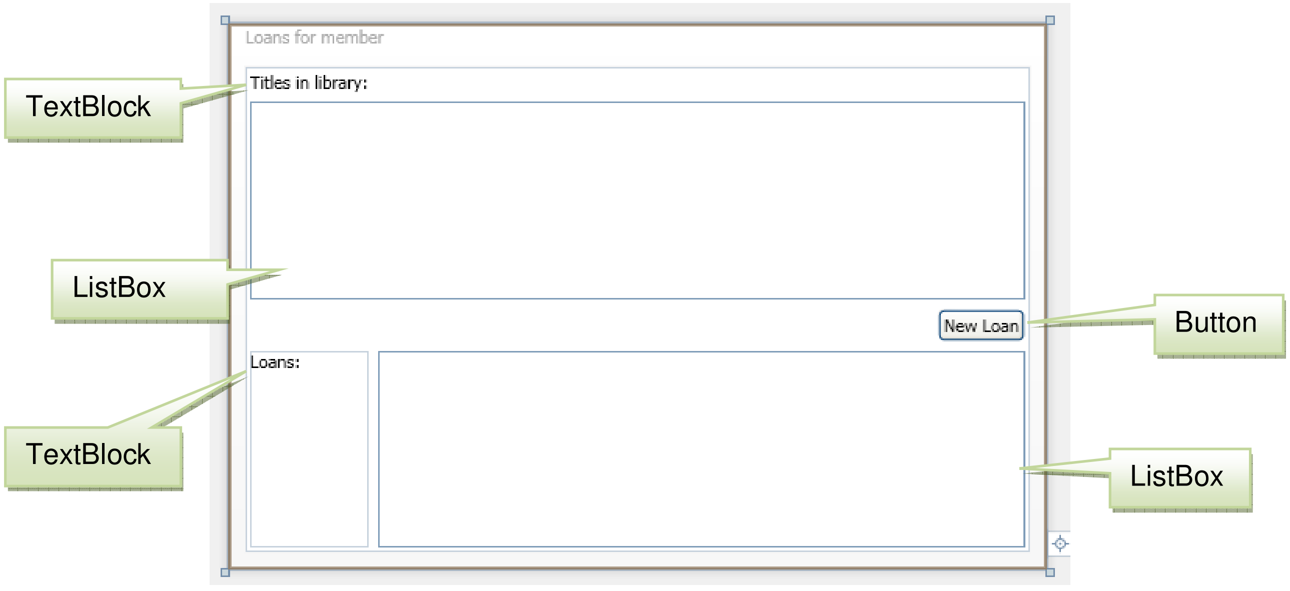
   The **Library** project has been added as a reference in the **LibraryGUI** project so that the WPF application can use the model classes. The code-behind file, *MainWindow.xaml.cs* contains the line:

   ```
   using Library;
   ```

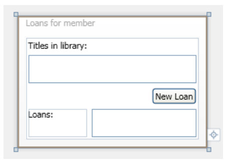
   The XAML code in *MainWindow.xaml* contains an empty **<Grid>** element.

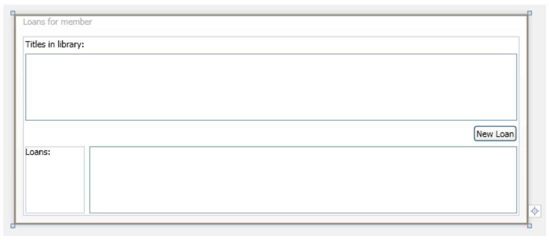
Define the layout:

4. **Write XAML code** inside the **<Grid>** element to define a window layout which looks similar to the figure below, with the controls indicated. You should plan out how many rows and columns your grid will have, and how the controls will fit into the grid. Use the Design view to view the layout which your XAML code produces – don't use it to create the layout.



Your layout should be **fluid** – it should cope gracefully with changes to the size of the window. Remember that a user may be able to resize your window when the application is running.





You can build and run the solution to check what it looks like when running.

Task 2: Displaying titles

You will now modify the window so that a list of all the titles in the library is displayed in the upper list box when the application starts.

XAML:

1. In *MainWindow.xaml*, give the upper list box the name *lstTitles* by defining an attribute as follows:

   ```
   <ListBox x:Name="lstTitles"
   ```

2. The list box should display the *TitleName* property of each of the titles in the library. Define the following attribute for the list box:

   ```
   DisplayMemberPath="TitleName"
   ```

Code-behind:

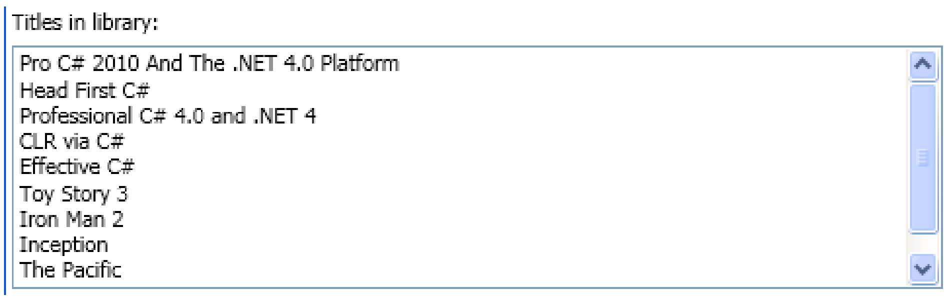
3. Open *MainWindow.xaml.cs* and look at the code. There is a method *GetAllTitles* which creates some *Title* and *Copy* objects, and associates copies with titles. There are ten titles and two copies of each title. The method returns a list of the *Title* objects.

4. Add code in the constructor of *MainWindow* which does the following:

   - Declares a variable *titles* of type *List<Title>* and initialises *titles* by calling *GetAllTitles*.
   - Sets the *ItemsSource* property of the upper list box to *titles*.

Test:

5. Build and run the application. Check that ten title names appear in the list box (there will probably be a scroll bar shown to allow all titles to be viewed).



```
Titles in library:
Pro C# 2010 And The .NET 4.0 Platform
Head First C#
Professional C# 4.0 and .NET 4
CLR via C#
Effective C#
Toy Story 3
Iron Man 2
Inception
The Pacific
```

Task 3: Binding window to a Member object

The purpose of the window is to manage loans for a particular member. You will now bind the window to a specific *Member* object. This Member object will become the window's **data context**.

XAML:

1. In *MainWindow.xaml*, add a new *TextBlock* element beside the block which displays "Loans:". You can enclose the two blocks in another container so that they appear neatly side-by-side.

2. The new text block should display the *Name* property of the window's *Member* object. Bind the *Text* property of the text block to the *Name* property of the window data context using the following attribute:

```
Text="{Binding Path=Name, Mode=TwoWay}"
```

Code-behind:

3. In *MainWindow.xaml.cs* there is a method *GetMember* which creates and returns a *Member* object.

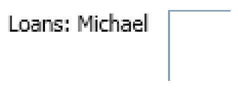
4. Add an instance variable called *member*, of type *Member*, to *MainWindow*.

5. Add code in the constructor of *MainWindow* which does the following:

   - Initialises *member* by calling *GetMember*.
   - Sets the *DataContext* property of the window to *member*.

Test:

6. Build and run the application. Check that name of the member appears.



Loans: Michael

NOTE: The methods *GetTitles* and *GetMember* in this example simply create objects using data coded into the application. More realistically, these methods would retrieve the information needed to create the objects from a database.

Task 4: Creating and displaying loans

In this task you will make the application interactive. When the user clicks the **Create Loans** button the application should create a new *Loan* for the member. The title to be loaned will be the currently selected item in the upper list box. The first available copy of that title will be loaned. The list of loans for the member should be displayed in the lower text box, and this will be updated each time a new loan is created.

XAML:

1. In *MainWindow.xaml*, give the lower list box the name *lstLoans*. Do not define a *DisplayMemberPath* attribute – if no path is specified the return value of the *ToString* method of each displayed object will be shown. You can look at the code for *Loan* to see what *ToString* will return.

2. Name the *Button* control *btnNewLoan* and define an event handler by adding the following attribute to it:

```
Click="btnNewLoan_Click"
```

Code-behind:

3. In *MainWindow.xaml.cs* add an instance variable called *loans*, of type *ObservableCollection<Loan>* to *MainWindow*. *ObservableCollection* is a special collection type that can be bound to a WPF control and will automatically update the control when a new item is added to the collection.

4. Add code in the constructor of *MainWindow* which does the following:

   - Initialises *loans* to an empty *ObservableCollection<Loan>*
   - Sets the *ItemsSource* property of the lower list box to *loans*

5. .Add a new event handler method for the button click event using the following code:

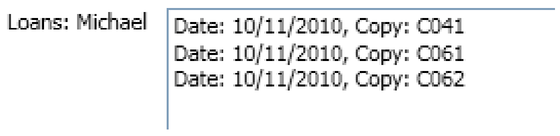
```
private void btnNewLoan_Click(object sender,
    RoutedEventArgs e)
{
     Title title = (Title)lstTitles.SelectedItem;
     Copy copy = title.GetCopy();
     Loan newLoan = new Loan(copy, member);
     loans.Add(newLoan);
}
```

Test:

6. Build and run the application. Select “CLR via C#” in the upper list box and click New Loan. Check that a loan for copy C041 is displayed in the lower list box.

7. Repeat for “Toy Story 3”. Check that a loan for copy C061 is displayed in the lower list box.

8. Repeat for “Toy Story 3” again. Check that a loan for copy C062 is displayed in the lower list box.



```
Loans: Michael   Date: 10/11/2010, Copy: C041
                 Date: 10/11/2010, Copy: C061
                 Date: 10/11/2010, Copy: C062
```

9. Repeat for “Toy Story 3” again. What happens? Remember that the code in *GetTitles* creates two copies of each title.

Task 5: Exception handling

In lab 7 you saw how the *Title* class was written to throw a custom exception if it can't find an available copy to be loaned. In the last step of Task 4 you should have seen that this exception is not handled in your application. In this task, you will handle the exception in the user interface, and use the information in the custom exception class to give useful information to the user.

Code-behind:

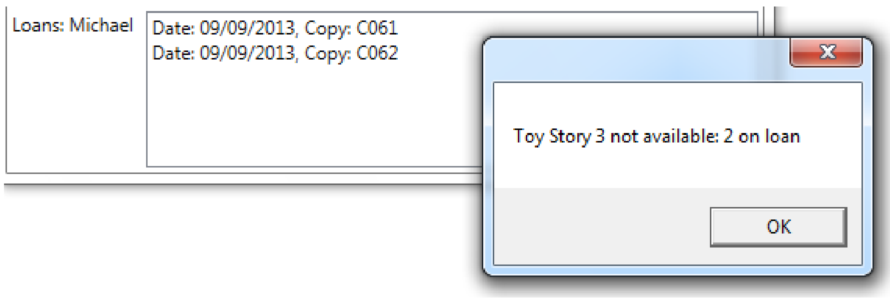
1. In *MainWindow.xaml.cs* find the button event handler method which you added in task 4. Enclose the code inside the method in a try-catch block, using the following code for the catch part:

```
catch(TitleNotAvailableException ex)
{
    MessageBox.Show(String.Format(
       "{0} not available: {1} on loan",
       ex.TitleName,ex.CopiesOnLoan));
}
```

Test:

2. Build and run the application. Create two loans for "Toy Story 3" as you did in Task 4, and check that the loans are displayed in the lower list box.

3. Click the button to create a third loan for "Toy Story 3". A message box should be shown:


Loans: Michael
Date: 09/09/2013, Copy: C061
Date: 09/09/2013, Copy: C062

Toy Story 3 not available: 2 on loan

Task 6: System testing

System testing involves testing that the completed software product meets the requirements which were specified, and documenting the tests. You have actually informally tested the functionality as you built the application – each task included a Testing section which asked you to perform a test. You should now play the part of a **software tester** who is required to test the completed application against the specification. Note that unit testing is done by developers as part of the development process, but system testing is often done by separate persons who are specialists in designing and executing test plans.

Test plan:

1. Create a test document in MS Word, which includes a table with the following headings:

Test case ID	Test description	Test data	Expected result	Actual result	Pass/fail

2. Complete the **test case ID**, **description**, **data** and **expected result** for four test cases corresponding to the requirements. The test description is the steps the tester needs to follow in order to perform the test. The test cases should correspond to the tests you performed during tasks 2 to 5. The first test case is illustrated for you below:

Test case ID	Test description	Test data	Expected result	Actual result	Pass/fail
1	Start application	List of titles coded in application	All titles shown in upper list box		

Test log:

3. Perform each of the tests described in your test plan, and complete the **actual result** and **pass/fail** columns for each test case, as shown in the example below. Note that this is essentially repeating the tests you did during the tasks, but you are now playing the part of a software tester.

Test case ID	Test description	Test data	Expected result	Actual result	Pass/fail
1	Start application	List of titles coded in application	All titles shown in upper list box	All titles shown in list box	Pass

If any of the tests fail, which might be the case if you did not complete the relevant task correctly, then you should (as the developer) fix the problem and (as the tester) perform and document the test again – you can create an additional test plan table for the tests to be repeated.

Task 7: Looking at code reuse

You have now completed your WPF application. The GUI code in this application makes use of a **model** which consists of C# classes representing the entities in the library system. These classes implement the **business logic** of the system, while the GUI simply initiates actions and displays results. Because of this, it is easy to re-use the model in a different application which may provide a completely different user interface. In this task you will simply look at a version of the library application which has been created as a web application, using Microsoft's ASP.NET. Don't worry about the details of how the ASP.NET application works, as that is beyond the scope of this module, but note that it uses exactly the same model classes as the WPF application you have been working with.

Open the project:

1. Download the file *lab8.zip* from GCULearn, and extract the contents.

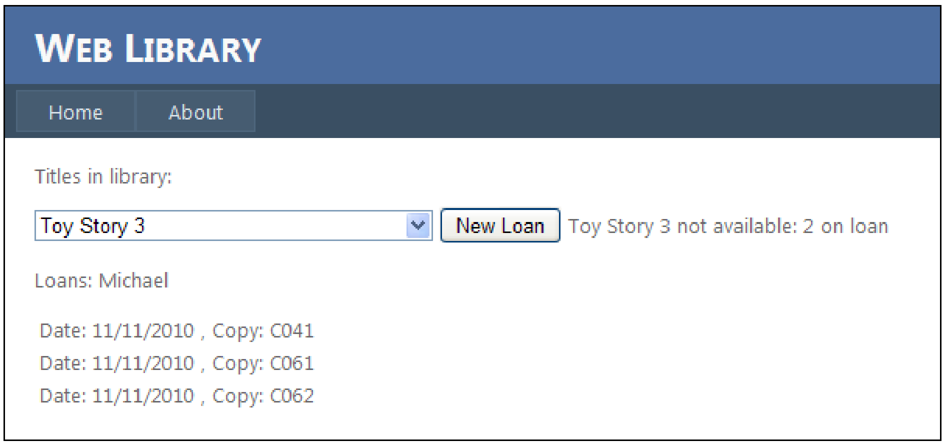
2. In Visual Studio, open the *LibraryWeb* solution inside the *LibraryWeb* folder, then click **Open**. This solution contains two projects:

   - **Library** – the model classes, which are **exactly the same** as in the WPF application – you can look at the code to check this.
   - **LibraryWeb**– an ASP.NET Web Forms project, which contains a home page *Default.aspx.*

   The **Library** project has been added as a reference in the **LibraryWeb** project so that the web application can use the model classes.

Test:

1. Build and run (Start Debugging) the application. The home page should be shown in your web browser. Repeat the tests you carried out for the WPF application.



Toy Story 3 not available: 2 on loan

Loans: Michael

Date: 11/11/2010 , Copy: C041
Date: 11/11/2010 , Copy: C061
Date: 11/11/2010 , Copy: C062