Put a professional polish on your
Windows Phone 7 applications

Windows Phone 7 Recipes

A Problem-Solution Approach

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Contents at a Glance

CHAPTER 1

Introduction to Windows Phone 7 Application Development

This chapter introduces Windows Phone 7, including its device hardware characteristics and software development tools. After this introduction, you will learn how to create simple applications and how to deploy them. Finally, you are going to look at the application's distribution via Windows Phone Marketplace. The recipes in this chapter describe how to do the following:

- 1-1: Examine Windows Phone 7 hardware
- 1-2: Examine Windows Phone 7 development tools
- 1-3 and 1-4: Create a simple Windows Phone 7 Silverlight and XNA application
- 1-5 and 1-6: Deploy a Windows Phone 7 application on both the emulator and device
- 1-7: Put a Windows Phone 7 application into Windows Phone Marketplace
- 1-8: Create a Windows Phone 7 trial application

1-1. Examining Windows Phone 7

Problem

You have just bought your new Windows Phone 7 device and would like to start developing applications. You need to know the device's hardware characteristics such as screen resolution and memory capability—but also which sensors and services it provides. Finally, you need to understand what the Windows Phone 7 operating system provides in order to integrate your application in the best way.

Solution

If you have Windows Mobile development experience, please erase it! Joking aside, Microsoft has provided a brand new operating system for its new smartphone: Windows Phone 7. This operating system has been written from scratch in order to reach—and sometime go beyond—other operating systems' functionalities.

To make an operating system that is reliable and fast and has high performance, Microsoft has dictated hardware requirements. So, every Windows Phone 7–compatible phone on the market right now and in the future has (or will have) at least minimum common hardware characteristics. For us as developers, this is great news, because we can write code having some certainty of what the smartphone provides.

The Windows Phone 7 device provides a screen resolution of 480×800 pixels in portrait orientation. In the future, mobile vendors plan to release smartphones with smaller screens having a resolution of 320×480 pixels. Having this in mind, you can create a game and draw your sprites knowing that your game will be played on a screen with that resolution—so no scale operations, screen text adaptation, and so forth will be necessary. But even for classic applications showing, for example, text boxes and buttons, this resolution is useful for drawing rich user interfaces.

Every phone provides three hardware buttons, usually at the bottom of the screen, as shown in Figure 1-1. They are the Back button, the Start button, and the Search button. The leftmost button is used to go back to the previous application (just like the Back button on an Internet browser). The middle button is used to close the current application and to show the Start menu so that the user can open another application. The rightmost button is used to access the start screen and start a search (for example, a search into the phone content for contacts or a search on the Bing site).

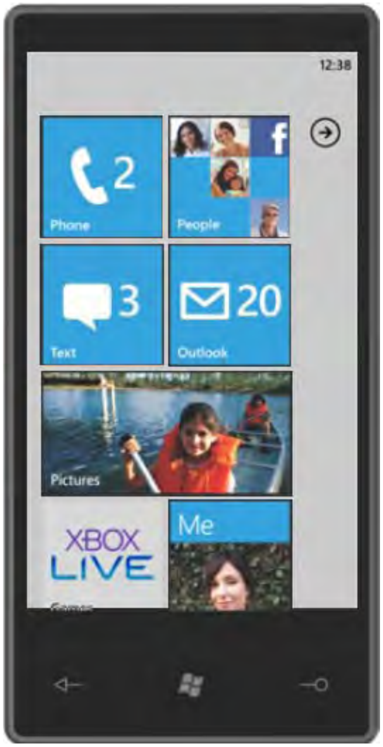


Figure 1-1. An image of a generic Windows Phone 7 device

From a developer's point of view, it is important to understand the impact that these buttons have on an application. When each button is pressed, the running application is either deactivated or killed. A developer has to provide code that responds to those events, perhaps saving data in isolated storage (an application's disk-dedicated storage). To redisplay the application, perhaps after the user pushes the Back button, code has to have been written in order to re-create the same situation present before the deactivation. You can see more on this in Chapter 2.

Windows Phone 7 devices have a Soft Input Panel (SIP) that enables users to write text into text boxes. A hardware keyboard is optional. In both cases, the application will receive text input in the same manner. The same is true for key pressure events. The SIP is shown automatically by Windows Phone 7 when text input is required by the user.

In Figure 1-1, you can see the Windows Phone 7 starting page and its new *Metro* user interface. Microsoft designers, with users' feedback, have preferred to put the accent on content and information instead of eye-catching graphics. So the screen is populated with something similar to either metro or airport banners. Every square and rectangle is called a *live tile* and gives access to the *hub*. Each live tile is updated in real time with information taken from the hub. The hub is a sort of aggregator to group similar information such as group photos taken from the web, from the phone itself, and from social networks. For example, the Office tile will show counter indicating the number of incoming e-mail when a new e-mail arrives. So the hub contains an aggregation of information that is both local (on the phone) and remote (on the cloud and from the Internet). For example, the *Pictures hub* contains photos taken from the internal camera and from social networks such as Facebook. There are six hubs provided with Windows Phone 7:

- People
- Office
- Pictures
- Music and Videos
- Marketplace
- Games

By the way, the phone is completely customizable, so you can remove live tiles, add your preferred ones, move tiles, and so on. Users can choose between two graphics themes: dark or light. Each presents a different background color (black and white, respectively), which is important to be aware of as you draw your icons, buttons, and images for an application.

The user can interact with Windows Phone 7 by using its multi-touch screen. Using your fingers to perform various gestures such as taps, you can move the tiles, zoom in and zoom out on text and pictures, and so on. Every vendor that produces Windows Phone 7 devices must provide at least a four-point multi-touch capacitive screen so that you can use at least four fingers on the touch screen.

The Windows Phone 7 device ships with 256 MB or more of RAM and with 8 GB or more of flash storage. The CPU is an ARMv7 with at least 1 GHz of frequency.

Finally, the Windows Phone 7 device provides sensors and services to bring the user experience to the next level. Here is a list of the most important ones:

> *A-GPS*: This sensor is the Assisted Global Positioning System. It enables users to retrieve their position in the world in terms of longitude and latitude coordinates taken from both satellite services and cell-site triangulation. The latter is less accurate because it represents the nearest radio network from the phone position but it is useful when satellite signals are low or absent.

Accelerometer: This sensor enables programs to understand when the phone has been moved—for example, either because the user has taken it from the desk to respond to a call, or worse, the phone is falling from the user's hands!

Wi-Fi: This sensor enables the phone to connect to a Wi-Fi spot for an Internet connection.

Camera: This sensor enables users to take photos and videos through a 5-megapixel (or more) camera with flash.

Office: This service is not so advertised, but every phone has a very usable and powerful version of Microsoft Office with its common applications such as Word, Excel, Outlook, and PowerPoint.

Location: Thanks to this service, a user can be located, and that -user's position can be represented via Bing Maps.

Push Notifications: This is a great service that prevents phone to polling information from the Internet. The phone waits to receive notifications from programs that live outside the phone avoiding to continually going to search for new informations.

Developers can use all these sensors and services together to create innovative applications and sell them on Windows Phone Marketplace. They do not have to worry about hardware differences (for example, whether a certain cell model has the accelerometer) because every Windows Phone 7 has the same minimum features.

1-2. Understanding the Development Tools

Problem

You want to start developing for Windows Phone 7. You want to know which tools and which languages you have to use to make an application.

Solution

You have to download the Microsoft Windows Phone Developer Tools.

How It Works

We started Recipe 1-1 saying that if you have Windows Mobile development experience, it is better to erase it! This is a joke, of course, but it is not completely false. In Windows Phone 7 development, you don't have the freedom to create low-level applications with C or C++ languages. Using .NET is the only way allowed by Microsoft to develop your applications for Windows Phone 7. Even if you find a way to go around this limitation—let's say by injecting some Intermediate Language (IL) code at runtime—you still have to remember that every application will be distributed by Windows Phone Marketplace. And, of course, before users can find your application on Marketplace, that application has to go through different approval steps, and you can be sure that any non-.NET application would not pass the certification process.

You can create two kinds of applications: Silverlight for Windows Phone and XNA for Windows Phone. The former uses a custom Silverlight 3 version in which Microsoft has added some specific features. The latter uses XNA libraries and is targeted at creating videogames. You can combine both technologies in your application, with the only limitation being the user interface; you can't draw controls by using Silverlight and use XNA to draw sprites at the same time. On the other hand, you can use Silverlight for the user interface and XNA libraries to provide full access to media storage on the phone, to capture audio, and more.

C# is actually the only language that has full support on both Silverlight and XNA technologies. At the time of this writing, with Visual Basic, you can develop only Silverlight applications.

To start developing, you first have to download the Windows Phone Developer Tools from `http://go.microsoft.com/fwlink/?LinkID=189554`. This setup includes Visual Studio 2010 Express for Windows Phone, Windows Phone 7 Emulator, Silverlight Tools, XNA 4, and Microsoft Expression Blendfor Windows Phone. If you already have Visual Studio 2010 installed on your machine, the setup will install only the necessary files and you will see new project templates the next time you start the development tool.

■ **Note** At the time of this writing, Visual Studio 2010 Express doesn't support Visual Basic. You must have Visual Studio 2010 Professional or Superior to use Visual Basic. You can always download a Visual Studio 2010 trial version.

Let's see the necessary steps to install the Microsoft Windows Phone Developer Tools:

1. Launch the installer (`vm_web.exe`) after having downloaded it.
2. Accept the license agreement.
3. Optionally, choose the Customized installation so you can select a folder in which to install the tools.
4. Wait for the installer to download all the necessary files from the Internet. The number of files downloaded depends on what the installer finds already in your operating system.
5. If you have to install the developer tools on machines not connected to the Internet, you can use the ISO version from `http://go.microsoft.com/fwlink/?LinkId=201927`.

The next step is to download the Windows Phone Developer Tools October 2010 update, which includes some updates such as the Windows Phone Connection Tool, some changes to Bing Maps for the Windows Phone Silverlight control, and a tool to detect phone capabilities. By the way, since things are moving so fast in the Windows Phone panorama, Microsoft's App Hub site at `http://create.msdn.com/en-US` should be the starting point for every developer.

1-3. Creating a Simple Silverlight Windows Phone 7 Application

Problem

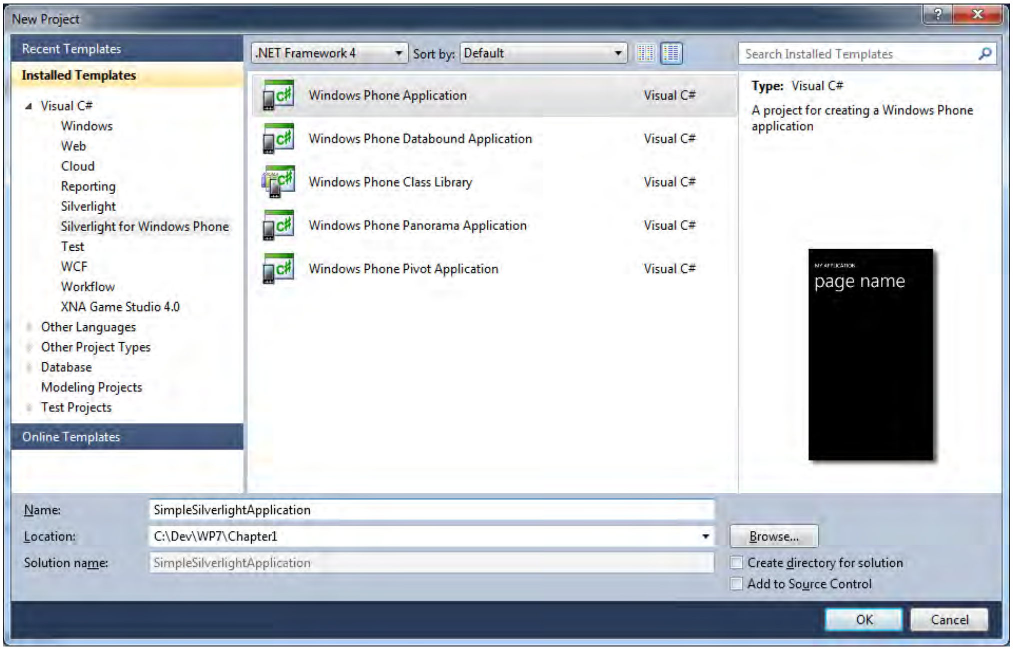
You have to create a Windows Phone 7 application by using Silverlight.

Solution

Use Visual Studio 2010 (either the Express, Professional, or Superior edition). Use the Windows Phone Application project template.

How It Works

After opening Visual Studio 2010, you have to create a new project. From the File menu, choose New Item ➤ Project item (or press Ctrl+Shift+N). Figure 1-2 shows the dialog box that appears after launching the New Project command.


New Project
Recent Templates
Installed Templates
Visual C#
Windows
Web
Cloud
Reporting
Silverlight
Silverlight for Windows Phone
Test
WCF
Workflow
XNA Game Studio 4.0
Other Languages
Other Project Types
Database
Modeling Projects
Test Projects
Online Templates
Windows Phone Application Visual C#
Windows Phone Databound Application Visual C#
Windows Phone Class Library Visual C#
Windows Phone Panorama Application Visual C#
Windows Phone Pivot Application Visual C#
Search Installed Templates
page name
Browse...
OK
Cancel

.NET Framework 4
Sort by: Default

Type: Visual C#

A project for creating a Windows Phone application

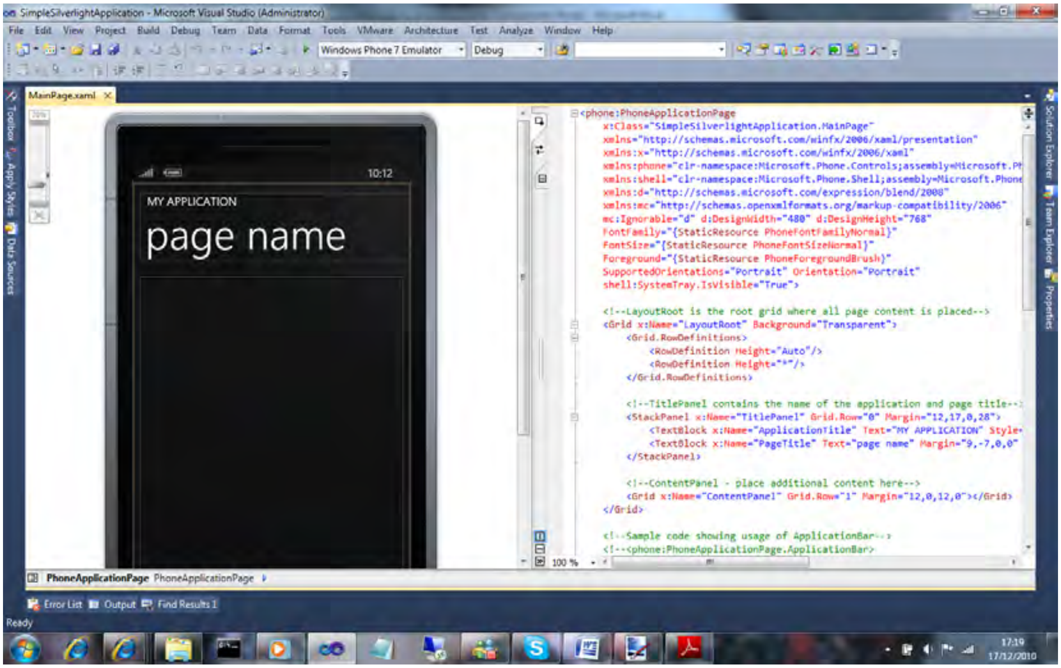
Name: SimpleSilverlightApplication
Location: C:\Dev\WP7\Chapter1
Solution name: SimpleSilverlightApplication
□ Create directory for solution
□ Add to Source Control

Figure 1-2. Visual Studio 2010 New Project dialog box

From the Installed Templates on the left, select Silverlight for Windows Phone. There are five project templates provided by Visual Studio 2010:

- *Windows Phone Application* creates a skeleton code for a generic phone application; no controls or other stuff are added.
- *Windows Phone Databound Application* creates a Windows Phone application, adding List and Navigation controls.
- *Windows Phone Class Library* creates a skeleton code for an external assembly specific to Windows Phone 7.
- *Windows Phone Panorama Application* creates an application including the Panorama control (see more on that in Chapter 3, Recipe 3-7).
- *Windows Phone Pivot Application* creates an application including the Pivot control (see more on that in Chapter 3, Recipe 3-7).

Select the Windows Phone Application project template and type `SimpleSilverlightApplication` in the project's Name text box. Choose a Location where to save the project and then click the OK button. Wait while Visual Studio 2010 writes every file and folder, and after a few seconds you should have `MainPage.xaml` opened in the integrated development environment (IDE) of Visual Studio 2010 (see Figure 1-3).


SimpleSilverlightApplication - Microsoft Visual Studio (Administrator)
File Edit View Project Build Debug Team Data Format Tools VMware Architecture Test Analyze Window Help
Windows Phone 7 Emulator
Debug
MainPage.xaml
10:12
MY APPLICATION
page name
100 %
PhoneApplicationPage PhoneApplicationPage
Error List Output Find Results 1
Ready
17:19
17/12/2010

```
<phone:PhoneApplicationPage
    x:Class="SimpleSilverlightApplication.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Ph
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="Portrait" Orientation="Portrait"
    shell:SystemTray.IsVisible="True">

    <!--LayoutRoot is the root grid where all page content is placed-->
    <Grid x:Name="LayoutRoot" Background="Transparent">
        <Grid.RowDefinitions>
            <RowDefinition Height="Auto"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <!--TitlePanel contains the name of the application and page title--:
        <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
            <TextBlock x:Name="ApplicationTitle" Text="MY APPLICATION" Style=
            <TextBlock x:Name="PageTitle" Text="page name" Margin="9,-7,0,0"
        </StackPanel>

        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0"></Grid>
    </Grid>

    <!--Sample code showing usage of ApplicationBar-->
    <!--<phone:PhoneApplicationPage.ApplicationBar>
```

Figure 1-3. `MainPage.xaml` *ready to be edited*

The Code

The project contains two main files: `App.xaml` and `MainPage.xaml`. Two classes are created: the App class and the MainPage class (see class diagram in Figure 1-4). The other files are resources such as a splash screen image, background image, and the application icon. Finally, there is an application manifest file called `WMAppManifest` that contains application data such as the application's title, the resource names, and so forth. It also includes a list of capabilities that you have to specify when you want to use a particular phone feature. For example, if you want to use the phone microphone in your application, you have to add the `ID_CAP_MICROPHONE` capability. The file comes with more than ten capabilities already defined in it; you should remove the ones you don't use.

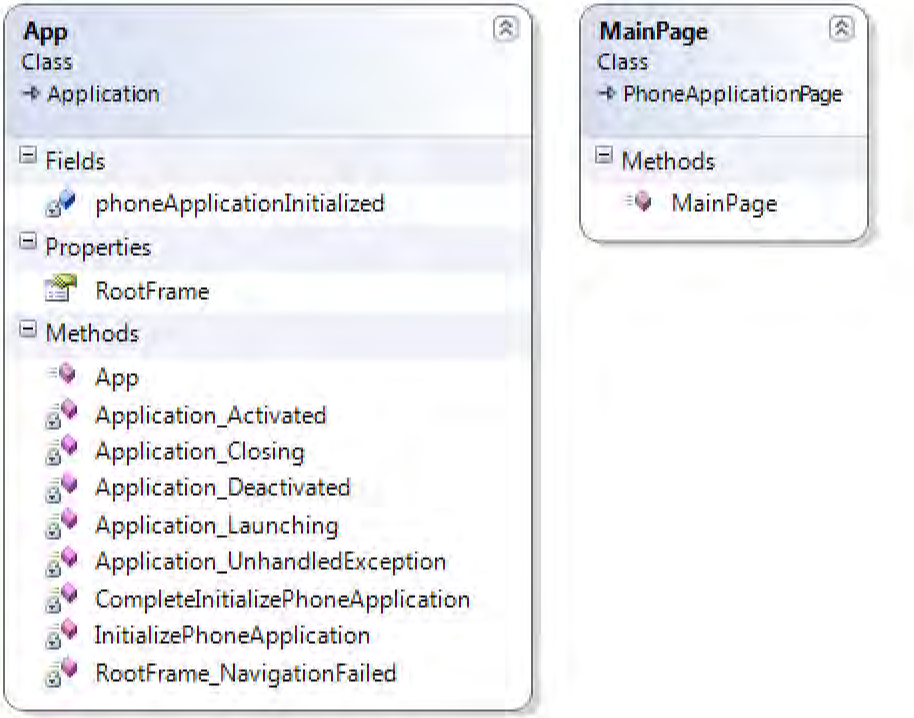


***Figure 1-4.** The class diagram for the App and MainPage classes.*

Let's focus our attention on the main two files. The `MainPage.xaml` file contains the Extensible Application Markup Language (XAML) markups that define the main page. At the beginning of the code, all the namespaces used by the application are declared.

```
<phone:PhoneApplicationPage
    x:Class="SimpleSilverlightApplication.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"

….
```

The root tag is PhoneApplicationPage, which is the class from which our application derives. The prefix phone: is necessary because the PhoneApplicationPage name is defined in the namespace clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone. The x:Class attribute states that the MainPage class is defined in the code-behind and is included in the SimpleSilverlightApplication namespace. The first namespace in the XAML code is the main Silverlight namespace; the x namespace contains definitions of all extra XAML elements not defined in the previous namespace. The shell, d, and mc namespaces are specific to the Windows Phone application and contain markups for shell instructions, Microsoft Expression Blend, and the Visual Studio designer.

The other attributes of the <phone:PhoneApplicationPage> markup are used to define the application's orientation, font, and colors. It is worth noting the use of static resources provided by the Windows Phone resource dictionary (see http://msdn.microsoft.com/en-us/library/ff769552(v=vs.92).aspx for the full list of available resources).

```
….
    mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="Portrait" Orientation="Portrait"
    shell:SystemTray.IsVisible="True">
```

Then the code includes a grid with two rows. In the first row is a stack panel with two text blocks, and in the second row is a content panel where you can add your controls.

```
    <!--LayoutRoot is the root grid where all page content is placed-->
    <Grid x:Name="LayoutRoot" Background="Transparent">
        <Grid.RowDefinitions>
            <RowDefinition Height="Auto"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>

        <!--TitlePanel contains the name of the application and page title-->
        <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
            <TextBlock x:Name="ApplicationTitle" Text="MY APPLICATION"
                       Style="{StaticResource PhoneTextNormalStyle}"/>
            <TextBlock x:Name="PageTitle" Text="page name" Margin="9,-7,0,0"
                       Style="{StaticResource PhoneTextTitle1Style}"/>
        </StackPanel>
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0"></Grid>
    </Grid>
```

The other important file is App.xaml and its related code-behind App.xaml.cs file. The Application root tag represents the class from which our App class derives. Again, the x:Class attribute contains the name of our class and the namespace in which it is contained. The namespaces are the same as those you have seen before. The <Application.Resources> markup is used to add custom resources to the application. But the most important code section is the one included in <Application.ApplicationLifetimeObjects>, which defines four event handlers in response to four important events in the application's lifetime. The Launching event occurs when the application is started, the Closing event occurs before the application is closed, the Activated event occurs when the user comes back to the application after having browsed to other phone applications, and the Deactivated event occurs when the user leaves the application (for example, by pressing the Back button or answering an incoming call).

```
<Application
    x:Class="SimpleSilverlightApplication.App"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone">

    <!--Application Resources-->
    <Application.Resources>
    </Application.Resources>

    <Application.ApplicationLifetimeObjects>
        <!--Required object that handles lifetime events for the application-->
        <shell:PhoneApplicationService
            Launching="Application_Launching" Closing="Application_Closing"
            Activated="Application_Activated" Deactivated="Application_Deactivated"/>
    </Application.ApplicationLifetimeObjects>
</Application>
```

In the App.xaml.cs code-behind, there is a lot of interesting auto-generated code. First, there are the event handlers, where you have to insert your code to respond to application tombstoning (see more on tombstoning in Chapter 2).

```
        // Code to execute when the application is launching (e.g., from Start)
        // This code will not execute when the application is reactivated
        private void Application_Launching(object sender, LaunchingEventArgs e)
        {
        }

        // Code to execute when the application is activated (brought to foreground)
        // This code will not execute when the application is first launched
        private void Application_Activated(object sender, ActivatedEventArgs e)
        {
        }
```

```
// Code to execute when the application is deactivated (sent to background)
// This code will not execute when the application is closing
private void Application_Deactivated(object sender, DeactivatedEventArgs e)
{
}

// Code to execute when the application is closing (e.g., user hit Back)
// This code will not execute when the application is deactivated
private void Application_Closing(object sender, ClosingEventArgs e)
{
}
```

In the App class's constructor, there are application initialization steps.

```
public App()
{
...

    // Standard Silverlight initialization
    InitializeComponent();

    // Phone-specific initialization
    InitializePhoneApplication();
}
```

In the InitializePhoneApplication method, RootFrame is created. Frame is the topmost control that contains phone pages. It allows page navigation, manages orientation, and reserves space for the system bar and application bar. The Navigated event is used to understand when the application has completed the initialization. Until then, a splash screen is shown. The SplashScreenImage.jpg image will be used as a splash screen, but you can customize it or replace it with another one you prefer.

```
private void InitializePhoneApplication()
{
    if (phoneApplicationInitialized)
        return;

    // Create the frame but don't set it as RootVisual yet;
    // this allows the splash
    // screen to remain active until the application is ready to render.
    RootFrame = new PhoneApplicationFrame();
    RootFrame.Navigated += CompleteInitializePhoneApplication;

    // Handle navigation failures
    RootFrame.NavigationFailed += RootFrame_NavigationFailed;

    // Ensure we don't initialize again
    phoneApplicationInitialized = true;
}
```

Finally, in the CompleteInitializePhoneApplication event handler, the RootVisual property is set to RootFrame. RootVisual is the main application user interface.

```
private void CompleteInitializePhoneApplication(object sender,
                                                NavigationEventArgs e)
{
    // Set the root visual to allow the application to render
    if (RootVisual != RootFrame)
        RootVisual = RootFrame;

    // Remove this handler since it is no longer needed
    RootFrame.Navigated -= CompleteInitializePhoneApplication;
}
```

Usage

Press Ctrl+F5 (or choose Debug ➤ Start Without Debugging from the menu).After Visual Studio 2010 compiles the code, the application will start. Visual Studio 2010 will launch the Windows Phone 7 Emulator application (unless you changed the target from the related combo box that is Windows Phone 7 Emulator by default), and you will be able to see your application running in the emulator, as shown in Figure 1-5.

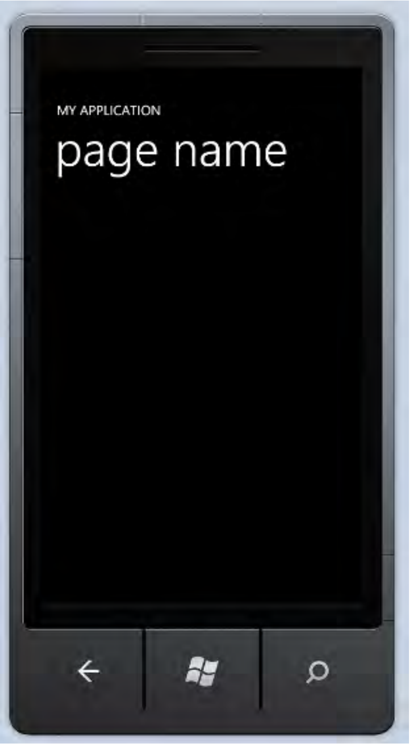


Figure 1-5. *Simple Silverlight for Windows Phone 7 application running in the emulator*

1-4. Creating a Simple XNA Windows Phone 7 Application

Problem

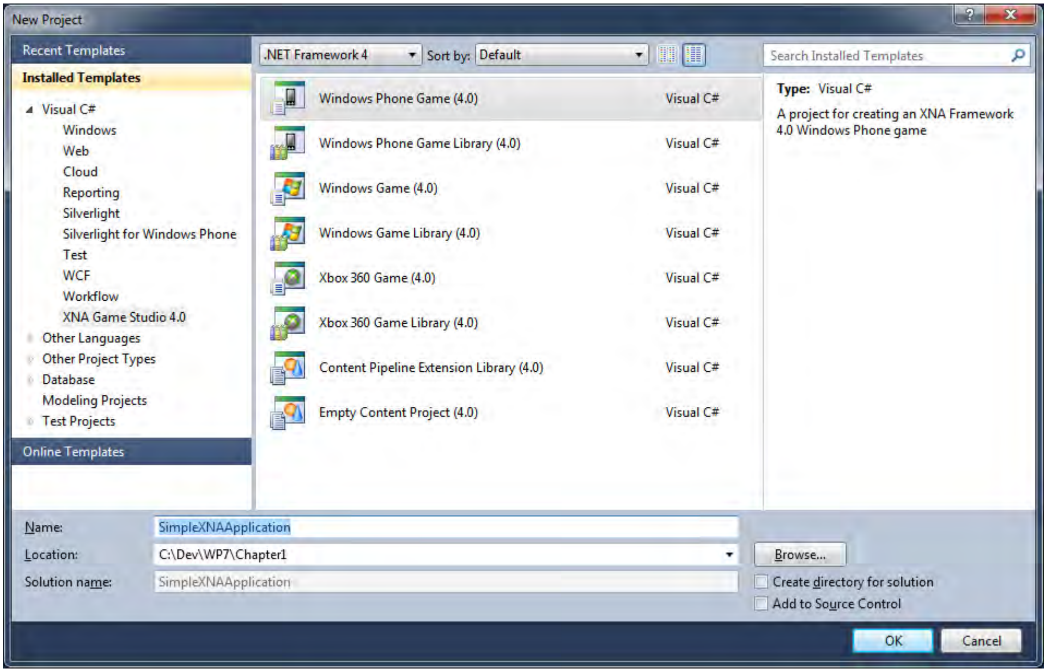
You have to create a Windows Phone 7 application by using XNA.

Solution

Use Visual Studio 2010 (either Express, Professional, or Superior edition). Use the Windows Phone Game (4.0) project template.

How It Works

Press Ctrl+Shift+N after opening Visual Studio 2010. This brings up the New Project dialog box. Select the XNA Game Studio 4.0 template from the Installed Templates on the left and select the Windows Phone Game (4.0) project template (see Figure 1-6). Type`SimpleXNAApplication` in the project Name text box and then click the OK button.


New Project
Recent Templates
Installed Templates
Visual C#
Windows
Web
Cloud
Reporting
Silverlight
Silverlight for Windows Phone
Test
WCF
Workflow
XNA Game Studio 4.0
Other Languages
Other Project Types
Database
Modeling Projects
Test Projects
Online Templates
.NET Framework 4
Sort by: Default
Search Installed Templates
Windows Phone Game (4.0) Visual C#
Windows Phone Game Library (4.0) Visual C#
Windows Game (4.0) Visual C#
Windows Game Library (4.0) Visual C#
Xbox 360 Game (4.0) Visual C#
Xbox 360 Game Library (4.0) Visual C#
Content Pipeline Extension Library (4.0) Visual C#
Empty Content Project (4.0) Visual C#
Browse...
OK
Cancel

Type: Visual C#

A project for creating an XNA Framework 4.0 Windows Phone game

Name: SimpleXNAApplication

Location: C:\Dev\WP7\Chapter1

Solution name: SimpleXNAApplication

□ Create directory for solution

□ Add to Source Control

Figure 1-6. Create a new XNA Windows Phone 7 application by using the Windows Phone Game (4.0) project template.

After few moments, you will have two projects in the solution. One contains the files to create the game, and the other is specifically for game resources such as sprites, images, and sounds.

The Code

The main file in the project is `Game1.cs`; it contains the code to create a game in Windows Phone 7 using the Game1 class derived from the Game class (in Figure 1-7 is shown its own class diagram). The project template does nothing relevant other than creating the code to paint the screen with the CornflowerBlue color. But it is worth noting the class structure and its methods to understand how the XNA game works.

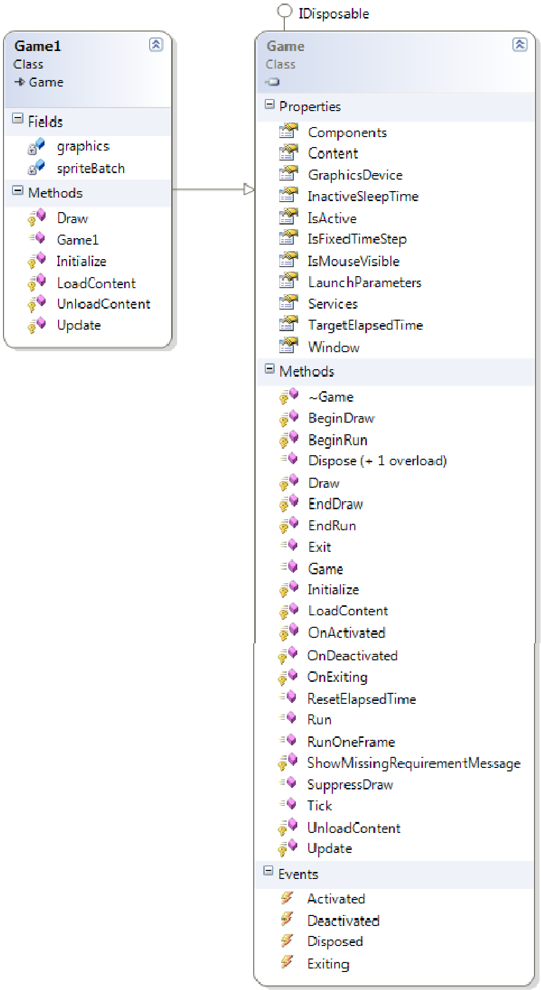


Figure 1-7. *The Game1 and Game classes diagram.*

In the class's constructor, a GraphicsDeviceManager object is created. This object represents the graphic device manager of the Windows Phone and contains properties used to change resolution, toggle full-screen mode, and more. It sets the refreshing frame rate to 30 frames per second (fps), which means that in 1 second, the Update method is called 30 times.

```
public Game1()
{
    graphics = new GraphicsDeviceManager(this);
    Content.RootDirectory = "Content";

    // Frame rate is 30 fps by default for Windows Phone.
    TargetElapsedTime = TimeSpan.FromTicks(333333);
}
```

The Initialize method is where you have to put the code to initialize your objects.

```
protected override void Initialize()
{
    // TODO: Add your initialization logic here

    base.Initialize();
}
```

The next method that is called by the XNA framework is LoadContent. In this method, you have to load the content previously added to the Content project in the solution. You can add images, sounds, sprites, 3D models, and all your game resources.

```
protected override void LoadContent()
{
    // Create a new SpriteBatch, which can be used to draw textures.
    spriteBatch = new SpriteBatch(GraphicsDevice);

    // TODO: use this.Content to load your game content here
}
```

Finally, the XNA game framework enters into a loop in which two methods are automatically called one by one—first the Update method and then the Draw method. In the Update method, you have to add the code that manages the game's logic, the sprites' movement, a collision algorithm, and so on. The Draw method is where you draw the game objects and you have to be faster to do it. Your game code shouldn't update and check objects in the Draw method.

```
protected override void Update(GameTime gameTime)
{
    // Allows the game to exit
    if (GamePad.GetState(PlayerIndex.One).Buttons.Back == ButtonState.Pressed)
        this.Exit();
```

```
            // TODO: Add your update logic here

            base.Update(gameTime);
        }

        protected override void Draw(GameTime gameTime)
        {
            GraphicsDevice.Clear(Color.CornflowerBlue);

            // TODO: Add your drawing code here

            base.Draw(gameTime);
        }
```

There is another method defined in the code that is used to unload the content when the game is closed.

```
        protected override void UnloadContent()
        {
            // TODO: Unload any non ContentManager content here
        }
```

■ **Note** In this book, you will find XNA code used to provide access to Windows Phone features such as the media library and audio files. If you are interested in Windows Phone game development, take a look at *Windows Phone 7 Game Development* by Adam Dawes (Apress, 2010).

Usage

Press Ctrl+F5 to see the game running in the emulator (see Figure 1-8).

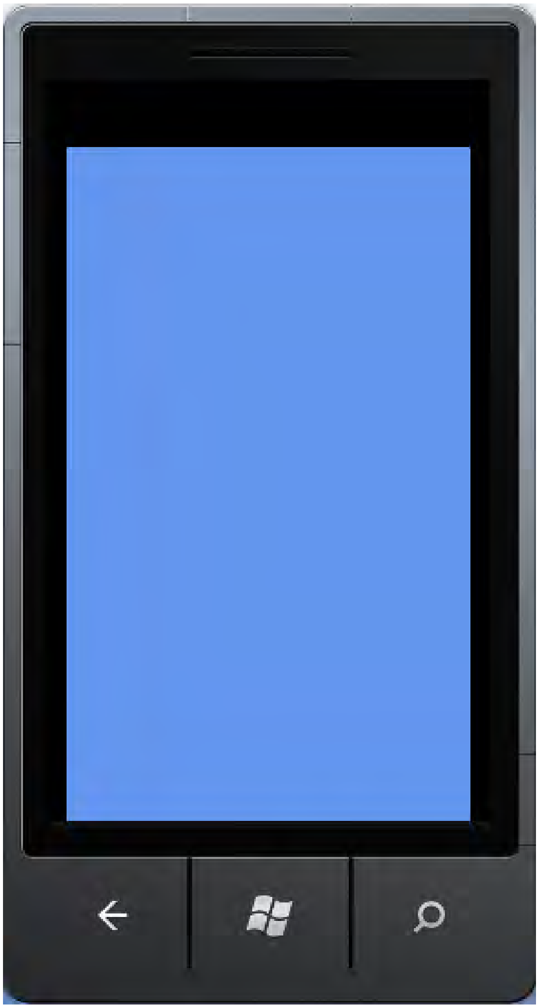


Figure 1-8. `SimpleXNAApplication` *running on the Windows Phone 7 Emulator*

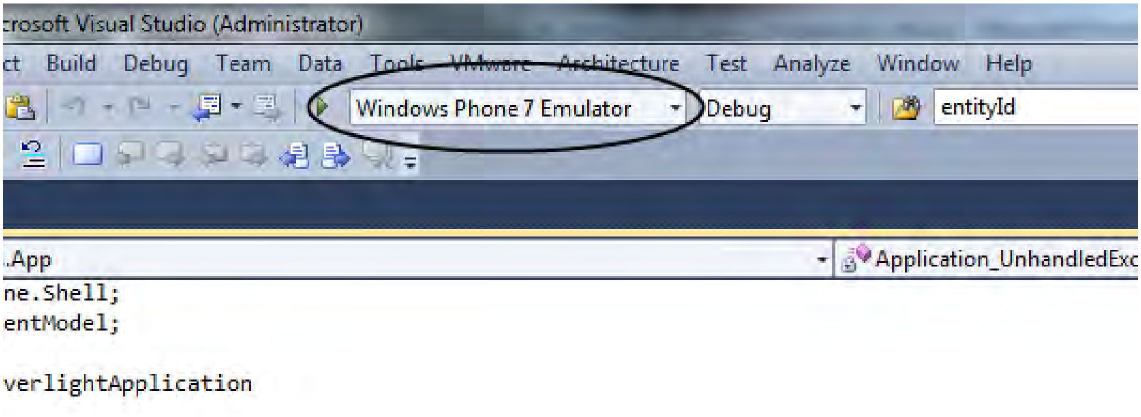
1-5. Deploying the Application to the Windows Phone 7 Emulator

Problem

You have developed your application and want to run it, but you don't have the physical device.

Solution

From Visual Studio 2010—with your phone project loaded—select Windows Phone 7 Emulator from the target combo box (see Figure 1-9).



crosoft Visual Studio (Administrator)
ct Build Debug Team Data Tools VMware Architecture Test Analyze Window Help
Windows Phone 7 Emulator
Debug
entityId
.App
Application_UnhandledExc

```
ne.Shell;
entModel;

verlightApplication
```

Figure 1-9. The target combo box set to Windows Phone 7 Emulator

Usage

Press Ctrl+F5 or choose Debug ➤ Start Without Debugging. If your code builds correctly, you will see your application running in the Windows Phone 7 Emulator (see Figure 1-10).

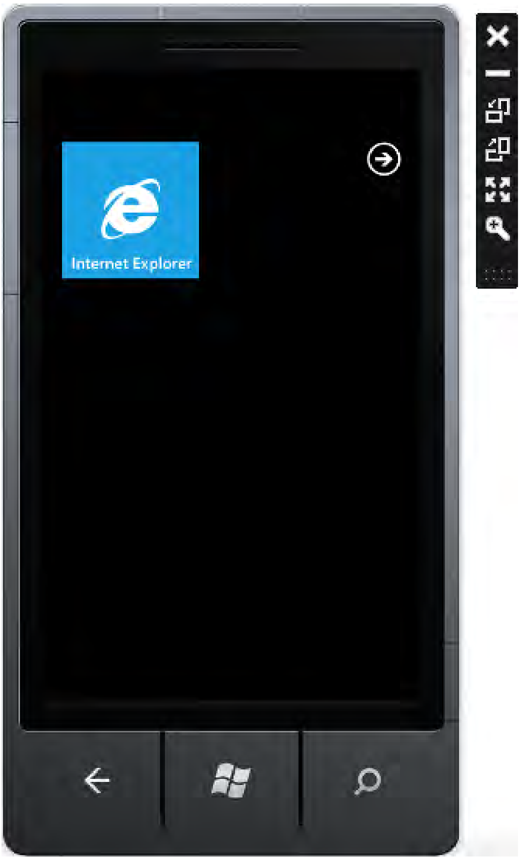


Figure 1-10. *Windows Phone 7 Emulator*

This emulator is very powerful. It supports multi-touch capabilities if your PC monitor supports touching. It supports graphics acceleration if your graphical device supports DirectX 9 or higher. Obviously, it doesn't support phone sensors such as the accelerator, compass, or A-GPS. When you run the code that uses phone sensors, you will always get the same result. For example, when running the code to retrieve a user's geographical location, you will always receive the same position.

■ **Note** The Multi-Touch Vista library from CodePlex enables users to use multiple mice to simulate fingers. After installing this multi-touch driver, you can test your multi-touch Windows Phone application in the emulator. Download the driver from `http://multitouchvista.codeplex.com`.

After launching the emulator for the first time, it is convenient to not close it. Every change you make to your code and deploy to the opened emulator will then be visible and testable. With no need to rerun the emulator, the deployment is much faster.

The emulator contains the working version of Internet Explorer plus the Settings application used to change the phone background and styles.

In Figure 1-10, you can see next to the emulator a little floating rectangle with some icons. These buttons are used to close the emulator, minimize it, rotate it, and zoom it. If you choose a 100% zoom level, you will see a large Windows Phone emulator on your monitor. That's because the Windows operating system assumes that your monitor is 96 dpi, while the Windows Phone display has 262 DPI. To enable you to see all the pixels in your monitor, the emulator shows a very large screen.

1-6. Deploying the Windows Phone 7 Application on the Device

Problem

You want to deploy your application to the Windows Phone 7 device because you have to test the sensors' functionalities.

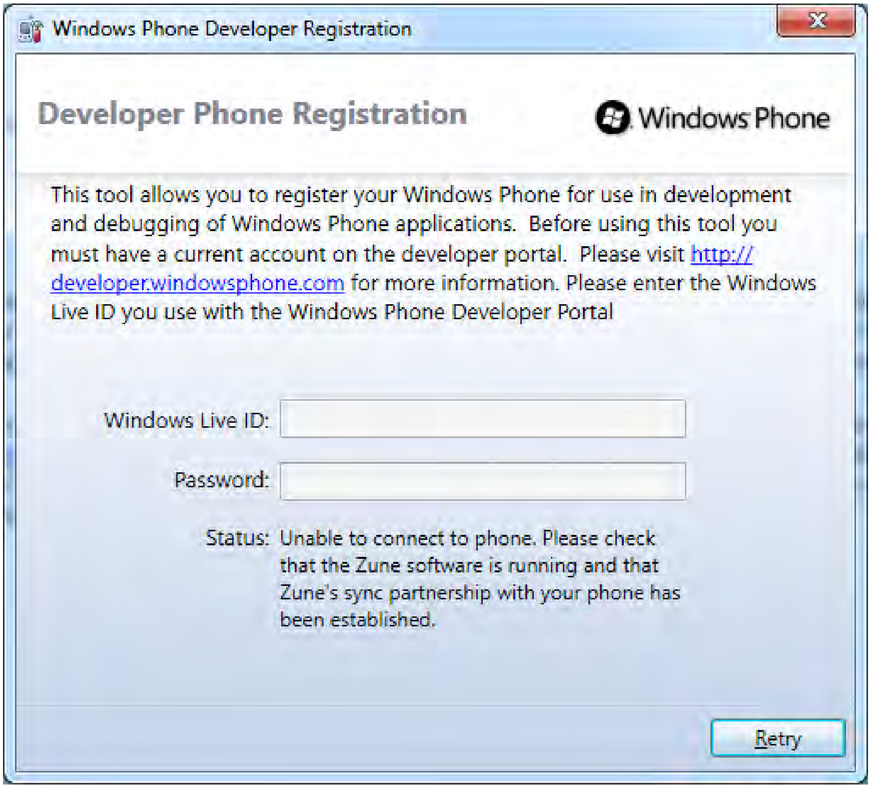
Solution

You have two ways to deploy your application to the phone: using either Visual Studio 2010 or the Application Deployment tool.

How It Works

In both cases, you have to download and install the latest version of Zune software from `www.zune.net/en-US/`. Zune is an entertainment device—initially available only in the United States—and it is Microsoft's response to Apple's iPod family of devices. You can transfer your music and videos by using the Zune software, but you can use it to deploy your software too.

Moreover, in both cases, you have to unlock your Windows Phone device with a developer license. You can obtain a license from Microsoft's App Hub site at `http://create.msdn.com/en-us/home/membership` by paying an annual $99 fee. In the registration, you will associate your Windows Live ID account with an App Hub identifier. This coupling of data is necessary to unlock your Windows Phone device with the help of the Windows Phone Developer Registration tool, which you find within the tools installed with the Windows Phone Developer Tools (see Figure 1-11).



Windows Phone Developer Registration

Developer Phone Registration

This tool allows you to register your Windows Phone for use in development and debugging of Windows Phone applications. Before using this tool you must have a current account on the developer portal. Please visit http://developer.windowsphone.com for more information. Please enter the Windows Live ID you use with the Windows Phone Developer Portal

Windows Live ID:

Password:

Status: Unable to connect to phone. Please check that the Zune software is running and that Zune's sync partnership with your phone has been established.

Figure 1-11. The Windows Phone Developer Registration tool used to unlock your phone and deploy applications

■ **Note** As you can see in Figure 1-11, Zune software is required to unlock the Windows Phone 7 device.

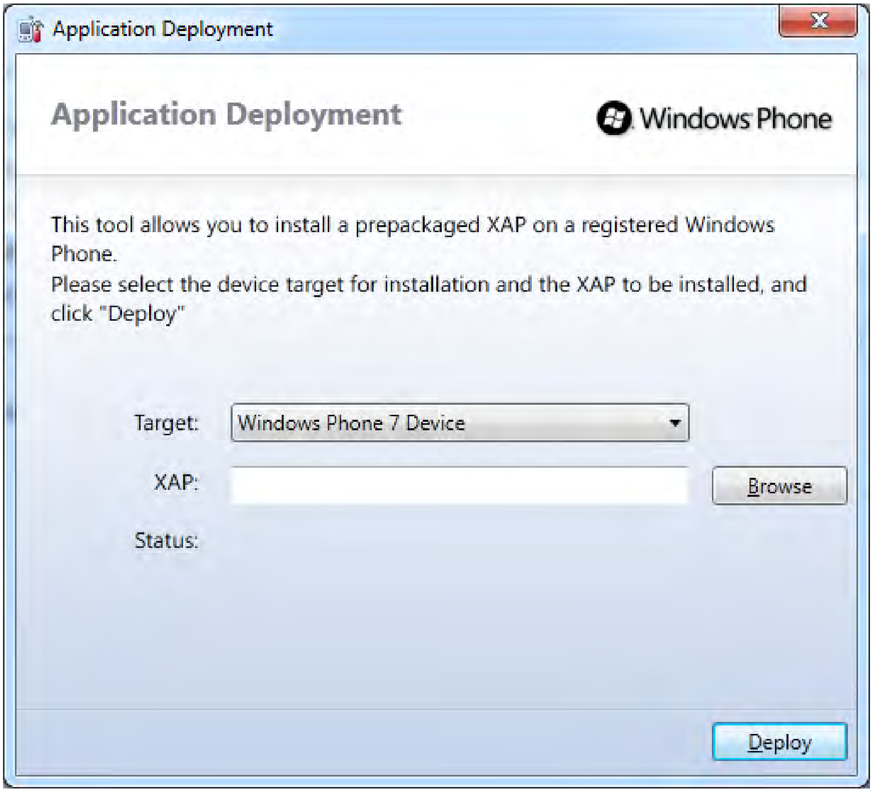
Okay, after completing these mandatory steps, your device is ready to receive your application. From Visual Studio 2010, you simply have to change the target combo box from Windows Phone 7 Emulator to Windows Phone 7 Device.

Usage

Now, as usual, you can press F5 to start a debug session or press Ctrl+F5 to start the application without the debug. Visual Studio 2010 will compile your application, start Zune software to connect to the Windows Phone device, copy the XAP file to the device, and finally run the application. In your device, you will see your application running.

■ **Note** The October 2010 update of the Windows Phone Developer Tools includes the `WPConnect.exe` program. When your application uses the Windows Phone media library or plays a song, it will find those resources locked by Zune software. You have to close Zune software after having connected the phone and then run `WPConnect.exe`. The device will remain connected, but now you have full access to the phone device.

The second method to deploy your application on the Windows Phone device is to run the Application Deployment tool (see Figure 1-12).



Application Deployment

This tool allows you to install a prepackaged XAP on a registered Windows Phone.
Please select the device target for installation and the XAP to be installed, and click "Deploy"

Target: Windows Phone 7 Device

XAP:

Status:

Figure 1-12. The Application Deployment tool used to deploy your application without Visual Studio 2010

The target combo box contains both device and emulator targets. The XAP text box contains the path of your application's XAP file. When you compile your application, Visual Studio 2010 creates the XAP file, which is a compressed file containing everything Windows Phone needs to run the application (EXE, DLLl, images, and so on). After you click the Deploy button, the Application Deployment tool connects to the phone and deploys the application.

1-7. Sending a Windows Phone 7 Application to the Marketplace

Problem

You want to distribute your application by using Windows Phone Marketplace.

Solution

You have to go to the App Hub site and follow the application submission walk-through.

How It Works

Windows Phone Marketplace is the place where you can find applications, music, videos, and more for your device. If you know the Apple Store or Android Market, well, this is the same type of site. The marketplace categorizes applications and lets you download free, trial, and paid applications. When you are satisfied with one application, you can buy it either with electronic payment such as a credit card or by adding the cost to your billing, if your mobile operator lets you do that.

Actually, there is no other way to distribute your application than the marketplace. If you develop an enterprise application and need to distribute it to employees' phones, you have to submit to the marketplace as well. You will probably register the application as free, but remember that your account allows up to only five free applications. As you can imagine, this is a big limitation, and we guess that Microsoft will find a particular solution to Windows Phone enterprise applications.

Every application running on the Windows Phone must be signed with a Microsoft Authenticode certificate. You don't have to sign your application, because it will be signed after Microsoft's review of your application submission. If your application satisfies all the Marketplace conditions, the XAP file will be signed, and the application will be added to the application's category provided during the submission walk-through.

There is an official document at `http://go.microsoft.com/fwlink/?LinkID=183220` called Windows Phone Certification Requirements. It is 27 pages long and contains everything you have to do and avoid doing so that your application satisfies Marketplace conditions. Let's see the most important rules for a developer:

- The maximum XAP size is 225 MB. This file must contain both `WMAppManifest.xml` and `AppManifest.xml` files, assemblies, and two icons. By the way, Visual Studio 2010 provides everything you need to create a valid XAP automatically.
- Your application must be developed by using the .NET Framework and cannot use native code. Before submitting the XAP package, you have to build the retail version of your application. The application cannot mix XNA graphic calls with Silverlight controls.
- The application must be reliable. The certification process will check whether the application manages errors, hangs unexpectedly, or has long periods of inactivity caused, for example, by data downloading. In the latter case, you have to provide users a way to cancel the operation and display a progress bar indicating the status of the operation.

- The application must show the first screen within 5 seconds. As you have seen in Recipe 1-3, the Silverlight Windows Phone application provides a splash screen, so you might think that this rule is always satisfied. Sadly, it is not, because the splash screen must disappear within 5 seconds, and the main page has to be rendered. If your application takes longer, you can implement a splash screen with a progress bar, as shown in Chapter 3, Recipe 3-1. The user must use your application within 20 seconds.
- The application must respond correctly to execution model events. When the user presses the Start button, the Windows Phone application should be deactivated; when the user presses the Back button and comes back to your application, it should be activated and should show the same screen information that it was running in the background. Chapter 2 is completely dedicated to the execution model and application tombstoning.
- The application must be usable with the phone's templates, dark and light. So if you have images or other graphics effects working well in one template, you have to implement an algorithm to replace them if the user changes the phone's template.

■ **Note** There is an interesting article at `http://blogs.msdn.com/b/devfish/archive/2010/10/06/ben-s-big-ten-for-wp7-marketplace-acceptance.aspx` that highlights the ten most important rules that you have to satisfy so that your application passes the acceptance process.

1-8. Creating a Trial Windows Phone 7 Application

Problem

You want to distribute an application that provides a trial version. Also, you want your application to remind users to buy the full version.

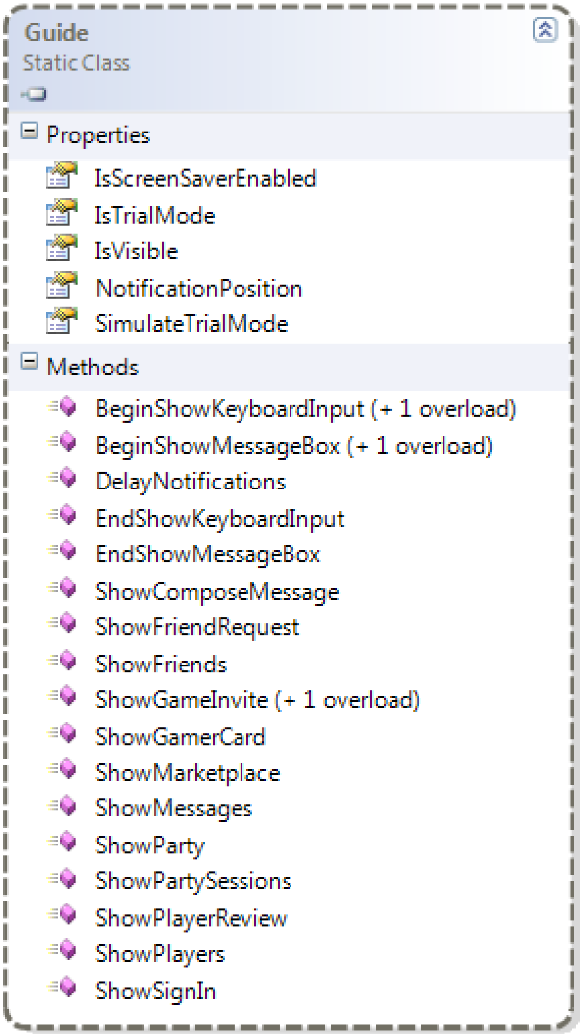
Solution

You have to use the `Guide` class from the `GamerServices` namespace, which provides properties and methods enabling you to check whether your application is running in trial version mode. Moreover, the `Guide` class provides methods to simulate both trial mode and buy request when your application is running in either debug mode or in the emulator.

How It Works

Microsoft again helps developers: Marketplace implements a feature enabling users to choose between a trial version and a full version of your application. As a developer, you don't have to provide two versions of your software, but simply check your code to see whether the application is running in trial mode. In fact, when the user chooses to install the trial version of your application, Marketplace adds a trial license file to the directory where the application is installed. If the user decides to buy the application after having tried it, Marketplace replaces the trial license with a full license.

Depending on the framework chosen to write your application, either XNA or Silverlight, there are different ways to check whether the application is running in trial mode. The XNA framework provides the `Guide` class contained in the `GamerServices` namespace (see Figure 1-13 for Guide class diagram). The Silverlight framework provides the `LicenseInformation` sealed class with the `IsTrial` method.



Guide
Static Class

⊟ Properties

- IsScreenSaverEnabled
- IsTrialMode
- IsVisible
- NotificationPosition
- SimulateTrialMode

⊟ Methods

- BeginShowKeyboardInput (+ 1 overload)
- BeginShowMessageBox (+ 1 overload)
- DelayNotifications
- EndShowKeyboardInput
- EndShowMessageBox
- ShowComposeMessage
- ShowFriendRequest
- ShowFriends
- ShowGameInvite (+ 1 overload)
- ShowGamerCard
- ShowMarketplace
- ShowMessages
- ShowParty
- ShowPartySessions
- ShowPlayerReview
- ShowPlayers
- ShowSignIn

Figure 1-13. *The Guide class diagram.*

Your job as a developer in implementing trial mode in the application is to add test conditions in your code, excluding extra application functionalities available only after the user buys the full version of the application. For example, you can show extra menus during the load of the form when the `IsTrial` method returns `false`, or you can show an image in your game indicating that the next level is locked if the `IsTrialMode` property of the `Guide` class returns `true`.

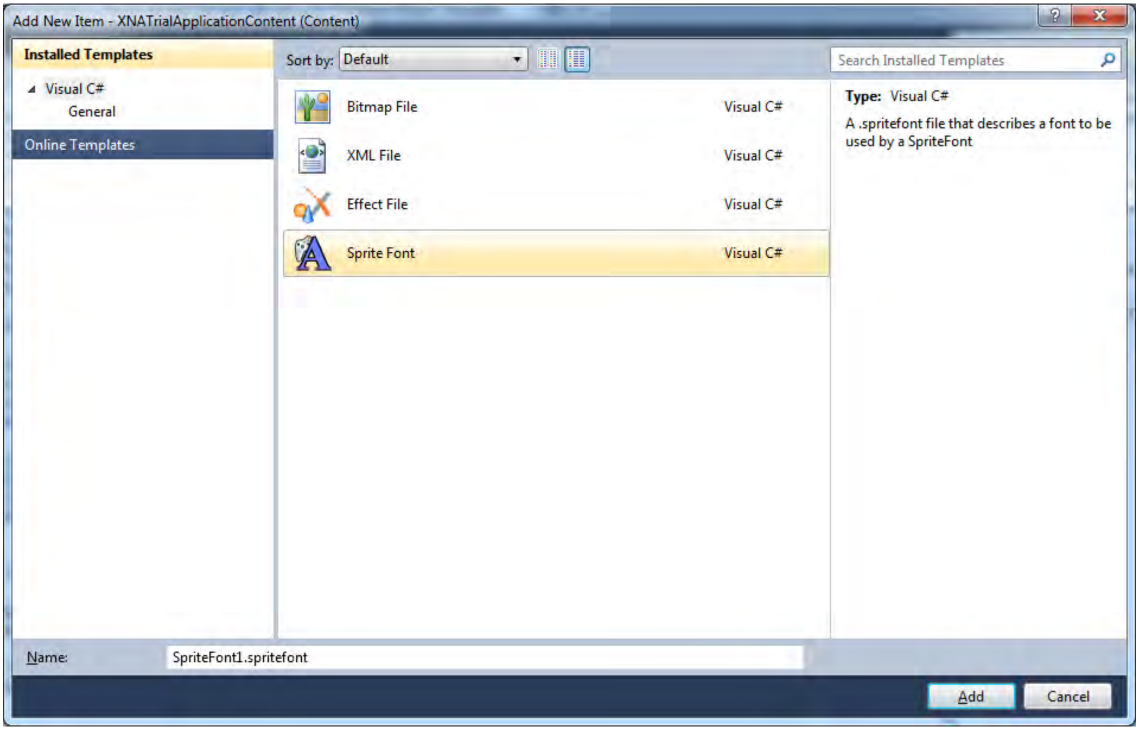
As stated before, Marketplace informs the application if it has been bought or if it is in trial mode. So when you test your application in the emulator or from your device, and the application is not being installed by Marketplace, both the `IsTrial` method and the `IsTrialMode` property return `false`. Therefore, it is not so easy to test the application functionalities in trial mode. By the way, there are a lot of solutions that you can implement to resolve this behavior and decide when to run the application in trial mode or full mode. It has been suggested that you could create your own version of the `LicenseInformation` class, use the var keyword to define the object instanciated from it, and specify via an internal member field whether the application is a trial or not. After testing the code, you could simply remove the class from the project and change a few other code rows. But we don't like this solution, because the XNA framework provides the `SimulateTrialMode` property from the `Guide` class, which enables you to specify when the application is in trial mode (by setting the property to `true`) or not (by setting the property to `false`).

The `Guide` class can be used with Silverlight applications too. This is an example of using mixed code between the XNA and Silverlight frameworks. As stated in a previous recipe, the only mixed code that is prohibited is that related to graphics context. We prefer to use the `Guide` class in Silverlight because it is already provided by the XNA framework, and even if you have to reference the XNA assembly in your project, using `Guide` doesn't add any extra space in the XAP application's distribution file.

Finally, it is a good practice to ask users whether they want to buy the full application before exiting from it. If they agree to buy the full application, you have to show the related Marketplace page. This can be accomplished by using either the Marketplace APIs such as the `MarketplaceDetailTask` and `MarketplaceReviewTask` classes or the `ShowMarketplace` method from the `Guide` class.

We have created two examples to show different trial approaches in Silverlight and XNA Windows Phone applications. Both examples use the `Guide` class from the `Microsoft.Xna.Framework.GamerServices` namespace, but they differ in their event handlers. These two applications print a message on the screen telling users that the application is running in trial mode.

In the XNA world, everything is a sprite, so the same is true for text. To print text on the screen, you have to use a sprite font. You can add a font in the Content project (in the example, this is called `XNATrialApplicationContent`) from Visual Studio 2010 by selecting Project ➤ Add New Item. From the dialog box that appears, you then have to select the Sprite Font item and give it a name (see Figure 1-14).



Add New Item - XNATrialApplicationContent (Content)

Bitmap File	Visual C#
XML File	Visual C#
Effect File	Visual C#
Sprite Font	Visual C#

Type: Visual C#

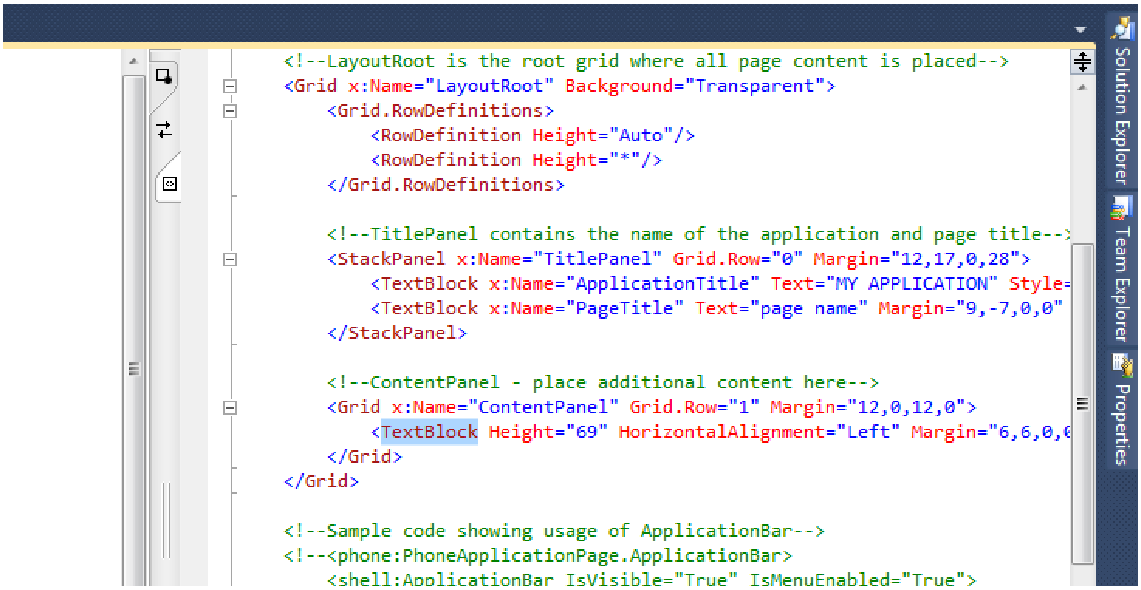
A .spritefont file that describes a font to be used by a SpriteFont

Name: SpriteFont1.spritefont

Figure 1-14. Add a sprite font to the XNA game.

The `.spritefont` file added to the project is an XML file containing the font's characteristics such as font family, dimension, and style. You can edit this file to change the font's characteristics. Moreover, the Asset Name property is important because it represents the name of the font that you have to refer to in your code (press F4 to see the font's properties).

`SilverlightTrialApplication` uses a new text block added to the main content panel, and its text is used to show the message. To add a new text block, you can either drag it from the toolbox or type the XAML code in the editor (see Figure 1-15).



```
<!--LayoutRoot is the root grid where all page content is placed-->
<Grid x:Name="LayoutRoot" Background="Transparent">
    <Grid.RowDefinitions>
        <RowDefinition Height="Auto"/>
        <RowDefinition Height="*"/>
    </Grid.RowDefinitions>

    <!--TitlePanel contains the name of the application and page title-->
    <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
        <TextBlock x:Name="ApplicationTitle" Text="MY APPLICATION" Style=
        <TextBlock x:Name="PageTitle" Text="page name" Margin="9,-7,0,0"
    </StackPanel>

    <!--ContentPanel - place additional content here-->
    <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
        <TextBlock Height="69" HorizontalAlignment="Left" Margin="6,6,0,
    </Grid>
</Grid>

<!--Sample code showing usage of ApplicationBar-->
<!--<phone:PhoneApplicationPage.ApplicationBar>
    <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
```

Figure 1-15. Adding a **`TextBlock`** *control to the main content panel*

The Code

In the XNA game application, we use the `Draw` event handler to show a message indicating that the application is in trial mode. We add a class Boolean field to store the value from the `IsTrialMode` property of the `Guide` class. This is suggested by Microsoft because reading the `IsTrialMode` property for each instance consumes more time, and in a game, saving time is very important! This operation is accomplished in the `Initialize` method, where another interesting feature is present. The `#DEBUG` compiler directive is used to set the `SimulateTrialMode` property. In that way, when the application is compiled with debug settings, you can simulate the trial mode and test your code.

The `Draw` method uses the `IsTrial` property to check that the application is in trial mode and uses the `DrawString` method in the affirmative case. The `DrawString` method is necessary for printing information on the screen. This method accepts the sprite font object, the message to show, the X,Y position indicating where to print the message, and the font color to use. The sprite font object is loaded in the `LoadContent` method.

Finally, in the `OnExiting` event handler, we add the code to ask users to buy the application. The `Guide` class provides the `ShowMarketplace` method to accomplish that. Internally, the method already checks for the `IsTrialMode` property, so it is not necessary to add this check too.

```
namespace XNATrialApplication
{
    /// <summary>
    /// This is the main type for your game
    /// </summary>
    public class Game1 : Microsoft.Xna.Framework.Game
    {
        GraphicsDeviceManager graphics;
        SpriteBatch spriteBatch;
        SpriteFont font;
        bool isTrial = false;

. . .

        /// <summary>
        /// Allows the game to perform any initialization it needs to
        /// before starting to run.
        /// This is where it can query for any required services and load any non-graphic-
        /// related content.  Calling base.Initialize will enumerate through any components
        /// and initialize them as well.
        /// </summary>
        protected override void Initialize()
        {
#if DEBUG
            Guide.SimulateTrialMode = true;
#endif

            isTrial = Guide.IsTrialMode;

            base.Initialize();
        }

        /// <summary>
        /// LoadContent will be called once per game and is the place to load
        /// all of your content.
        /// </summary>
        protected override void LoadContent()
        {
            // Create a new SpriteBatch, which can be used to draw textures.
            spriteBatch = new SpriteBatch(GraphicsDevice);

            // TODO: use this.Content to load your game content here
            font = this.Content.Load<SpriteFont>("Font");
        }

. . .

        /// <summary>
        /// This is called when the game should draw itself.
        /// </summary>
        /// <param name="gameTime">Provides a snapshot of timing values.</param>
        protected override void Draw(GameTime gameTime)
        {
            GraphicsDevice.Clear(Color.CornflowerBlue);
            if (isTrial)
            {
                spriteBatch.Begin();
                spriteBatch.DrawString(font, "The Application is in Trial Mode",
                                        new Vector2(10, 10), Color.Black);
                spriteBatch.End();
            }

            base.Draw(gameTime);
        }

        protected override void OnExiting(object sender, EventArgs args)
        {
            Guide.ShowMarketplace(PlayerIndex.One);

            base.OnExiting(sender, args);
        }
    }
}
```

Writing text in the SilverlightTrialApplication application is easier than XNA application. The lbMessage TextBlock control provides the Text property, where you can specify the string message to print. In the MainPage.xaml code, you can specify the Loaded event, and in the related code-behind method, you can check whether the application is in trial mode.

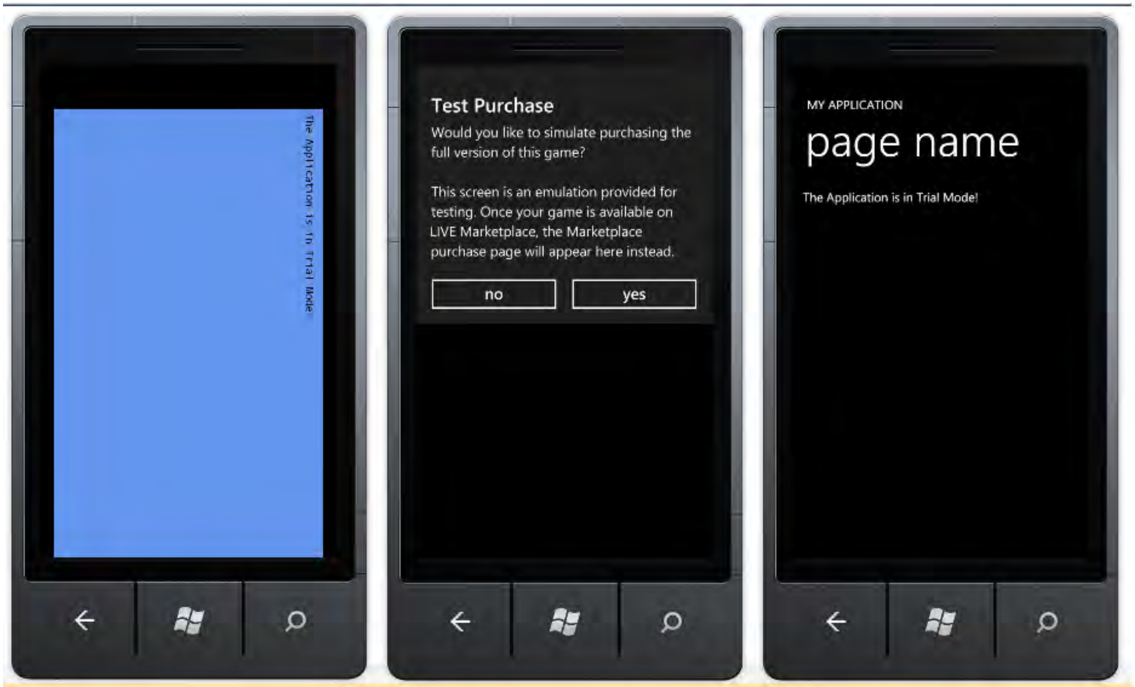
```
<phone:PhoneApplicationPage
    x:Class="SilverlightTrialApplication.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="Portrait" Orientation="Portrait"
    shell:SystemTray.IsVisible="True" Loaded="PhoneApplicationPage_Loaded">

    <!--LayoutRoot is the root grid where all page content is placed-->
    <Grid x:Name="LayoutRoot" Background="Transparent">
        <Grid.RowDefinitions>
            <RowDefinition Height="Auto"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>
        <!--TitlePanel contains the name of the application and page title-->
        <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
            <TextBlock x:Name="ApplicationTitle" Text="MY APPLICATION"
Style="{StaticResource PhoneTextNormalStyle}"/>
            <TextBlock x:Name="PageTitle" Text="page name" Margin="9,-7,0,0"
Style="{StaticResource PhoneTextTitle1Style}"/>
        </StackPanel>

        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
             <TextBlock Height="69" HorizontalAlignment="Left" Margin="6,6,0,0"
Name="lbMessage" Text="" VerticalAlignment="Top" Width="450" />
        </Grid>
    </Grid>
</phone:PhoneApplicationPage>


namespace SilverlightTrialApplication
{
    public partial class MainPage : PhoneApplicationPage
    {
        // Constructor
        public MainPage()
        {
            InitializeComponent();

#if DEBUG
            Guide.SimulateTrialMode = true;
#endif
        }

        private void PhoneApplicationPage_Loaded(object sender, RoutedEventArgs e)
        {
            if (Guide.IsTrialMode)
            {
                lbMessage.Text = "The Application is in Trial Mode!";
            }
        }
    }
}
```

Finally, in the `App.xaml.cs` code, the `Application_Closing()` event handler is defined and is called by the Windows Phone operating system before closing the application. It is the best place to insert the call to the `ShowMarketplace` method.

```
        // Code to execute when the application is closing (eg, user hit Back)
        // This code will not execute when the application is deactivated
        private void Application_Closing(object sender, ClosingEventArgs e)
        {
            Guide.ShowMarketplace(PlayerIndex.One);
        }
```

Usage

When both applications run, they check for trial mode and then print the appropriate message on the screen. When both applications close, they show a message asking users to buy the application. In Figure 1-16, you can see both examples' output. On the left is the XNA application, in the middle is the common screenshot asking to buy the application, and finally on the right is the Silverlight application.



The Application is in Trial Mode

Test Purchase

Would you like to simulate purchasing the full version of this game?

This screen is an emulation provided for testing. Once your game is available on LIVE Marketplace, the Marketplace purchase page will appear here instead.

The Application is in Trial Mode!

Figure 1-16. `XNATrialApplication` and `SilverlightTrialApplication` outputs

CHAPTER 2

Windows Phone 7 Execution Model

In this chapter, you are going to examine the Windows Phone 7 execution model. First, you will examine the navigation of pages in a Windows Phone 7 application. Then you will focus your attention on how the Windows Phone 7 operating system manages running applications.

The recipes in this chapter describe how to do the following:

- 2-1. Navigate the Windows Phone 7 application's pages
- 2-2. Pass parameters through pages
- 2-3. Use global defined variables
- 2-4. Use the State dictionary to store the application's global variables
- 2-5. Manage tombstoning
- 2-6. Manage tombstoning in XNA
- 2-7. Manage `Obscured` and `Unobscured` events

2-1. Navigating Between Pages

Problem

You have a Windows Phone 7 Silverlight application with more than one page and you need to navigate through the pages.

Solution

You have to use the `NavigationService` class (see Figure 1-1 to see its class diagram) and, optionally, the `OnNavigatedTo` and `OnNavigatedFrom` event handlers (see Recipe 2-4 for more on this).

How It Works

The Windows Phone 7 Silverlight application is based on pages and a frame. The latter is the top-level container that provides features such as page orientation and reserves space for the pages' rendering and status bar. The Frame contains one or more pages and provides the navigation service to go through the pages.

A page is a container for Silverlight controls that is rendered in a space reserved by the frame. The page optionally provides the application bar (see Chapter 3), which is used to provide a page menu and a toolbar.

The `PhoneApplicationPage` class provides developers everything needed to manage a page. On the other hand, the `PhoneApplicationFrame` class represents the frame.

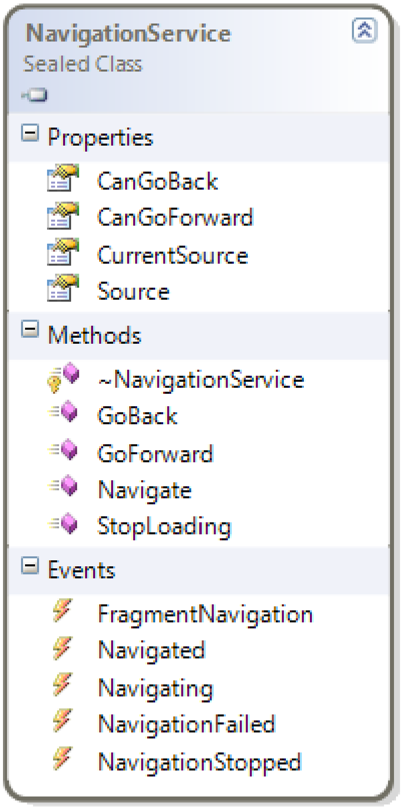


***Figure 2-1.** The NavigationService class diagram*

The `NavigationServices` property of the `PhoneApplicationClass` class enables developers to access the frame's navigation service and use the `Navigate` method. This method has one parameter, which is the `Uri` object containing the URL of the target page. This `Uri` constructor has two parameters: the former is the string containing the URL of the page, and the latter is the `UriKind` enumeration, where you can set whether the URL is relative or absolute.

```
public bool Navigate(
        Uri source
)
```

Another useful method provided by the `NavigationServices` class is `GoBack`. This method simulates the hardware Back button press in going one page back. You can use the `CanGoBack` property to retrieve a Boolean value indicating whether you can go back to the previous page (`true`) or not (`false`).

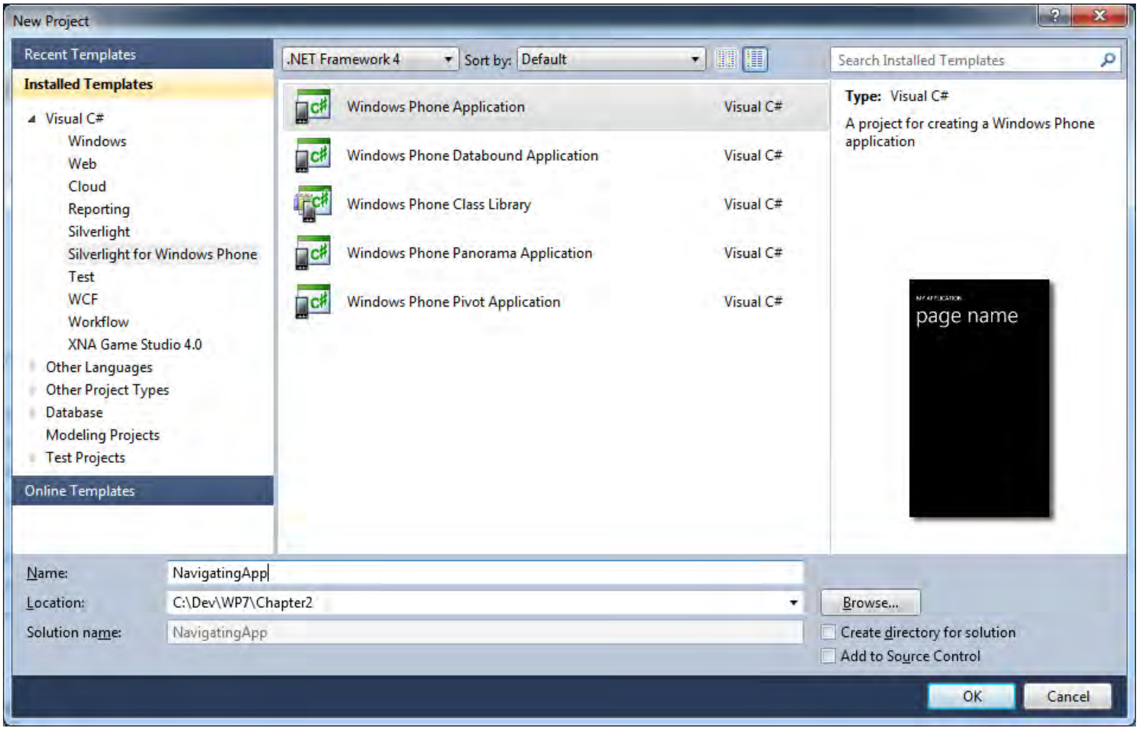
```
public void GoBack()
public bool CanGoBack { get; }
```

■ **Note** The `NavigationServices` class provides the `GoForward` method too, but because there is no forward navigation in a Windows Phone 7 application, this method always returns an exception.

The Code

To demonstrate simple navigation between two pages, we have created the `NavigatingApp` Silverlight application.

Start Visual Studio 2010 and choose New Project from the Start page and then select the Windows Phone Application template. In the Name text box of the New Project dialog box, type`NavigatingApp` (see Figure 2-2).


New Project
Recent Templates
Installed Templates
Visual C#
Windows
Web
Cloud
Reporting
Silverlight
Silverlight for Windows Phone
Test
WCF
Workflow
XNA Game Studio 4.0
Other Languages
Other Project Types
Database
Modeling Projects
Test Projects
Online Templates
Windows Phone Application Visual C#
Windows Phone Databound Application Visual C#
Windows Phone Class Library Visual C#
Windows Phone Panorama Application Visual C#
Windows Phone Pivot Application Visual C#
Search Installed Templates
page name
Browse...
OK
Cancel

.NET Framework 4

Sort by: Default

Type: Visual C#

A project for creating a Windows Phone application

Name: NavigatingApp

Location: C:\Dev\WP7\Chapter2

Solution name: NavigatingApp

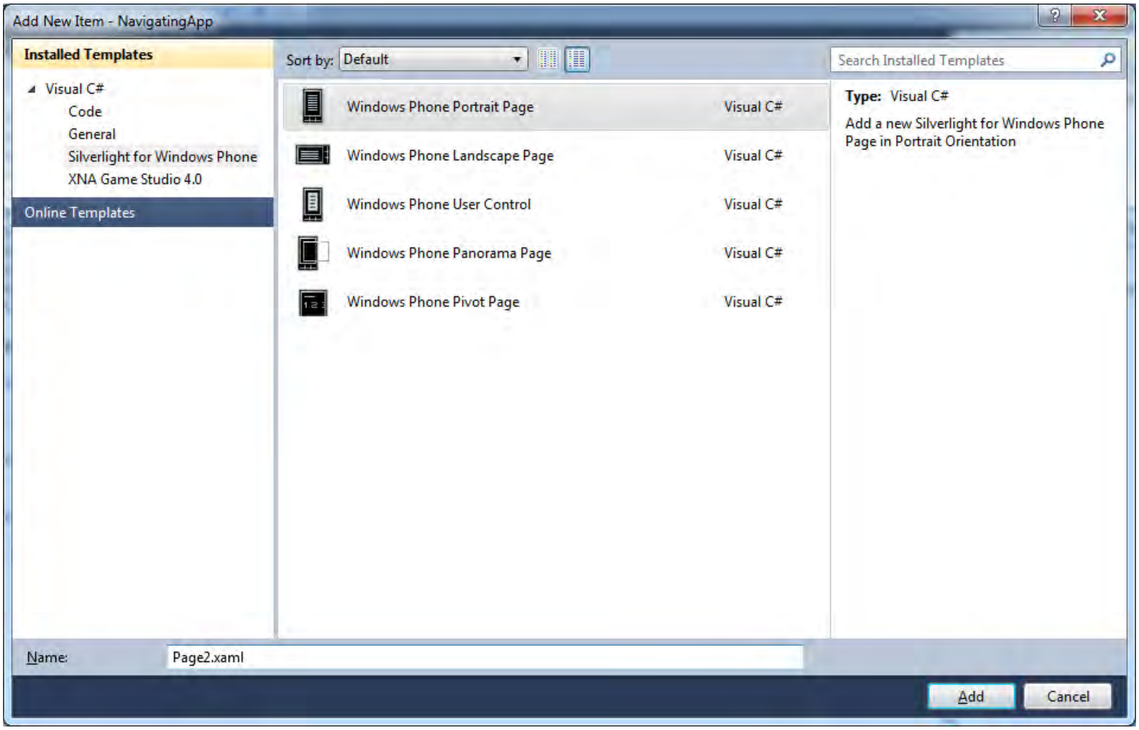
□ Create directory for solution

□ Add to Source Control

Figure 2-2. Creating the **`NavigatingApp`** *application*

From the Solution Explorer window, right-click the `NavigatingApp` project name and choose Add New Item.

From the Add New Item dialog box, select the Silverlight for Windows Phone template from the Installed Templates list. Then select Windows Phone Portrait Page. Name the page `Page2.xaml` and then click OK (see Figure 2-3).


Add New Item - NavigatingApp
Installed Templates
Visual C#
Code
General
Silverlight for Windows Phone
XNA Game Studio 4.0
Online Templates
Sort by: Default
Search Installed Templates
Windows Phone Portrait Page Visual C#
Windows Phone Landscape Page Visual C#
Windows Phone User Control Visual C#
Windows Phone Panorama Page Visual C#
Windows Phone Pivot Page Visual C#
Add
Cancel

Type: Visual C#

Add a new Silverlight for Windows Phone Page in Portrait Orientation

Name: Page2.xaml

Figure 2-3. Adding a new page to the project

On both pages, you have to add a hyperlink button. In the `MainPage.xaml` page, add the following code between the `ContentPanel` grid tags:

```
. . .
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <HyperlinkButton x:Name="hbButton1" Content="Navigate to Page 2"
                             Click="hbButton1_Click"/></Grid>
. . .
```

In the `Page2.xaml` page, insert the following code:

```
. . .
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <HyperlinkButton x:Name="hbButton2" Content="Go back" Click="hbButton2_Click"/>
. . .
```

Both codes specify the `Content` attribute, used to define the text that will be shown in the page, and the `Click` event handler. In the event handler code, we find the navigation logic between the two pages.

In the MainPage.xaml.cs file, we find the Click event handler:

```
private void hbButton1_Click(object sender, RoutedEventArgs e)
{
    this.NavigationService.Navigate(new Uri("/Page2.xaml", UriKind.Relative));
}
```

Because the event handler is defined in the MainPage class that derives from the PhoneApplicationPage class, you can have direct access to the NavigationService property. By using the Navigate method, you can go to Page2.xaml. Note the relative URL attribute specified by the UriKind enumeration. This indicates that the URL is relative to the root application path. Because Page2.xaml is stored at the same level as MainPage.xaml—that is, the root—we can use that simple form.

In the Page2.xaml.cs file, we find the other Click event handler:

```
private void hbButton2_Click(object sender, RoutedEventArgs e)
{
    if (this.NavigationService.CanGoBack)
        this.NavigationService.GoBack();
}
```

First, you check whether you can go back to the previous page, and if you can, you call the GoBack method.

■ **Note** You could use the Navigate method in the Page2 event handler to pointing to MainPage. There is a side effect, however. As with browser navigation, pressing the Back button results in the application showing the previous page in the same state you left it. If you write the URL of the page and navigate to it, the browser shows a brand new page. The same occurs here: by using the Navigate method and specifying the URL of the MainPage.xaml page, you will obtain a fresh, new copy of the MainPage class.

Usage

In Visual Studio 2010, make sure your target is Windows Phone 7 Emulator and then press Ctrl+F5. The emulator will start, briefly showing the splash screen and then the main page. Click the hyperlink button to access the second page. Now click either the hyperlink button or the hardware Back button, and you will return to the main page.

■ **Note** If you use Navigate instead of GoBack to return to the main page and then press the hardware Back button, the application will not exit as you may expect but will showPage2 again. That's because each time you call the Navigate method, a brand new page is created and loaded, and the replaced page is put on the page stack. Pressing the hardware Back button of the Windows Phone 7 device goes away from the current page and pops the old page off the stack.

2-2. Passing Data Through Pages

Problem

You need to pass data from one page to another.

Solution

You can use the QueryString collection provided by the NavigationContext property from the PhoneApplicationPage class.

How It Works

The source page that has to pass parameters to the destination page can use the URL parameters' syntax:

```
/Page.xaml?param1=value&param2=value&...
```

■ **Note** According to the official documentation at http://msdn.microsoft.com/en-us/library/z6c2z492(v=VS.95).aspx, you will receive an exception when the length of the QueryString parameter exceeds 65,519 characters.

After the page name, the parameters' definition starts with a question mark and includes a series of key/value pairs separated by the ampersand character.

To retrieve the parameters' values in the destination page, you have to use the QueryString collection provided by the NavigationContext property of the PhoneApplicationPage class.

The Code

To demonstrate navigation between pages with the exchange of parameters, you have to create a new Windows Phone 7 Silverlight application and call it NavigatingWitParamsApp. As you did in Recipe 2-1, add a new page and call it Page2.xaml.

In MainPage.xaml, you have to add three hyperlink buttons. You then define for each of them a Click event handler. You can take advantage of the TabIndex property to set the value you want to pass to Page2. Let's see the XAML code of the MainPage page:

```
<!--ContentPanel - place additional content here-->
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
    <StackPanel Orientation="Vertical" >
        <HyperlinkButton Content="Option 1" Click="HyperlinkButton_Click"
                         TabIndex="1" />
```

```
            <HyperlinkButton Content="Option 2" Click="HyperlinkButton_Click"
                             TabIndex="2" />
            <HyperlinkButton Content="Option 3" Click="HyperlinkButton_Click"
                             TabIndex="3" />
        </StackPanel>
    </Grid>
```

In the code of the Click event handler, you can call the Navigate method, passing the parameter that represents the index of the pressed hyperlink button:

```
private void HyperlinkButton_Click(object sender, RoutedEventArgs e)
{
    HyperlinkButton hb = sender as HyperlinkButton;
    string url = string.Format("/Page2.xaml?ID={0}", hb.TabIndex);
    this.NavigationService.Navigate(new Uri(url, UriKind.Relative));
}
```

The sender object passed to the Click event handler represents the hyperlink button that raised the event. You can cast it to a HyperlinkButton object so you can use its TabIndex property and pass it to the Page2 page.

In the Page2.xaml file, you add a TextBlock control that will show a message indicating which button has been pressed in the MainPage page. As you can see in the following code, it is worth noting the PhoneTextTitle3Style static resource that is part of the theme resources for Windows Phone (see Recipe 3-5).

```
<!--ContentPanel - place additional content here-->
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
    <TextBlock x:Name="lbText" Style="{StaticResource PhoneTextTitle3Style}" />
</Grid>
```

In the Page2.xaml.cs file, you have to add the Page_Loaded event handler, where you will retrieve the parameter value passed by the source page.

```
private void PhoneApplicationPage_Loaded(object sender, RoutedEventArgs e)
{
    lbText.Text = string.Format("You clicked the option number {0}",
                                this.NavigationContext.QueryString["ID"]);
}
```

The Loaded event is raised when the page is fully created and every control is loaded. So you are sure here that the TextBlock is ready to show the Text property you set to the message. The event handler name must be specified in the XAML code of Page2.xaml as well:

```
<phone:PhoneApplicationPage
    x:Class="NavigatingWithParamsApp.Page2"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="Portrait" Orientation="Portrait"
    mc:Ignorable="d" d:DesignHeight="768" d:DesignWidth="480"
    shell:SystemTray.IsVisible="True" Loaded="PhoneApplicationPage_Loaded">

    ...
```

Usage

From Visual Studio 2010, make sure your target is Windows Phone 7 Emulator and press Ctrl+F5. The emulator will start, briefly showing the splash screen and then the main page (see Figure 2-4).

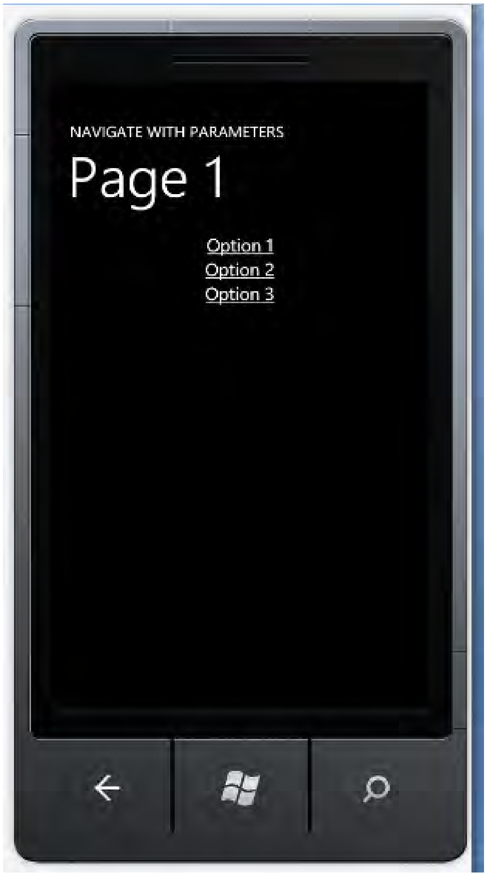
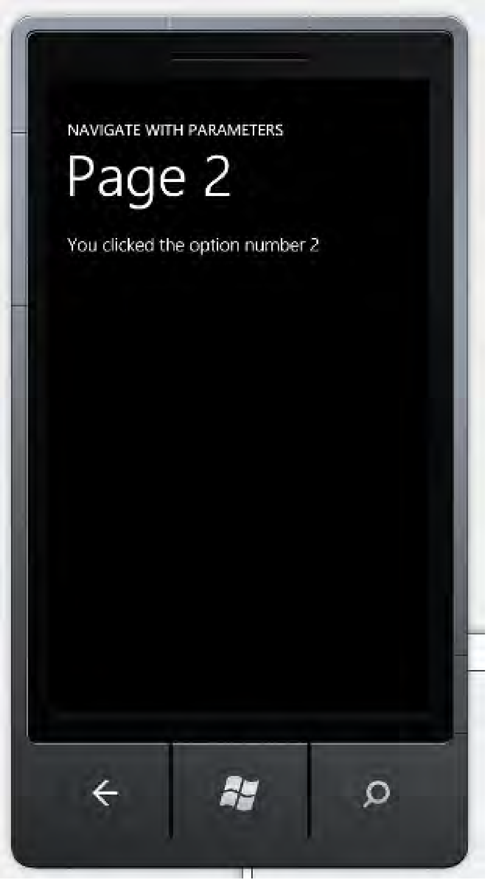


Figure 2-4. *The source page of the* `NavigatingWithParamsApp` *application*

Select one option of your choice, and the application will show the Page2 page with a message telling which option you selected. For example, in our case we clicked Option 2; Figure 2-5 shows the related message.



NAVIGATE WITH PARAMETERS

Page 2

You clicked the option number 2

Figure 2-5. *The second page shows the index of the clicked hyperlink button.*

2-3. Navigating Between Pages by Using Global Application Variables

Problem

You have to navigate between pages sharing data across them. You want to avoid using a query string because your application has a lot of pages, and you need a smart way to share data between pages.

Solution

You can add a public property to the `App` class and retrieve its value by using the `Current` static property provided by the `Application` class.

How It Works

The Windows Phone 7 Silverlight application always provides a class deriving from the `Application` class: the `App` class. This class represents the running application itself with a reference to the root frame and pages. See Recipe 1-3 for more details.

Defining a property in the `App` class ensures that the property is visible to all pages. At any time and from any page, you can use the `Current` static property from the `Application` class to retrieve a reference to the current `App` object. By using the instance of this object, you can easily either retrieve the property value or set it.

The Code

Create a new Windows Phone 7 Silverlight application called `NavigatingWithGlobalVariableApp` from Visual Studio 2010. Add two new pages called `Page2.xaml` and `Page3.xaml`by choosing Project Add New Item.

In the `App.xaml.cs` file, we added a Boolean property that represents the user's choice to have all red pages in the application.

```
public partial class App : Application
{
    /// <summary>
    /// Provides easy access to the root frame of the Phone Application.
    /// </summary>
    /// <returns>The root frame of the Phone Application.</returns>
    public PhoneApplicationFrame RootFrame { get; private set; }

    public bool RedPages { get; set; }
```

```
        /// <summary>
        /// Constructor for the Application object.
        /// </summary>
        public App()
        {
. . .
```

In the MainPage.xaml file, we added a check box and two hyperlink buttons. The check box has two event handlers to manage selected and deselected states. When the check box is selected, the background of every page will be red; otherwise, it will be black.

```
. . .
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <StackPanel>
                <CheckBox x:Name="chkRedColor" Content="I want all red pages"
                          Checked="chkRedColor_Checked" Unchecked="chkRedColor_Unchecked" />
                <HyperlinkButton Content="Navigate to page2" x:Name="hbToPage2"
                          Click="hbToPage2_Click" />
                <HyperlinkButton Content="Navigate to page3" x:Name="hbToPage3"
                          Click="hbToPage3_Click" />
            </StackPanel>
        </Grid>
. . .
```

In the Checked and Unchecked event handlers' code, we set the RedPages Boolean to true and false, respectively. Moreover, we change the background color properly.

```
        private void chkRedColor_Checked(object sender, RoutedEventArgs e)
        {
            App a = Application.Current as App;
            a.RedPages = true;
            ContentPanel.Background = new SolidColorBrush(Colors.Red);
        }

        private void chkRedColor_Unchecked(object sender, RoutedEventArgs e)
        {
            App a = Application.Current as App;
            a.RedPages = false;
            ContentPanel.Background = new SolidColorBrush(Colors.Black);
        }
```

As usual, both hyperlink buttons' event handlers contain the code to navigate to the other pages.

```
        private void hbToPage2_Click(object sender, RoutedEventArgs e)
        {
            this.NavigationService.Navigate(new Uri("/Page2.xaml", UriKind.Relative));
        }
```

```
private void hbToPage3_Click(object sender, RoutedEventArgs e)
{
    this.NavigationService.Navigate(new Uri("/Page3.xaml", UriKind.Relative));
}
```

In `Page2.xaml` and `Page3.xaml`, we added the `Loaded` event handler. In the related code, we retrieved the `RedPages` Boolean property, setting the page's background color accordingly.

```
private void PhoneApplicationPage_Loaded(object sender, RoutedEventArgs e)
{
    App a = Application.Current as App;
    if (a.RedPages == true)
        ContentPanel.Background = new SolidColorBrush(Colors.Red);
}
```

Usage

Run the application from Visual Studio 2010, selecting Windows Phone 7 Emulator as the output target. From the main page, select the I Want All Pages Red check box. The background color turns red (see Figure 2-6).

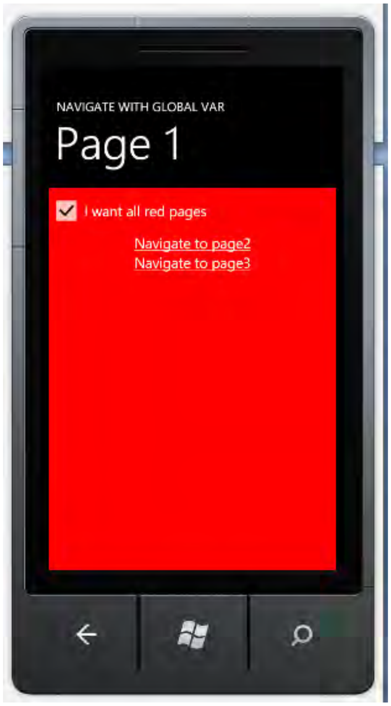


Figure 2-6. `NavigatingWithGlobalVariableApp` in action

Click the check box again to deselect it, and the main page's background color turns black. Select the check box once more and then press the Navigate to page2 hyperlink button. The `Page2` background color is red (see Figure 2-7).

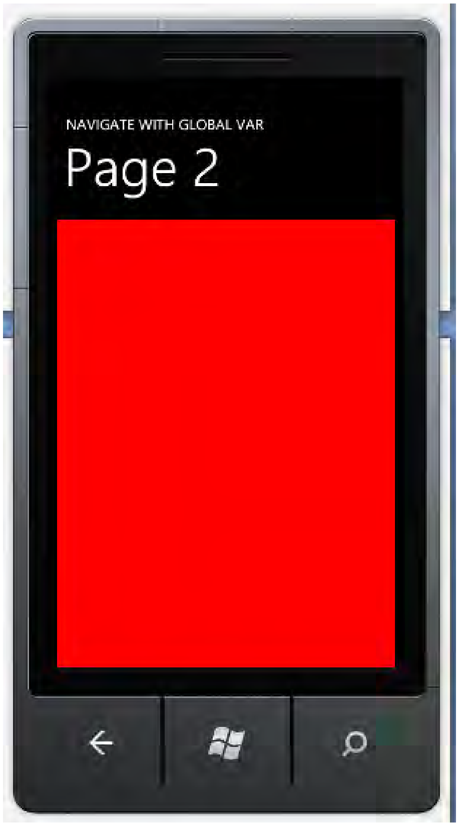


Figure 2-7. *Evenpage 2 has the background color set to red.*

2-4. Navigating Between Pages with State

Problem

You have to navigate between pages, and you want to store a complex object that is not suitably stored via the query string method. You need to store the object to prevent tombstoning.

Solution

You should use the State dictionary provided by the PhoneApplicationService class.

How It Works

Sometimes you have to share data between pages that is not suitable for the QueryString property—for instance, when you have to provide a complex object such as an array or list to another page. Moreover, the QueryString property can accept up to 65,519 characters from the Uri object.

Windows Phone 7 helps developers via the State dictionary, which is provided by the PhoneApplicationService class included in the Microsoft.Mobile.Shell namespace.

The PhoneApplicationService class includes the Current static property that retrieves the PhoneApplicationService object related to the current application. By using this object, you can use the State property to store data across pages. Moreover, the PhoneApplicationService automatically manages the application's idle behavior and the application's state when it becomes either active or inactive.

Indeed, managing active and inactive states is an important aspect of Windows Phone 7 life-cycle application management that a developer has to consider. During the application usage, a lot of external events may occur, and the developer has to provide the right solutions to avoid a bad user experience. For example, imagine that a user is filling in a form on the page you provided when that user remembers an important e-mail that needs to be sent immediately. The user presses the hardware Start button, and your application becomes inactive. After the e-mail is sent, the user presses the hardware Back button until the application becomes active again. How would the user react if all data in the form was lost?

To provide a complex object to another page, you could use the global application variable technique too (see Recipe 2-3). But what is provided here for free is tombstoning management. When the application is deactivated because of an external event such as the hardware Start button being pressed, the State dictionary is serialized and stored automatically by the Windows Phone 7 operating system. If the application is activated again—not by launching the application from the Start menu but by going back via the hardware Back button—the State dictionary is deserialized and provided to the application. That's why the State dictionary has to contain only serializable objects.

As already stated in Recipe 2-1, when the Navigate method is called, a brand new page is created and shown. So if your text boxes are blank by default, when the application is activated from the Windows Phone operating system, the page will show empty text boxes.

To manage this aspect and avoid this application behavior, you can implement the code in the OnNavigatedFrom and the OnNavigatedTo event handlers provided by the PhoneApplicationPage class. The OnNavigatedFrom event is raised just before the user is going to navigate off the page. This event handler is the right place to insert the code that saves your data. The OnNavigatedTo event is raised just after the page is shown because of navigation either from another page or from the Windows Phone 7 operating system.

Both event handlers provide a NavigationEventArgs object that provides some interesting properties such as the Uri of the target page or the target application, and the target Content object. For example, in the OnNavigatedFrom event handler, the Content property contains the MainPage object when you come back to the starting page from page 2. On the other hand, when the application is deactivated, the Content property is null and the Uri is set to the app://external/ value.

Another useful property provided by the PhoneApplicationPage class is State. Do not confuse this with the one provided by the PhoneApplicationService class. The one provided by the page is not shared through the application but is for the page only. This is great for storing page data such as text-box values, check-box selections, and so on.

The Code

To demonstrate navigation between pages with a complex data object exchanged, we will create a new Windows Phone 7 Silverlight application called NavigatingWithStateApp. In this application, MainPage will show a message taking the first name, last name, and city strings provided by the Page2 page. Those strings are defined in a new class called Person.

```
using System;

namespace NavigatingWithStateApp
{
    public class Person
    {
        public string FirstName { get; set; }
        public string LastName { get; set; }
        public string City { get; set; }

        public Person() { }
    }
}
```

The class must be serializable and must provide a public parameterless constructor (if you don't specify it, the compiler will create it for you).

In MainPage.xaml, we added a TextBlock control to show the message, and a hyperlink button to navigate to the second page.

```
. . .
<!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <TextBlock x:Name="tbMsg" />
            <HyperlinkButton x:Name="hlNavigate" Content="Navigate to Page 2"
                             Click="hlNavigate_Click"/>
        </Grid>
. . .
```

In the MainPage.xaml.cs source code, we added the Loaded event handler, which builds the string to be shown only when the State dictionary returned by the PhoneApplicationService's Context property contains the Person object saved in the Page2.

```
        private void PhoneApplicationPage_Loaded(object sender, RoutedEventArgs e)
        {
            if (PhoneApplicationService.Current.State.ContainsKey("Person"))
            {
                Person p = (Person)PhoneApplicationService.Current.State["Person"];

                tbMsg.Text = string.Format("Welcome {0} {1} from {2}", p.FirstName,
                                                                       p.LastName, p.City);
            }
        }
```

As already done in previous recipes, we add another page called Page2.xaml. In the Page2.xaml page, we add three TextBox controls and one Button control:

```
. . .
<!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <StackPanel>
                <TextBox x:Name="txtName" Text="FirstName" GotFocus="txt_GotFocus" />
                <TextBox x:Name="txtLast" Text="LastName" GotFocus="txt_GotFocus" />
                <TextBox x:Name="txtCity" Text="City" GotFocus="txt_GotFocus" />
                <Button x:Name="btnSave" Content="Save" Click="btnSave_Click" />
            </StackPanel>
        </Grid>
. . .
```

Every TextBox control implements GotFocus, so when the TextBox receives the focus, it will select its own text:

```
        private void txt_GotFocus(object sender, RoutedEventArgs e)
        {
            TextBox txt = sender as TextBox;
            txt.SelectAll();
        }
```

■ **Tip** This technique is done to avoid using labels; by showing the string, the text box indicates what its content should be.

The Save button calls the SaveOrUpdate method, which stores the text boxes' text into a Person object. First, the method checks whether the State dictionary of Page2 already contains a Person object. If it does, the method retrieves the object and changes its value. Otherwise, the method creates a brand new object, filling it with the text boxes' values. In both cases, the last instruction is used to store the Person object in the State dictionary of Page2.

Only when the SaveOrUpdate method is called via the Save button is the State dictionary (provided by the Context property of the PhoneApplicationService)populated with the Person object. In this way, the main page will show the message only when the user saves data. If you don't separate the two State dictionaries, and use the PhoneApplicationService's one to store text-box values both on a save operation and on tombstoning, you will have to implement a technique to know when MainPage has to manage data and when it does not.

```
        private void SaveOrUpdate(bool isSaved)
        {
            Person p = null;
            if (this.State.ContainsKey("Person"))
            {
                p = (Person) this.State["Person"];
                p.FirstName = txtName.Text;
                p.LastName = txtLast.Text;
                p.City = txtCity.Text;
            }
            else
            {
                p = new Person();
                p.FirstName = txtName.Text;
                p.LastName = txtLast.Text;
                p.City = txtCity.Text;
            }

            if (isSaved)
            {
                PhoneApplicationService.Current.State["Person"] = p;
            }

            this.State["Person"] = p;
        }
```

The core of this example is the code in the `OnNavigatedFrom` and `OnNavigatedTo` event handlers. In the former, the `SaveOrUpdate` method is called again so that when the application is deactivated, the user doesn't lose data. The method will not be called when the user presses the hardware Back button, because in this case its behavior is similar to the Cancel button in a dialog box. Retrieving when the hardware Back button is pressed is accomplished by checking the `Content` property of the `NavigationEventArgs` object passed to the event handler.

```
        protected override void
        OnNavigatedFrom(System.Windows.Navigation.NavigationEventArgs e)
        {
            if (e.Content == null)
            {
                SaveOrUpdate(false);
            }

            base.OnNavigatedFrom(e);
        }
```

In the OnNavigatedTo event handler, we simply check whether the State dictionary from the Page2 class contains the Person object and then we eventually fill the text boxes' text with its values.

```
protected override void OnNavigatedTo(System.Windows.Navigation.NavigationEventArgs
                                      e)
{
    if (this.State.ContainsKey("Person"))
    {
        Person p = (Person)this.State["Person"];
        txtName.Text = p.FirstName;
        txtLast.Text = p.LastName;
        txtCity.Text = p.City;
    }

    base.OnNavigatedTo(e);
}
```

Finally, the Save button code calls the SaveOrUpdate method, passing a true value to indicate that it will have to save the Person object into the PhoneApplicationService's State dictionary.

```
private void btnSave_Click(object sender, RoutedEventArgs e)
{
    SaveOrUpdate(true);
    this.NavigationService.GoBack();
}
```

Usage

From Visual Studio 2010, run the application after checking that the target is set to Windows Phone 7 Emulator. The main page will be shown briefly with just the link to navigate to the second page (see Figure 2-8).

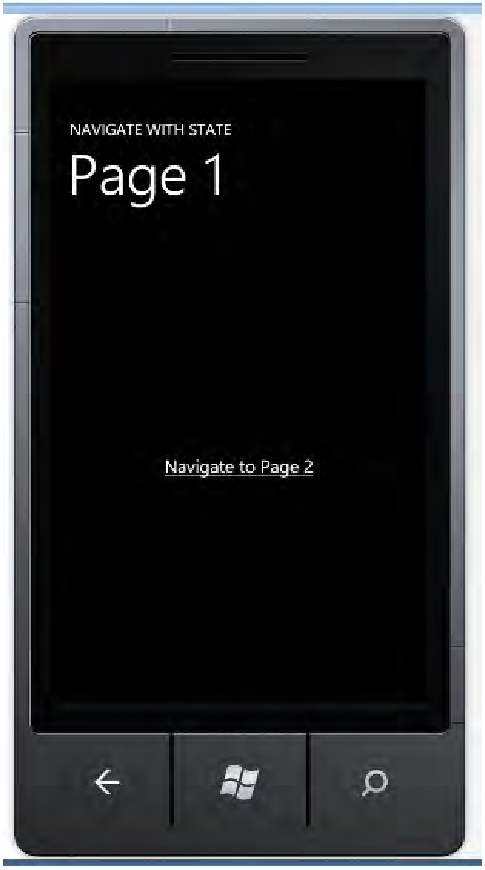
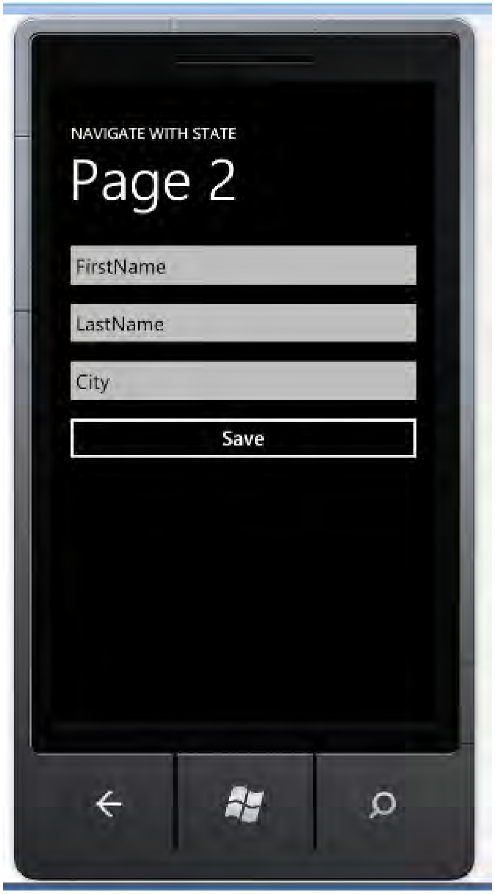


Figure 2-8. The ***NavigatingWithStateApp*** *application's first page*

By pressing the hyperlink button, you go to the second page, shown in Figure 2-9.



NAVIGATE WITH STATE

Page 2

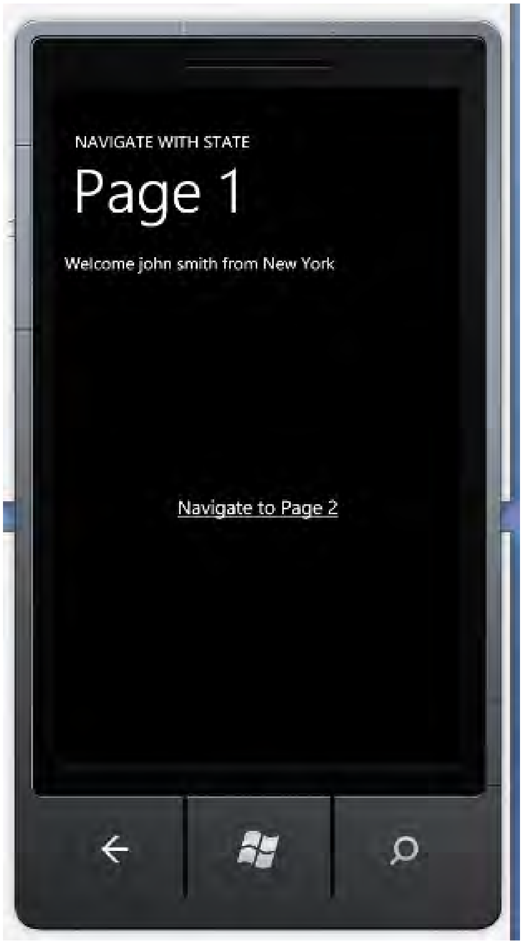
FirstName

LastName

City

Figure 2-9. The second page contains three text boxes and a button.

Now you can insert your credentials and press the Save button so the application returns to the start page and shows the message (see Figure 2-10).



NAVIGATE WITH STATE

Page 1

Welcome john smith from New York

Figure 2-10. *The main page greets the person you added from the page 2 form.*

Now let’s play a bit with the application and explore unexpected situations. Comment the code of the `OnNavigatedFrom` event handler from `Page2.xaml.cs` and restart the application. Go to page 2 and add some text to the text boxes. Press the hardware Start button, leaving the application, and then the hardware Back button. The application is resumed, but everything you inserted in text boxes is gone. Now redo the same steps, this time uncommenting the `OnNavigateFrom` code. The initial situation will be resumed, as you left it.

2-5. Managing Tombstoning in Windows Phone 7 Silverlight Applications

Problem

You have to manage tombstoning and store application data permanently so that when the application is either activated or executed, the application can reload data.

Solution

You have to use `IsolatedStorage` classes (see Chapter 6 for a full coverage on them) together with `Application` class event handlers: `Application_Launching`, `Application_Activated`, `Application_Deactivated`, and `Application_Closing`.

How It Works

The Windows Phone 7 operating system doesn't provide support for executing concurrent applications concurrently in the foreground. The application that you run on your phone is the only one executed in foreground, and no third-party application can run in the background. When you press the hardware Start button and run another application, the previous application is actually killed. This behavior is called *tombstoning*.

Let's take a look at an example. Say you press the hardware Start button and launch the Calendar application. You start to note an appointment with Company X, but you don't remember the name of the street where Company X is located. So you press the hardware Search button (in your application, the `Deactivated` event is raised), type the name of the company, and press the Enter key. The company site appears, and you click on it so Internet Explorer runs and the site is shown. You click the Contact Us link and read the company's address. Now you have two options:

- Press the hardware Start button and select the Calendar application again.
- Press the hardware Back button until you reach the Calendar application.

In the former case, you run a fresh new copy of the Calendar application, and everything you wrote before searching for the company's address is gone. In this case, the `Launching` event is raised.

In the latter case, you run a fresh new copy of the Calendar application, but the Windows Phone 7 operating system provides a collection of serializable objects in the `State` dictionary (as you saw in Recipe 2-4). So you will see your data again in the text boxes because Calendar developers have managed the tombstoning. In this case, the `Activated` event is raised.

There is another way to manage your application. You could store your data permanently. Indeed, the `State` dictionary is provided only when you activate the application with the hardware Back button and not when you launch it from the Start menu. You can use the four `Application` event handlers together with isolated storage in order to save data in the memory space reserved for the application.

■ **Note** There is no limited quota size for the storage of a Windows Phone 7 application. The application itself has to take care of the disk space avoiding useless information. When the application is removed from the phone, the isolated storage is removed as well.

The Code

To demonstrate how to manage the four `Application` event handlers in conjunction with the isolated storage, we will start to create an application that we will use throughout the book. The `7Drum` application provides useful tools to drummers who, for instance, want to plan their practices, record a groove they have in mind, or use a metronome during their drumming.

■ **Note** You can download this application code and all the source code shown in this book from the Source Code/Download area of the Apress website, `www.apress.com`.

In this particular case, we will focus our attention on the Training menu of the `7Drum` application, where the user can create a training plan specifying an exercise name, a description, and a duration. The application will provide three `TextBox` controls to contain that information. The code is contained in the `Exercise.xaml` page. It defines a new `Grid` with two columns and three rows within the `ContentPanel` grid. Finally, it adds three `TextBox` controls and three `TextBlock` controls as labels. It is worth noting the Description text box, which accepts more than one line of text thanks to the `AcceptReturns` property being set to `true`:

```
. . .
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <StackPanel>
                <Grid>
                    <Grid.RowDefinitions>
                        <RowDefinition Height="Auto"/>
                        <RowDefinition Height="Auto"/>
                        <RowDefinition Height="*"/>
                    </Grid.RowDefinitions>
                    <Grid.ColumnDefinitions>
                        <ColumnDefinition Width="Auto" />
                        <ColumnDefinition Width="*" />
                    </Grid.ColumnDefinitions>

                    <TextBlock Grid.Row="0" Grid.Column="0" Text="Name:"
                               Style="{StaticResource PhoneTextNormalStyle}"
                               VerticalAlignment="Center" />
                    <TextBox Grid.Row="0" Grid.Column="1" x:Name="txtName" />
                    <TextBlock Grid.Row="1" Grid.Column="0" Text="Description:"
                               Style="{StaticResource PhoneTextNormalStyle}"
                               VerticalAlignment="Center" />
                    <TextBox Grid.Row="1" Grid.Column="1" x:Name="txtDescription"
                               AcceptsReturn="True" Height="300"/>
                    <TextBlock Grid.Row="2" Grid.Column="0" Text="Duration:"
                               Style="{StaticResource PhoneTextNormalStyle}"
                               VerticalAlignment="Center" />
                    <TextBox Grid.Row="2" Grid.Column="1" x:Name="txtDuration"
                               InputScope="TelephoneNumber" KeyDown="txtDuration_KeyDown"/>
                </Grid>
            </StackPanel>
        </Grid>
. . .
```

In the Exercise.xaml.cs page, we have defined the code to save exercise planning. The Exercise page uses the ApplicationIconBar button (see more on this in Recipe 3-2), which calls the ApplicationBarIconSaveButton_Click event handler when clicked. The code first checks whether the page has to be shown in edit mode or whether the user is going to create a new exercise. This is accomplished by the QueryString property check. If the QueryString property contains an exercise identifier selected in the previous page—the Training page where all exercises are listed—then the user is going to modify the exercise. After that, if the Name and Duration text boxes contain values, a new ExerciseSettings object is created. It will contain values from the related page text boxes. The exercise identifier will be either created by calling the NewGuid static method from the Guid class or set equal to the one that has to be modified. As you will see shortly, the ExerciseSettings class contains everything necessary to store the exercise's information.

Finally, when the Save button is in modify mode, it retrieves the old exercise from the Exercises list, which is stored as a global variable in the Application class by using a LINQ query. This Exercise object is a reference to the stored exercise, so we can change its properties without changing the Guid identifier to modify the exercise.

```
    private void ApplicationBarIconSaveButton_Click(object sender, EventArgs e)
    {
        bool bNew = true;

        if (this.NavigationContext.QueryString.ContainsKey("Id"))
            bNew = false;
        else
            bNew = true;

        if (txtName.Text != string.Empty && txtDuration.Text != string.Empty)
        {
            ExerciseSettings exercise = null;

            if (!bNew)
            {
                exercise = (from ex in (Application.Current as App).Exercises
                             where ex.id == new
                             Guid(this.NavigationContext.QueryString["Id"])
                             select ex).SingleOrDefault<ExerciseSettings>();
            }
            else
            {
                exercise = new ExerciseSettings();
                exercise.id = Guid.NewGuid();
            }

            exercise.Description = txtDescription.Text;
            exercise.Name = txtName.Text;
            exercise.Duration = int.Parse(txtDuration.Text);

            if (bNew)
                (Application.Current as App).Exercises.Add(exercise);

            Clean();
        }
        else
            MessageBox.Show("Name and duration fields are mandatory.", "7Drum",
                            MessageBoxButton.OK);
    }
```

The ExerciseSettings class is used to store exercise data, and a collection of these objects is stored in the Application page.

```
    public class ExerciseSettings
    {
        public Guid id { get; set; }
        public string Name { get; set; }
        public string Description { get; set; }
        public int Duration { get; set; }
    }

    public partial class App : Application
    {
        /// <summary>
        /// Provides easy access to the root frame of the Phone Application.
        /// </summary>
        /// <returns>The root frame of the Phone Application.</returns>

. . .
        public List<ExerciseSettings> Exercises { get; private set; }

        /// <summary>
. . .
```

Let's discuss of the main part of the code, which handles tombstoning management. We created the ExerciseManager class, which contains the Load and Save methods. These methods, as their names indicate, are used to load exercises stored in isolated storage and to save them, respectively.

The Load static method returns a List<> collection of ExerciseSettings objects when exercises.xml is present in the application isoloated storage. Otherwise, the method returns an empty list.

■ **Note** This chapter does not cover isolated storage concepts in depth because Chapter 8 is dedicated to that topic.

```
public static List<ExerciseSettings> Load()
{
    List<ExerciseSettings> exercises = new List<ExerciseSettings>();

    IsolatedStorageFile storage = IsolatedStorageFile.GetUserStoreForApplication();

    if (storage.FileExists("exercises.xml"))
    {
        IsolatedStorageFileStream stream = storage.OpenFile("exercises.xml",
                                                            FileMode.Open);
        XmlSerializer xml = new XmlSerializer(typeof(List<ExerciseSettings>));
        exercises = xml.Deserialize(stream) as List<ExerciseSettings>;
        stream.Close();
        stream.Dispose();
    }

    return exercises;
}
```

The `Save` static method accepts a `List<ExerciseSettings>` objects collection that is stored in the `exercises.xml` file.

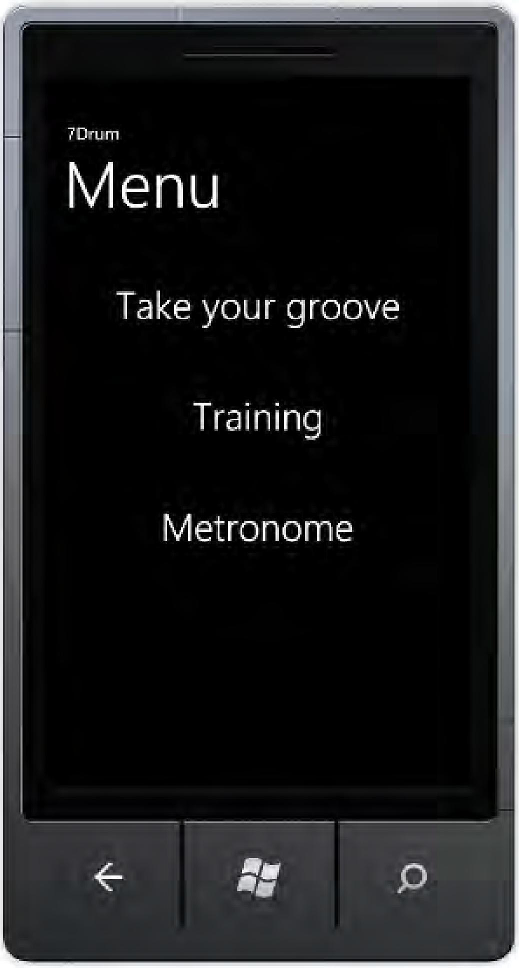
```
public static void Save(List<ExerciseSettings> exercises)
{
    IsolatedStorageFile iso = IsolatedStorageFile.GetUserStoreForApplication();
    IsolatedStorageFileStream stream = iso.CreateFile("exercises.xml");
    StreamWriter writer = new StreamWriter(stream);

    XmlSerializer ser = new XmlSerializer(typeof(List<ExerciseSettings>));

    ser.Serialize(writer, exercises);

    writer.Close();
    writer.Dispose();
}
```

The final step in managing tombstoning in our application is to call those two methods in the four `Application` event handlers. When the application is launched from the Start menu, the application calls the `Load` method from the `ExerciseManager` class in order to load stored exercises. The same occurs when the application is reactivated from tombstoning. On the other hand, when the application is closed by pressing the hardware Back button from the application's main page, the application calls the `Save` static method from the `ExerciseManager` class. The same occurs when the application is deactivated because of tombstoning (that is, the hardware Start button is pressed).

```
    public partial class App : Application
    {
        /// <summary>
        /// Provides easy access to the root frame of the Phone Application.
        /// </summary>
        /// <returns>The root frame of the Phone Application.</returns>
. . .

        // Code to execute when the application is launching (e.g., from Start)
        // This code will not execute when the application is reactivated
        private void Application_Launching(object sender, LaunchingEventArgs e)
        {
            Exercises = ExerciseManager.Load();
        }

        // Code to execute when the application is activated (brought to foreground)
        // This code will not execute when the application is first launched
        private void Application_Activated(object sender, ActivatedEventArgs e)
        {
            Exercises = ExerciseManager.Load();
        }

        // Code to execute when the application is deactivated (sent to background)
        // This code will not execute when the application is closing
        private void Application_Deactivated(object sender, DeactivatedEventArgs e)
        {
            ExerciseManager.Save(Exercises);
        }

        // Code to execute when the application is closing (e.g., user hit Back)
        // This code will not execute when the application is deactivated
        private void Application_Closing(object sender, ClosingEventArgs e)
        {
            ExerciseManager.Save(Exercises);
        }

        // Code to execute if a navigation fails
. . .
```

Usage

From Visual Studio 2010, open the 7Drum project and press Ctrl+F5. The application starts, briefly showing the main page and the menu shown in Figure 2-11.



7Drum

Menu

Take your groove

Training

Metronome

Figure 2-11. The `7Drum` *application's main page menu*

Select the Training menu and then tap the Plus button on the application bar, as shown in Figure 2-12.

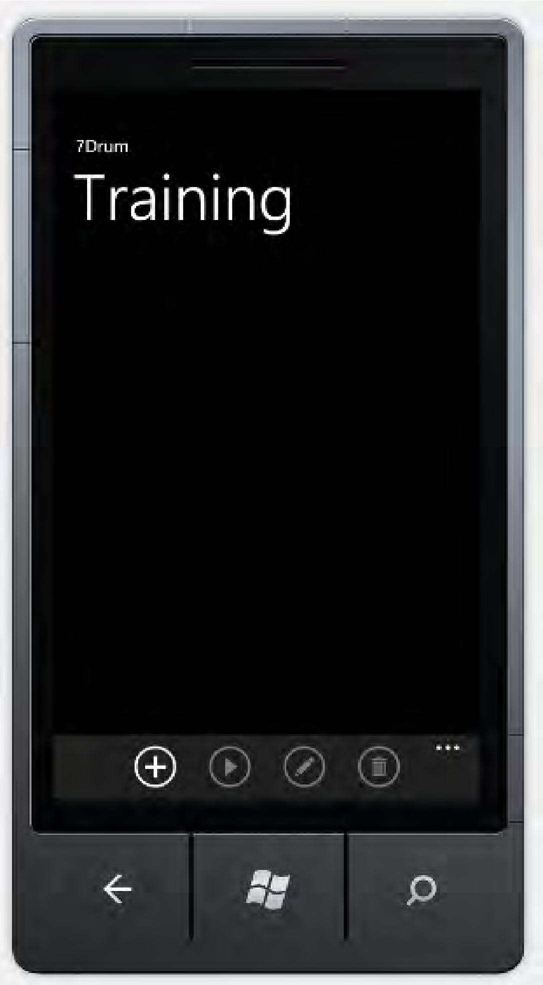
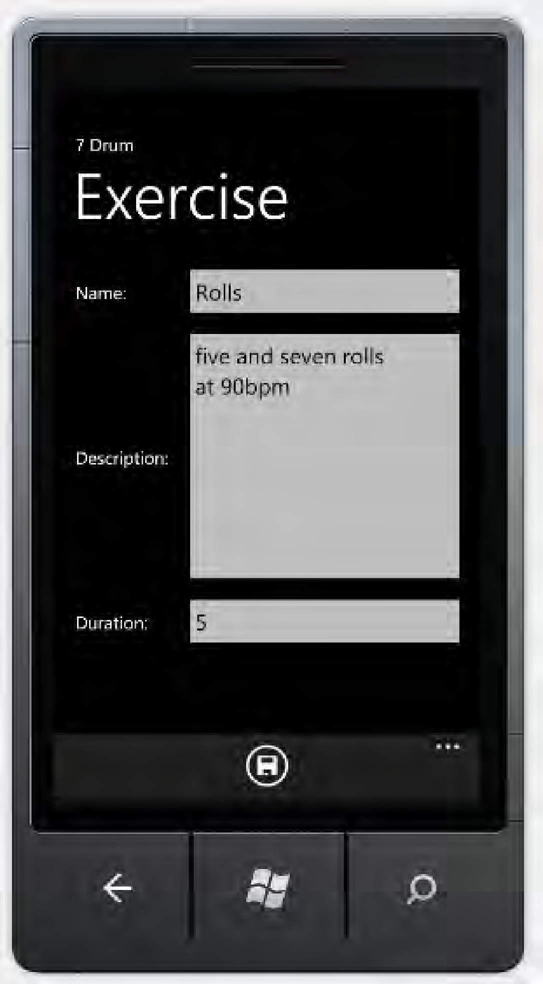


Figure 2-12. Add a new exercise by pressing the Plus button.

The Exercise page is shown with the three empty text boxes. Write something, as shown in Figure 2-13, and then click the Save button. The text boxes will be cleaned in order to let the user add another exercise. Press the hardware Back button to come back to the Training page.



7 Drum

Exercise

Name: Rolls

Description: five and seven rolls at 90bpm

Duration: 5

Figure 2-13. Adding a new exercise to the training plan

The Training page will show a list of exercises you added in the previous step. Now let's produce the tombstoning. Press the hardware Start button and navigate to the application list on the right. Run the `7Drum` application again. Select the Training menu, and you will hopefully see the list of exercises, because you never closed the application (see Figure 2-14).

■ **Note** When you close the Windows Phone 7 Emulator, the isolated storage is deleted along with your application.

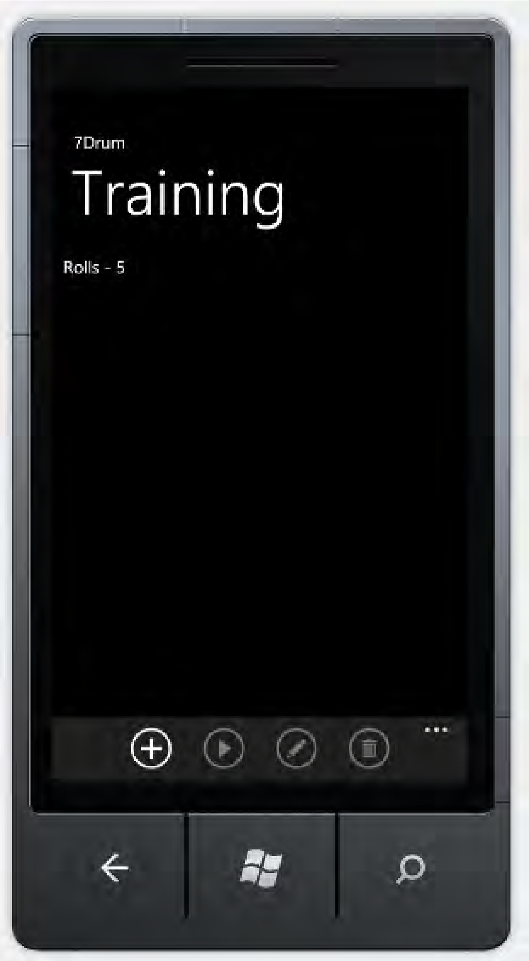


***Figure 2-14.** The Training page contains the list of exercises.*

2-6. Managing Tombstoning in Windows Phone 7 XNA Applications

Problem

You need to stop your XNA game when tombstoning occurs on your phone, by showing the game in pause mode.

Solution

You can use both the OnActivated and OnDeactivated event handlers provided by the Game class.

How It Works

Everything you studied in the previous recipes on tombstoning, including State collection, is valid for XNA games too. The big difference is the events raised when the application is tombstoned.

An XNA game responds to the OnActivated event when the application is either run or resumed from tombstoning. The game responds to the OnDeactivated event when the application is either tombstoned or closed.

■ **Note** The Game class provides the OnExiting event handler, which is used to know when the application is going to be closed. The OnDeactivated event will be called after OnExiting as well. So in the OnDeactivated event handler, there is no immediate way to know whether the application is going to be closed or it has been tombstoned.

When the game is tombstoned, the application stores game settings in the State dictionary. When the application is resumed from tombstoning, it loads the game settings and shows a bitmap representing the game in pause mode. Now if the user taps the screen, the game restarts.

The Code

To demonstrate tombstoning management in an XNA application, we have created a bouncing ball game that is paused if the tombstone occurs. The game provides a pause mode screenshot that is shown after the game is resumed from tombstoning.

The GameSettings class contains three properties to store the ball location, the ball velocity, and a Boolean indicating whether the game is in pause mode (its value is true) or not (its value is false).

```
public class GameSettings
{
    public bool Paused { get; set; }
    public Vector2 Location { get; set; }
    public Vector2 Velocity { get; set; }

    public GameSettings()
    {
        Paused = false;
        Location = Vector2.Zero;
        Velocity = new Vector2(1f, 1f);
    }
}
```

The GameSettingsManager class contains the Load and Save methods, which are used to load game settings from the State dictionary and to save them, respectively. With the Save method, the GameSettings object is stored in the GameSettings key of the State dictionary. With the Load method, we check whether the State dictionary contains the GameSettings key. If it does, the GameSettings object is loaded with the one provided by the State dictionary; otherwise, a brand new object is returned.

■ **Note** The Visual Studio 2010 XNA game project doesn't contain the assemblies needed to use the State dictionary, so you have to add a reference to Microsoft.Phone and System.Windows DLLs.

```
public class GameSettingsManager
{
    public static void Save(GameSettings settings)
    {
        PhoneApplicationService.Current.State["GameSettings"] = settings;
    }

    public static GameSettings Load()
    {
        GameSettings settings = new GameSettings();

        if (PhoneApplicationService.Current.State.ContainsKey("GameSettings"))
            settings = PhoneApplicationService.Current.State["GameSettings"] as
                       GameSettings;

        return settings;
    }

}
```

The Game1.cs file contains the OnActivated and OnDeactivated event handlers. In the former event handler, the Load static method from the GameSettingsManager class is called, and local variables' values are replaced with the stored ones. In the latter event handler, the Save static method is called, providing local variables' values and setting the Paused property to true.

```
protected override void OnActivated(object sender, EventArgs args)
{
    settings = GameSettingsManager.Load();
    spriteLocation = settings.Location;
    spriteVelocity = settings.Velocity;

    base.OnActivated(sender, args);
}
```

```
        protected override void OnDeactivated(object sender, EventArgs args)
        {
            settings.Paused = true;
            settings.Location = spriteLocation;
            settings.Velocity = spriteVelocity;

            GameSettingsManager.Save(settings);

            base.OnDeactivated(sender, args);
        }
```

The `Update` method is the core of the game, where all the logic is calculated, sprite positions are updated, and in this case, the pause mode is checked. When the game is in pause mode, the ball position is not changed and the ball texture is replaced with the Game Paused bitmap. Then the code waits for gesture events—specifically, for a tap on the screen—and when it occurs, the `Paused` property is set to `false` and the game restarts (see more on gestures in Chapter 5).

```
        protected override void Update(GameTime gameTime)
        {
            // Allows the game to exit
            if (GamePad.GetState(PlayerIndex.One).Buttons.Back == ButtonState.Pressed)
                this.Exit();

            // TODO: Add your update logic here
            if (settings.Paused == false)
            {
                spriteLocation = spriteLocation + spriteVelocity;
                spriteTexture = ballTexture;
            }
            else
            {
                spriteLocation = Vector2.Zero;
                spriteTexture = pauseScreen;

                while (TouchPanel.IsGestureAvailable)
                {
                    GestureSample gs = TouchPanel.ReadGesture();
                    switch (gs.GestureType)
                    {
                        case GestureType.Tap:
                            settings.Paused = false;
                            spriteLocation = settings.Location;
                            spriteVelocity = settings.Velocity;
                            spriteTexture = ballTexture;
                            break;
                    }
                }
            }
. . .
```

Usage

From Visual Studio 2010, select Windows Phone 7 Emulator as the output target and run the application. After few seconds, the emulator will show a bouncing ball moving on the screen (see Figure 2-15).

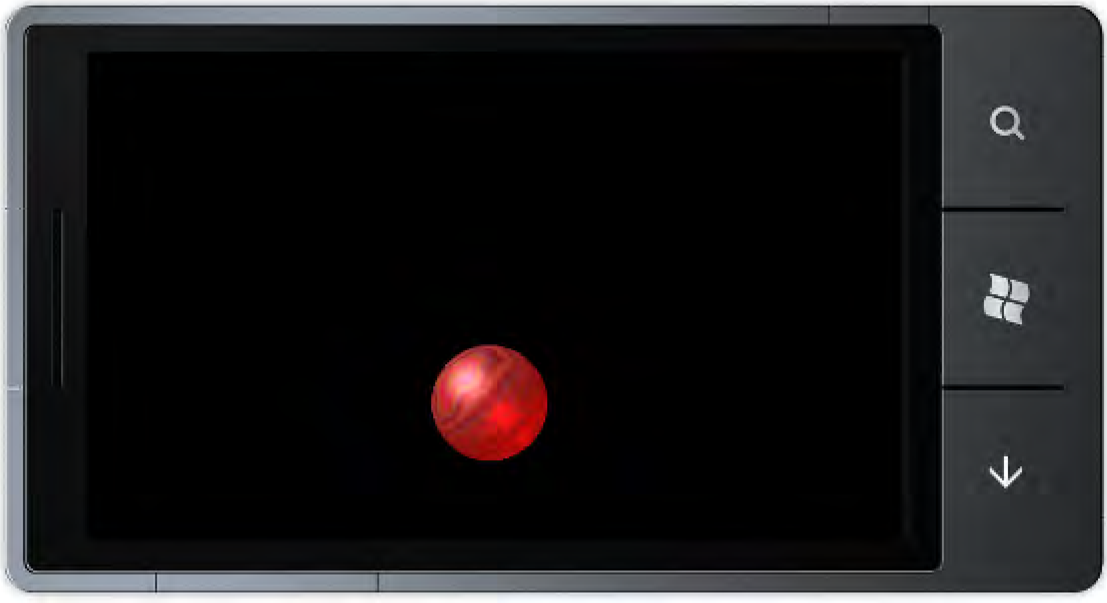


Figure 2-15. *The* `XNATombstoning` *application runs, showing a bouncing ball.*

Press the hardware Start button, causing tombstoning. Now press the hardware Back button so that the game is resumed. The application shows the Game Paused bitmap and waits for a tap on the screen (see Figure 2-16).

Game paused

Tap the screen to continue...

Figure 2-16. The game is in pause mode.

2-7. Managing Obscured and Unobscured Events

Problem

You need to create an application that continues to run either when the Windows Phone operating system locks the phone screen or you receive a phone call. During those events, you have to power off some battery-consuming resources. Then, when the screen is unlocked or the phone call ends, you have to turn those resources on again.

Solution

You have to use the `ApplicationIdleDetectionMode` property provided by the `PhoneApplicationService` class and register both `Obscured` and `Unobscured` event handlers defined in the `PhoneApplicationFrame` class.

How It Works

`ApplicationIdleDetectionMode` is a property that is defined in the `PhoneApplicationService` class and that has its default value set to `IdleDetectionMode.Enabled`. This means that the application is suspended when the operating system finds it idle. You can set the property to

IdleDetectionMode.Disabled so that your application will continue to run even when the operating system locks the screen.

■ **Note** The lock screen idle time is defined in the Settings of your physical phone and is not configurable from the emulator.

The Obscured event is raised when the phone screen is locked by the Windows Phone 7 operating system or when you receive a phone call. The Unobscured event is raised when the phone screen is unlocked or when the phone call is terminated.

When the IdleDetectionMode property of ApplicationIdleDetectionMode is set to Disabled, you can use those two methods to stop power-consuming resources (such as the accelerometer, screen animations, FM radio service, and so on) and then start them again when the lock screen is removed. In the Obscured event handler, you should specify the code to stop useless the service is one that your application is not going to use because the phone screen is locked. So if your application uses the StoryBoard to show an animated progress bar, you will stop the animation but upgrade the progress bar logic. You should stop other services to reduce battery consumption.

When IdleDetectionMode is set to Enabled, you can use Obscured and Unobscured event handlers to manage particular events that are not raised with tombstoning. Indeed, the phone lock screen and phone calls don’t raise tombstoning events. So, for example, if you have created a game with Silverlight and you want to show a pause screen after a phone call ends, you have to use the Obscured and Unobscured events.

■ **Note** The OnDeactivated event handler from the XNA Game class receives the phone screen lock and the phone call events. So it is not necessary to implement the Obscured and Unobscured event handlers to stop a game. The OnDeactivated event handler remains necessary when you disable idle detection mode.

The Code

Open Visual Studio 2010 and create a new Windows Phone 7 Silverlight application called ObscuredUnobscuredApp. In MainPage.xaml.cs, we added the code to the MainPage constructor in order to register the Obscured and Unobscured event handlers and to set the IdleDetectionMode.Disabled value to ApplicationIdleDetectionMode.

```
public MainPage()
{
    InitializeComponent();

    PhoneApplicationService.Current.ApplicationIdleDetectionMode =
                                                 IdleDetectionMode.Disabled;
    PhoneApplicationFrame rootFrame = ((App)Application.Current).RootFrame;
```

```
            rootFrame.Obscured += new EventHandler<ObscuredEventArgs>(rootFrame_Obscured);
            rootFrame.Unobscured += new EventHandler(rootFrame_Unobscured);
        }
```

■ **Note** A restart application is required if you change the `IdleDetectionMode` value twice at runtime. The official documentation indicates that this behavior could change in future operating system releases.

The `Obscured` event handler provides the `ObscuredEventArgs` parameter, which defines the `IsLocked` property used to know if the event is raised either by the phone screen lock (its value is `true`) or by the phone call (its value is `false`).

In the `Obscured` and `Unobscured` event handlers, we are going to disable and then enable the battery's power-consuming services, respectively.

```
        void rootFrame_Unobscured(object sender, EventArgs e)
        {
            FMRadio.Instance.PowerMode = RadioPowerMode.On;
            acc.Start();
            geoW.Start();
        }

        void rootFrame_Obscured(object sender, ObscuredEventArgs e)
        {
            FMRadio.Instance.PowerMode = RadioPowerMode.Off;
            acc.Stop();
            geoW.Stop();
        }
```

Usage

There is no way to test the application by using the `Obscured` and `Unobscured` event handlers in the emulator. So press F5 only if you changed the output target to the Windows Phone 7 device. You have to put two breakpoints in the `Obscured` and `Unobscured` code so you can see that events are raised.

The application will start, briefly showing the main page. Now you can call your phone with another phone or wait while the Windows Phone operating system locks the screen. Note the application hitting breakpoints.

CHAPTER 3

User Interface

A user's first impression of a computer application's user interface is critical. Users will immediately decide to uninstall an application if it is too complex or if it not do what it promises to do. When comparing two user interfaces, users will often choose the more eye-catching one.

The Windows Phone 7 user interface is not exempt from this type of user behavior. In addition, there are lot of applications on the Marketplace, so the competition is ruthless. The user might try your application, but you will have to convince that user to buy it.

In this chapter and in the next (which is about Expression Blend), you will find a lot of recipes on the user interface. You will see how to use Silverlight common controls and Silverlight features such as bindings, but also how to implement eye-catching effects including an animated splash screen and navigation between pages.

The recipes in this chapter describe how to do the following:

- 3-1. Create an animated splash screen
- 3-2. Use the `ApplicationBar` control
- 3-3. Detect changes in the theme template
- 3-4. Customize the Soft Input Panel keyboard to accept only numbers
- 3-5. Use the Windows Phone 7 predefined styles
- 3-6. Localize your application
- 3-7. Use `Panorama` and `Pivot` controls
- 3-8. Spice up the user interface with the Silverlight for Windows Phone Toolkit
- 3-9. Use launchers and choosers

3-1. Creating an Animated Splash Screen

Problem

Your application starts connecting to a web page, and you need to show a splash screen with an animated progress bar in order to inform users that they need to wait a few seconds before using the application.

Solution

You can create a user control and use it with the `Child` property provided by the `Popup` class. The `ProgressBar` control has the `IsIndeterminate` property set to `true`.

How It Works

The splash screen provided by the Visual Studio 2010 Windows Phone 7 Silverlight Application project template is static, a simple PNG image shown during the application launch. To create an animated splash screen, you need to remove the `SplashScreen.png` file from the project and use a trick: the `Popup` class.

Usually, the `Popup` class is used to show tooltips during mouse activities in desktop applications. However, with a Windows Phone 7 application, you can use it to show a generic `UIElement` object, perhaps either a common control or a user control. User controls are often used when you need to compose more than one common control within a unique control having its own logic. Instead of using dozens of controls to create a complex user interface, you can separate functionality into user controls and thereby achieve code reusability too.

In this case, you are going to create a user control composed of a full-screen image—480×800 pixels—some text, and a progress bar. The `Popup` class provides the `Child` property used to specify the `UIElement` that has to be shown. In this case, the `Child` property will be set to the `MySplashScreen` object defined by the user control.

The `ProgressBar` control within the user control has the `IsIndeterminate` property set to `true` because the loading time of the web page cannot be estimated. Indeed, when your application starts, you make a call to a web page, and because you don't know whether the phone is connected to Wi-Fi or to General Packet Radio Service (GPRS), or whether some network traffic delays might occur, you cannot estimate the loading time.

When the application is launched, the pop-up will fill the entire screen surface, and the progress bar will display across the screen. Behind the scenes, the `WebBrowser` control (see Recipe 3-2) will load the page and then raise the `Navigated` event. Trapping the `Navigated` event will allow you to hide the pop-up and show the user interface that is underneath.

The Code

To demonstrate the animated splash screen example, you are going to create a `FlickrPhotoAlbum` application. This application uses the Flickr.NET library (see `http://flickrnet.codeplex.com`) and the phone camera to take a picture and upload it to a Flickr gallery.

Before uploading Flickr.NET API calls to the destination, users have to be authenticated to Flickr and have to accept that your application will use their resources.

Our application accomplishes these steps by redirecting the WebControl content to an URL page returned by the AuthCalcUrl method call. In this case, the animated splash screen is really useful in enabling you to avoid having the user interface show blank WebControl content until the page is loaded. Indeed, by using the Navigated event handler, you know exactly when the page has finished loading and can hide the splash screen. Let's examine the code from the FlickrPhotoAlbum application.

In the MySplashScreen.xaml file, you defined the user control's user interface. It is composed of a full-screen image, a TextBlock control showing the Loading text, and a ProgressBar:

```
<UserControl x:Class="FlickrPhotoAlbum.MySplashScreen"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    d:DesignHeight="800" d:DesignWidth="480">

    <Grid x:Name="LayoutRoot" Background="White" Width="480" Height="800">
        <ProgressBar HorizontalAlignment="Left" Margin="47,692,0,89" Name="pbProgress"
         Width="383"  />
        <Image Height="512" HorizontalAlignment="Left" Margin="114,75,0,0" Name="imgScreen"
         Stretch="Fill" VerticalAlignment="Top" Width="272" Source="images/screen.png" />
        <TextBlock HorizontalAlignment="Left" Margin="185,656,0,114" Text="Loading..."
         Width="111" Foreground="Black" FontSize="22" />
    </Grid>
</UserControl>
```

■ **Note** The screen.png image is included in the project inside the images folder and has the Build Action property set to Content. In this way, you can use the relative path in the Source attribute of the Image tag.

The IsIndeterminate property value is set to true in the MySplashScreen constructor:

```
namespace FlickrPhotoAlbum
{
    public partial class MySplashScreen : UserControl
    {
        public MySplashScreen()
        {
            InitializeComponent();
            this.pbProgress.IsIndeterminate = true;
        }
    }
}
```

In the MainPage.xaml.cs file, you define the MainPage class constructor in which the Popup object is created, its Child property is set to an object of the MySplashScreen class, and the IsOpen property is set to true, causing the splash screen to be shown:

```
    public partial class MainPage : PhoneApplicationPage
    {
        Popup popup = null;

        // Constructor
        public MainPage()
        {
            InitializeComponent();

. . .

            popup = new Popup();
            popup.Child = new MySplashScreen();
            popup.IsOpen = true;
        }
```

The IsOpen property is set to false in the Navigated event handler that is raised by the WebBrowser control after having completely loaded the web page:

```
        private void wbBrowser_Navigated(object sender,
                                         System.Windows.Navigation.NavigationEventArgs e)
        {
            this.popup.IsOpen = false;
        }
```

The instruction to trap the Navigated event is declared in the phone:WebBrowser XAML tag by using the Navigated attribute:

```
<phone:WebBrowser x:Name="wbBrowser" Grid.Row="0" Navigated="wbBrowser_Navigated"/>
```

Usage

In Visual Studio 2010, select Windows Phone 7 Emulator as the target output and press Ctrl+F5. The emulator displays the animated splash screen, as shown in Figure 3-1.

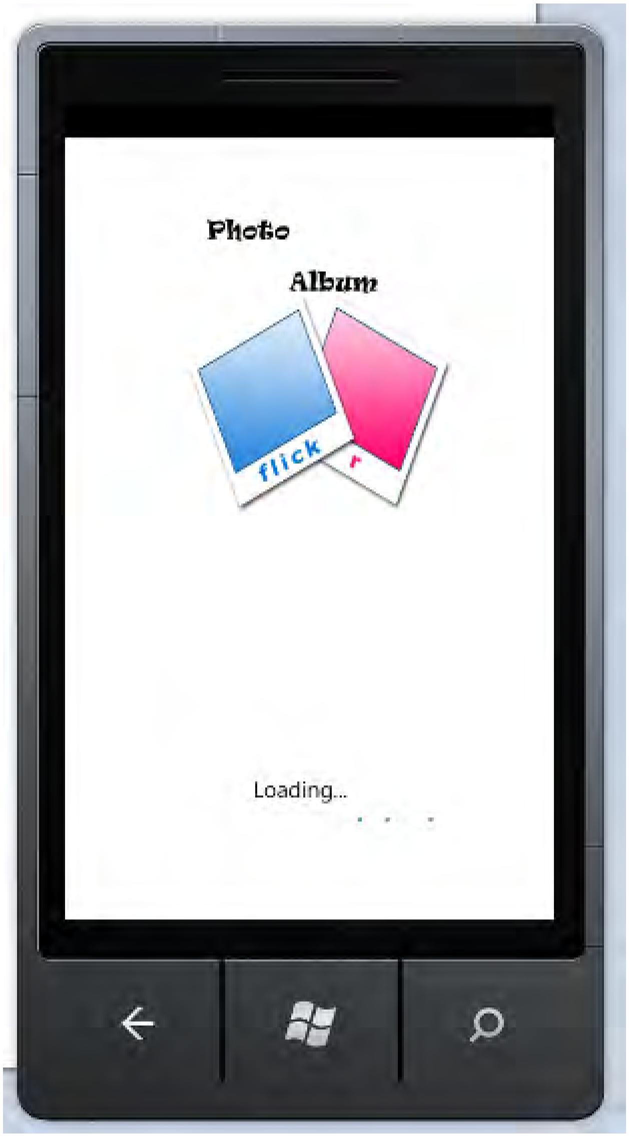


Figure 3-1. *The animated splash screen in action*

The splash screen automatically disappears when the web page is loaded, showing the user interface beneath (see Figure 3-2).

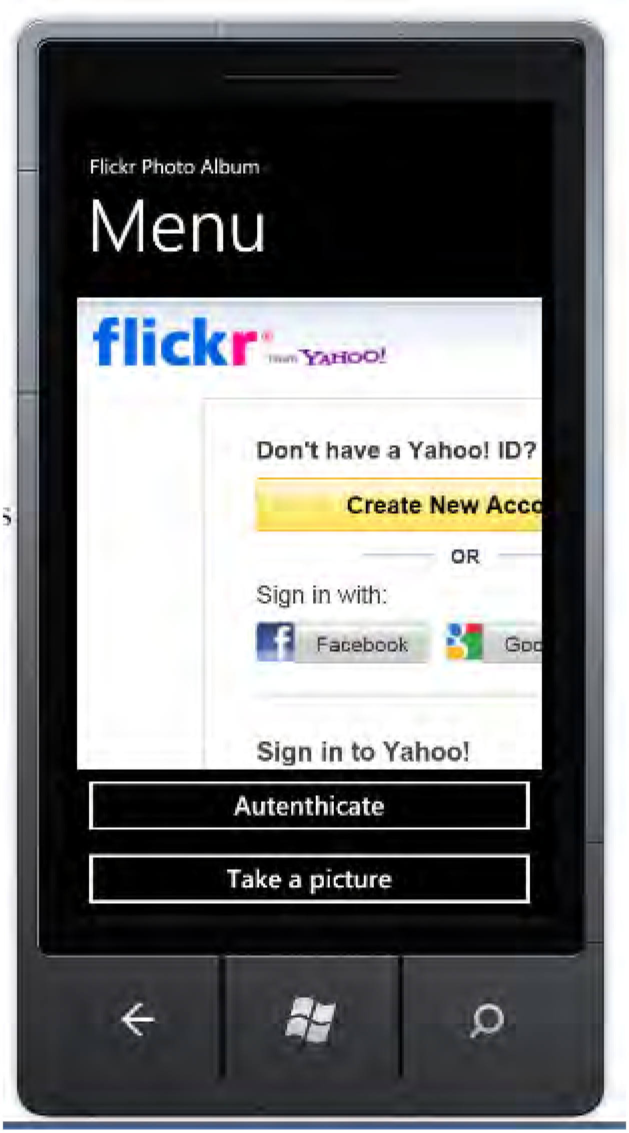


Figure 3-2. *The splash screen is automatically hidden, and the application is ready to authenticate the user on Flickr.*

3-2. Using the ApplicationBar Control

Problem

You need to add the application bar to your application.

Solution

You have to add an `ApplicationBar` section to the XAML of your page provided by `PhoneApplicationPage` within the phone namespace. Within this new tag, you can include one or more `ApplicationBar` tags provided—this time—by the shell namespace. The code generated by Visual Studio already contains a commented section in which `ApplicationBar` is defined with some buttons and menu items. You can simply uncomment and customize the code to obtain your goal.

How It Works

`ApplicationBar` is a Windows Phone control added to Silverlight just for Windows Phone devices. It allows you to have a sort of toolbar and menu in the application. The application bar is completely managed by the operating system, so it is placed at the bottom of the page when the application is in Portrait mode, and moved to one side when the phone is put in Landscape mode (which side depends on the direction in which you rotate your phone).

The application bar should contain at least four icons, and you should use the ones provided with the SDK. In the `%Program Files%\Microsoft SDKs\Windows Phone\v7.0\Icons` path, you can find both dark and light versions of application bar icons. You should use different icon colors depending on the selected theme (see Recipe 3-3). If you use the dark version, the operating system will take care of changing the icon colors for you, automatically. If you don't find the icon you need, you can use Microsoft Expression Blend for Windows Phone to draw your own.

The application bar also can contain menu items that will be shown when the user selects the ellipses at the top-right of the bar. You should not specify too many menu items, however, because the application bar will expand toward the top to show all items and could cover important parts of the user interface control. The official documentation sets this limit to at most five menu items. You have to set the `IsMenuEnabled` property to `true` to enable menu items in the application bar (see Figure 3-3 for the class diagram).

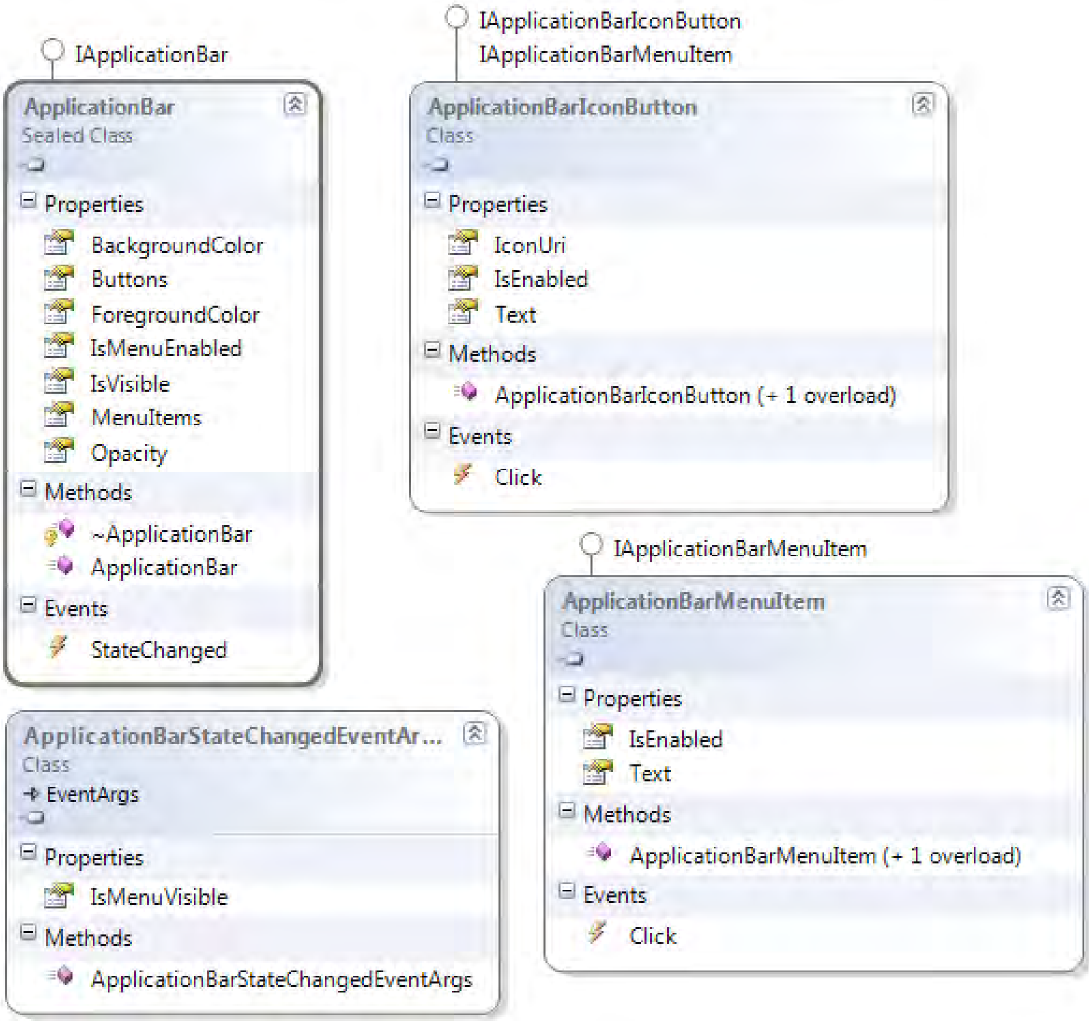


***Figure 3-3.** The `ApplicationBar` class diagram*

The `ApplicationBar` control has the `Opacity` property, which affects the rectangle that contains the icons, not the icons themselves.. This property accepts a decimal value between 0 and 1. When you set this property to 1, the frame resizes the page's content in order to reserve space for the application bar. On the other hand, when you set this property to a value less than 1, the application bar and its buttons will be drawn over the page content.

The `IsVisible` property is used to set when the application bar has to be shown (`true`) and when it does not (`false`).

Although you can assign a name to both menu items and application bar buttons, you can't use those names to access related properties. You have to use the Buttons and MenuItems collections provided as properties by the ApplicationBar class to retrieve a reference to those buttons and menu items. Usually, you can use the page class constructor to map application bar items to relative names.

As already said, ApplicationBar can contain both ApplicationBarIconButton and ApplicationBarMenuItem controls. ApplicationBarIconButton has some interesting properties, such as IconUri, which specifies the URI relative to a path where the image is stored.

■ **Note** Remember to change the icon's Build Actions property from Resource to Content so that you can specify a relative URI path to the image.

The Text property is used to specify a very short button's description that will be shown when the user selects the ellipses button. Finally, IsEnabled is used to either enable or disable the button. ApplicationBarMenuItem uses the Text property to specify the menu item text that will be shown when the user displays the application bar by clicking the ellipses button.

The Code

You will find a lot of applications using the ApplicationBar control in this book. To demonstrate this recipe, we are implementing the ApplicationBar in the 7Drum application, specifically in the Training page. This page allows you to add, edit, and delete an exercise.

In the Training.xaml page, you define an ApplicationBar control with four buttons and one menu item:

```
. . .
<!--Sample code showing usage of ApplicationBar-->
    <phone:PhoneApplicationPage.ApplicationBar>
        <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
            <shell:ApplicationBarIconButton IconUri="/images/dark/appbar.new.rest.png"
            Text="new" Click="ApplicationBarIconNewButton_Click" x:Name="btnNew" />
            <shell:ApplicationBarIconButton
            IconUri="/images/dark/appbar.transport.play.rest.png"
            Text="start" IsEnabled="False" Click="ApplicationBarIconPlayButton_Click"
            x:Name="btnPlay"/>
            <shell:ApplicationBarIconButton IconUri="/images/dark/appbar.edit.rest.png"
            Text="edit" IsEnabled="False" Click="ApplicationBarIconEditButton_Click"
            x:Name="btnEdit"/>
            <shell:ApplicationBarIconButton IconUri="/images/dark/appbar.delete.rest.png"
            Text="delete" IsEnabled="False" Click="ApplicationBarIconDeleteButton_Click"
            x:Name="btnDelete"/>
            <shell:ApplicationBar.MenuItems>
                <shell:ApplicationBarMenuItem Text="Exercise of the day"
                 Click="ApplicationBarMenuItem_Click"/>
            </shell:ApplicationBar.MenuItems>
        </shell:ApplicationBar>
    </phone:PhoneApplicationPage.ApplicationBar>
. . .
```

In the `Training.xaml.cs` code, you use the constructor to map application bar buttons to related names so you can use variables to manage the buttons' properties throughout the entire code. The `Buttons` collection indexes correspond to the order you specified the buttons in the XAML code. So, the first New button will have the 0 index, the Play button will have the 1 index, and so on:

```
    public partial class Training : PhoneApplicationPage
    {
        public Training()
        {
            InitializeComponent();
            btnNew = ApplicationBar.Buttons[0] as ApplicationBarIconButton;
            btnPlay = ApplicationBar.Buttons[1] as ApplicationBarIconButton;
            btnEdit = ApplicationBar.Buttons[2] as ApplicationBarIconButton;
            btnDelete = ApplicationBar.Buttons[3] as ApplicationBarIconButton;
        }
. . .
```

Finally, you can use the buttons' names in other methods such as the `lbExercise_SelectionChanged` event handler that is raised when the user select an exercise from the list box. This event handler either enables or disables application bar buttons:

```
        private void lbExercise_SelectionChanged(object sender,
                                                  SelectionChangedEventArgs e)
        {
            if (lbExercise.SelectedItems.Count > 0)
            {
                btnPlay.IsEnabled = true;
                btnEdit.IsEnabled = true;
                btnDelete.IsEnabled = true;
            }
            else
            {
                btnPlay.IsEnabled = false;
                btnEdit.IsEnabled = false;
                btnDelete.IsEnabled = false;
            }
        }
```

Usage

In Visual Studio 2010, load the `7Drum` project from the companion code and then press Ctrl+F5. If your target output is the Windows Phone 7 Emulator, you will see it running briefly. Tap the Training menu so that you go to the Training page shown in Figure 3-4. At the bottom of the screen, you can see the application bar with the Add button enabled and the others disabled.

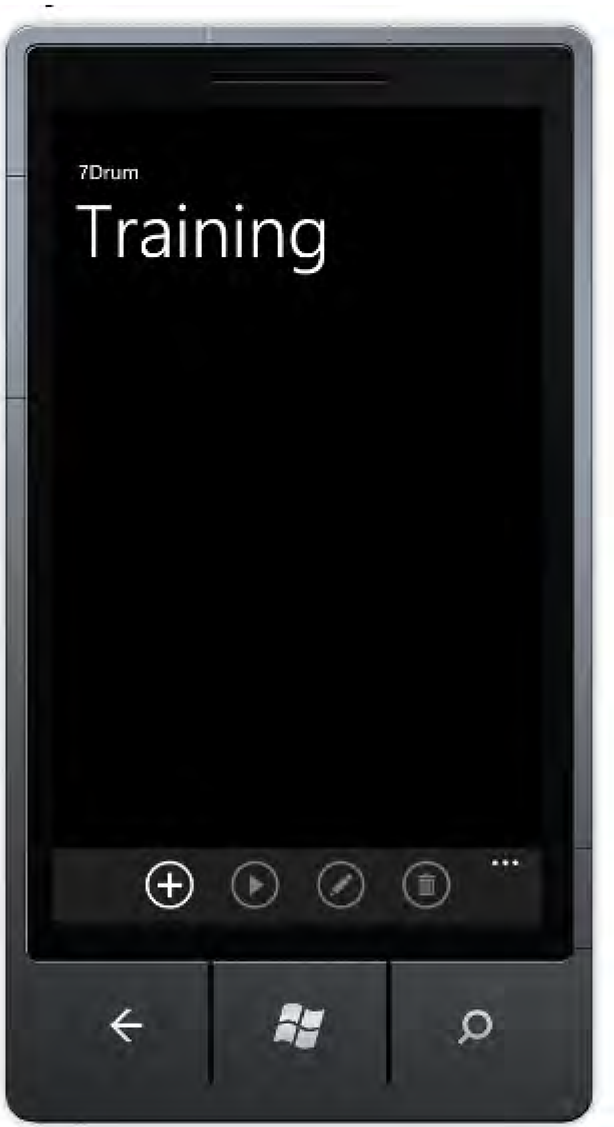


Figure 3-4. The application bar contains four buttons, but only one is enabled.

Clicking the ellipses button at the top-right corner of the application bar causes the button descriptions and the menu items to appear (see Figure 3-5).

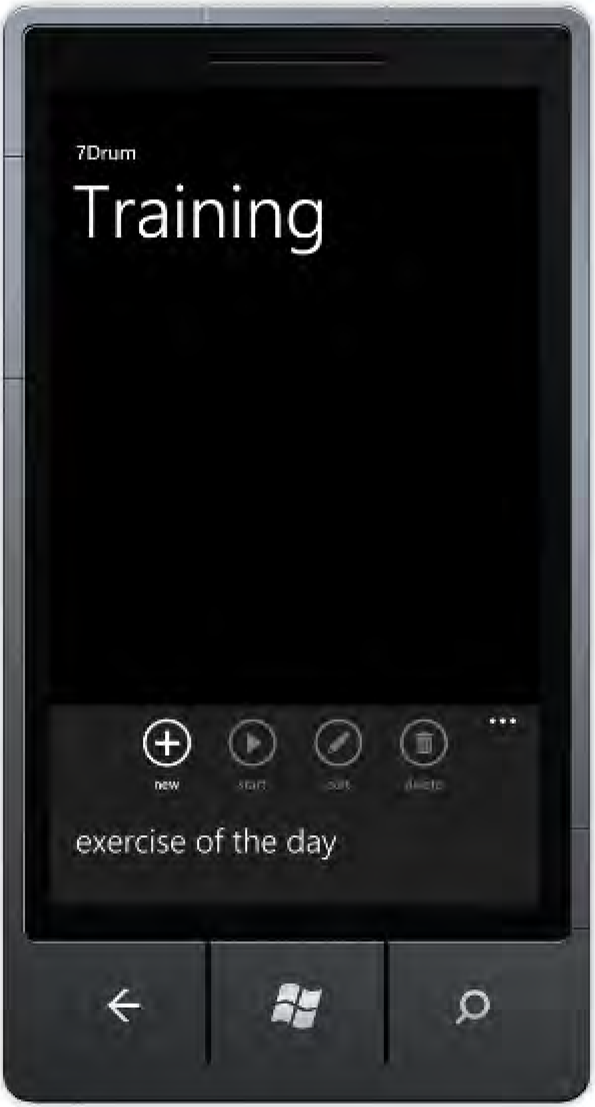


Figure 3-5. *Clicking the ellipses button the application bar shows the buttons' text and menu items.*

3-3. Detecting Changes in the Theme Template

Problem

You need to detect when the user changes the Windows Phone 7 theme from Dark to Light or vice versa so you can change icons, buttons, and background colors accordingly.

Solution

You can use the `ResourceDictionary` class provided by the `Resources` property from the `Application` class.

How It Works

The `Application` class has a static property called `Resources` that returns a `ResourceDictionary` object filled with Windows Phone resources representing, for example, the chosen fonts, the background color, the foreground color, and so on.

In this recipe, you will use the `PhoneBackgroundBrush` resource to retrieve the chosen background theme color. If the theme is set to *Dark,* this value will be equal to the black color (Red Green Blue values set to 0). Otherwise, it will be set to the white color (Red Green Blue values set to 255) for the *Light* theme.

The Code

To demonstrate this recipe, you will create the `DetectingThemeChanging` Silverlight for Windows Phone application. The application has a main page on which two application bar buttons are set with the dark image version. During the `Loaded` event handler, the application checks what color is stored in the `PhoneBackgroundBrush` key within the `Resources` dictionary. Based on the returned value, the icons are taken from either the dark or the light relative path.

In the `MainPage.xaml` file, the application bar is defined with two buttons:

```
. . .
<phone:PhoneApplicationPage.ApplicationBar>
        <shell:ApplicationBar IsVisible="True" IsMenuEnabled="False" Opacity="0">
            <shell:ApplicationBarIconButton x:Name="btnPlay"
            IconUri="/Images/dark/appbar.transport.play.rest.png" Text="Play"/>
            <shell:ApplicationBarIconButton x:Name="btnStop"
            IconUri="/Images/dark/appbar.stop.rest.png" Text="Stop"/>
        </shell:ApplicationBar>
    </phone:PhoneApplicationPage.ApplicationBar>
. . .
```

In the `MainPage.xaml.cs` code file, the `Loaded` event handler is hooked so you can call the `UpdateUI` method, which is the core method of this recipe. The `IsDarkTheme` static property from the `ThemeDetector` class is checked to retrieve whether the current background theme is the Dark theme. If it is, the icons are picked from the dark directory; otherwise, the icons are picked from the Light directory.

```
        private void UpdateUI()
        {
            if (ThemeDetector.IsDarkTheme)
            {
                btnPlay.IconUri = new Uri("/Images/dark/appbar.transport.play.rest.png",
                                          UriKind.Relative);
                btnStop.IconUri = new Uri("/Images/dark/appbar.stop.rest.png",
                                          UriKind.Relative);
                PageTitle.Text = "Dark Theme";
            }
            else
            {
                btnPlay.IconUri = new Uri("/Images/light/appbar.transport.play.rest.png",
                                          UriKind.Relative);
                btnStop.IconUri = new Uri("/Images/light/appbar.stop.rest.png",
                                          UriKind.Relative);
                PageTitle.Text = "Light Theme";
            }
        }
```

The `ThemeDetector` class has only one property, which returns a Boolean value indicating when the Dark background theme is in use:

```
    public class ThemeDetector
    {
        public static bool IsDarkTheme
        {
            get
            {
                SolidColorBrush backgroundBrush =
                Application.Current.Resources["PhoneBackgroundBrush"] as SolidColorBrush;
                if (backgroundBrush.Color == Color.FromArgb(255, 0, 0, 0)) // Black color
                    return true;
                else
                    return false;
            }

        }
    }
```

■ **Tip** You can use the `ThemeDetector` class in your projects to retrieve the current background theme and to change your buttons' colors, icons, and so forth.

Usage

From Visual Studio 2010, select the Windows Phone 7 Emulator as your target output and then press Ctrl+F5. The emulator starts, briefly displaying the application with the application bar shown in Figure

3-6. As you can see, the application uses the page title to inform the user about the background theme it has found in the operating system.

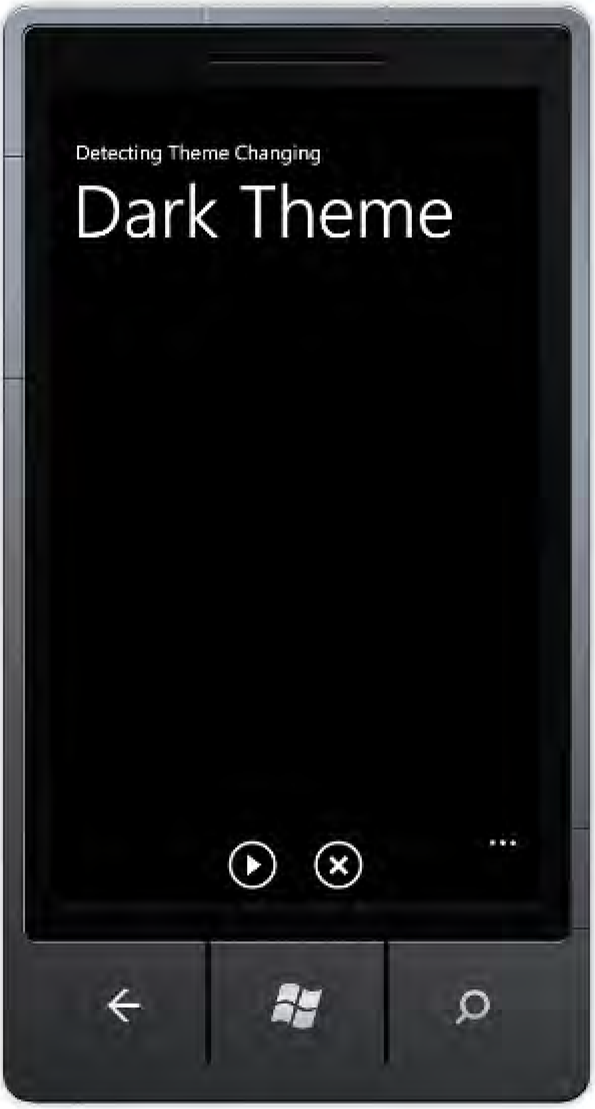


Figure 3-6. *The application has detected the Dark theme.*

Press the hardware Start button and then go to the application list by pressing the right arrow at the top-right corner of the screen. Select the Settings tile, tap the Theme list item, and change the Background value from Dark to Light.

Now the emulator has the white background color; go back to the application either by pressing the hardware Back button until you reach it or by running a new application instance. The application retrieves the current background theme as the Light theme and changes the icon accordingly (see Figure 3-7).

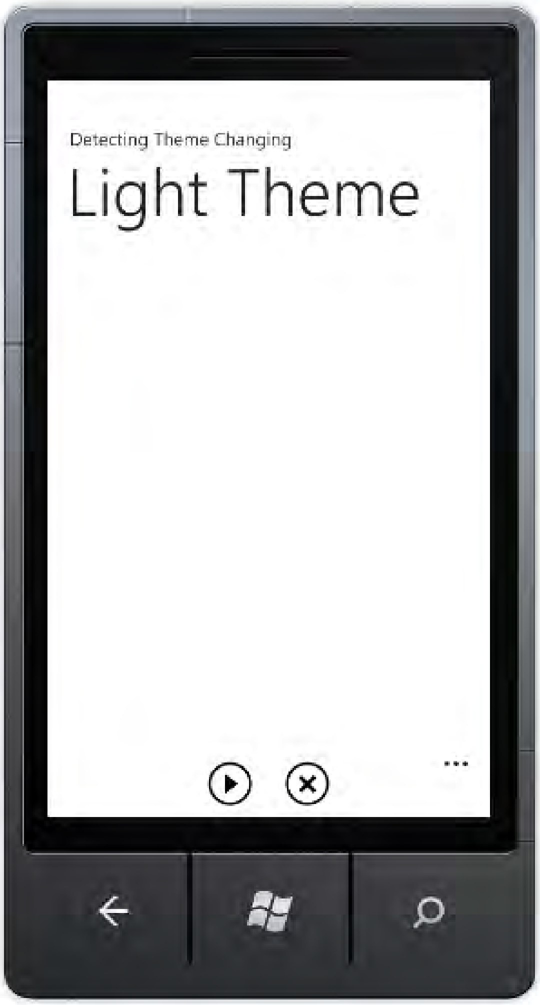


Figure 3-7. *The application detects the new background and changes the icons and page title.*

3-4. Customizing the Soft Input Panel Keyboard to Accept Only Numbers

Problem

You need to provide a virtual keyboard (also called a Soft Input Panel, or SIP) that accepts only numbers so users can insert numeric values into a text field.

Solution

You can use the `InputScope` property provided by the `TextBox` control and use the `KeyDown` event to exclude keys that are not needed.

How It Works

When the user has to insert information in your application and taps on a text field, a SIP keyboard appears, allowing the input of text. By using the `InputScope` attribute in your XAML code, you can customize the SIP in order to help users during text input.

You can use one of the values available from the `InputScopeNameValue` enumerator, as shown in Table 3-1. For example, if you use the `TelephoneNumber` value, the tapped text box will show the panel used to compose a telephone number.

■ **Note** There are more than 50 values in the `InputScopeNameValue` enumerator, and most of them either are useless or cause no changes to the SIP. Table 3-1 lists the most common values that are specific to the Windows Phone.

Table 3-1. The Most Common `InputScope` Enumerator Values

Value	Description
`Chat`	Used for chat messaging, SIP recognizes pre-stored abbreviations.
`Digits`	Specifies digits.
`EmailNameOrAddress`	Specifies e-mail names and addresses, because some shortcut keys such as the *at* character (@) and the *.com* key will be added to the main keyboard.
`CurrencyAmount`	Specifies currency amount values.

Continued

Value	Description
`Date`	Inserts a calendar date.
`Maps`	Specifies a map location.
`NameOrPhoneNumber`	Specifies the destination address of a Short Message Service (SMS) text message.
`Password`	Specifies password text.
`Text`	The standard SIP layout for inserting text.
`Url`	Specifies an Internet address.

You can use a combination of the `InputScope` attribute and the `KeyDown` event handler to customize the SIP behavior.

This recipe creates a SIP layout that accepts only numeric digits. You will customized the text box with the `TelephoneNumber` SIP layout and disable the input of non-numeric keys.

The Code

To demonstrate this recipe, you have to open the `7Drum` project from the companion code by using Visual Studio 2010 and then focus on the Exercises page. It contains some data describing the exercise, such as the exercise's name and duration. It is the Duration text box that has to be numeric and accept only numeric digits.

In the `Exercise.xaml` file, you define the text box fields that compose the input form to specify an exercise. Note that the Duration text box field has the `InputScope` set to the `TelephoneNumber` value:

```
. . .
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <StackPanel>
                <Grid>
                    <Grid.RowDefinitions>
                        <RowDefinition Height="Auto"/>
                        <RowDefinition Height="Auto"/>
                        <RowDefinition Height="*"/>
                    </Grid.RowDefinitions>
                    <Grid.ColumnDefinitions>
                        <ColumnDefinition Width="Auto" />
                        <ColumnDefinition Width="*" />
                    </Grid.ColumnDefinitions>
                    <TextBlock Grid.Row="0" Grid.Column="0"
                     Text="Name:" Style="{StaticResource PhoneTextNormalStyle}"
                     VerticalAlignment="Center" />
                    <TextBox Grid.Row="0" Grid.Column="1" x:Name="txtName" />
                    <TextBlock Grid.Row="1" Grid.Column="0" Text="Description:"
                    Style="{StaticResource PhoneTextNormalStyle}"
                    VerticalAlignment="Center" />
                    <TextBox Grid.Row="1" Grid.Column="1" x:Name="txtDescription"
                    AcceptsReturn="True" Height="300"/>
                    <TextBlock Grid.Row="2" Grid.Column="0" Text="Duration (min):"
                    Style="{StaticResource PhoneTextNormalStyle}"
                    VerticalAlignment="Center" />
                    <TextBox Grid.Row="2" Grid.Column="1" x:Name="txtDuration"
                    InputScope="TelephoneNumber" KeyDown="txtDuration_KeyDown"/>
                </Grid>
            </StackPanel>
        </Grid>
. . .
```

In the Exercise.xaml.cs code, the KeyDown event handler ensures that no numeric digits are inserted in the Duration text box. The KeyEventArgs parameter provided by the KeyDown event handler contains the Key property that represents the pressed key. You can use this property to check that the pressed key is not the space key or other non-numeric key such as # or *. In this case, you can set the Handled property to true so that the key is accepted by the Duration text box. Otherwise, you have to set the Handled property value to false so that the key is not accepted.

```
    private void txtDuration_KeyDown(object sender, KeyEventArgs e)
    {
        if (e.Key != Key.Space && e.Key != Key.D8 && e.Key != Key.D3 &&
            e.Key != Key.Unknown)
            e.Handled = false;
        else
            e.Handled = true;
    }
```

Usage

Press Ctrl+F5 from Visual Studio 2010 so that the application is deployed to either the Windows Phone 7 Emulator or the Windows Phone 7 device. The application starts. Select the Training menu item from the main page and then select the Add application bar button to add a new exercise.

The Exercise page loads, and you will see the text boxes shown in Figure 3-8.

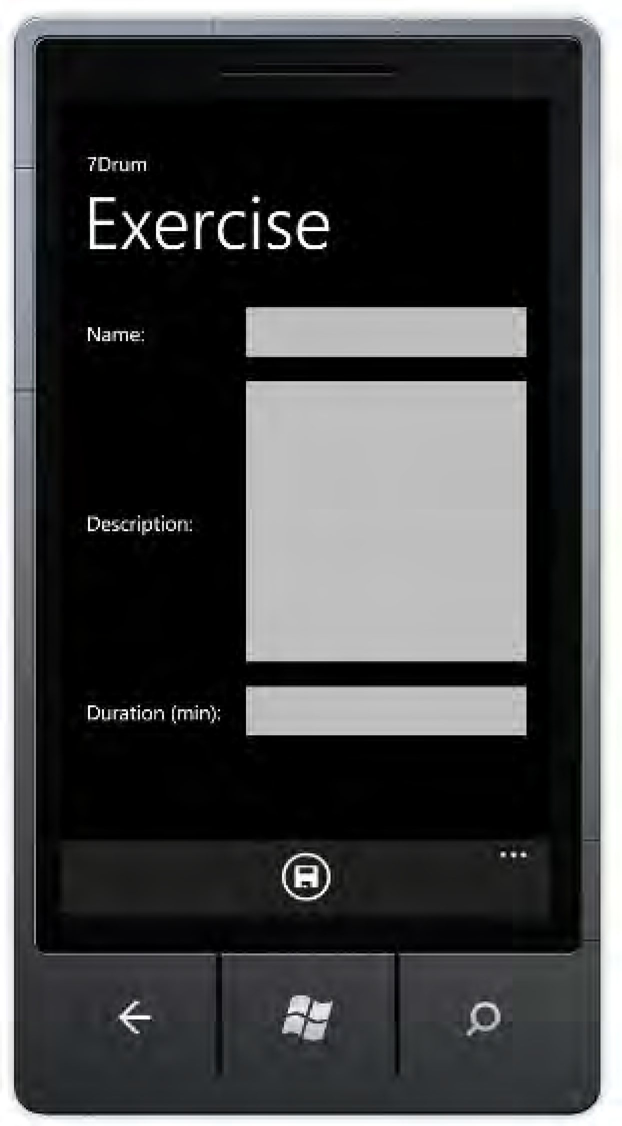


Figure 3-8. The Exercise page with the Duration numeric field

Now tap the Duration text box, and the `TelephoneNumber` layout of the Soft Input Panel virtual keyboard appears (see Figure 3-9).

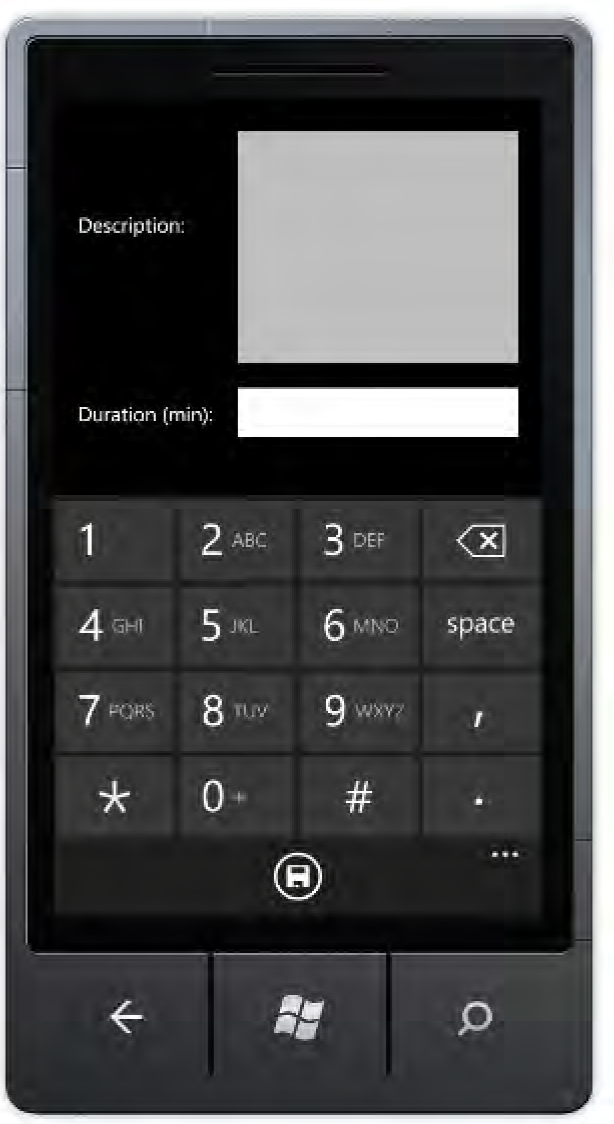


Figure 3-9. The customized `TelephoneNumber` *virtual keyboard*

Try to press numeric and non-numeric keys, and you will see that only the former are allowed.

3-5. Using the Windows Phone 7 Predefined Styles

Problem

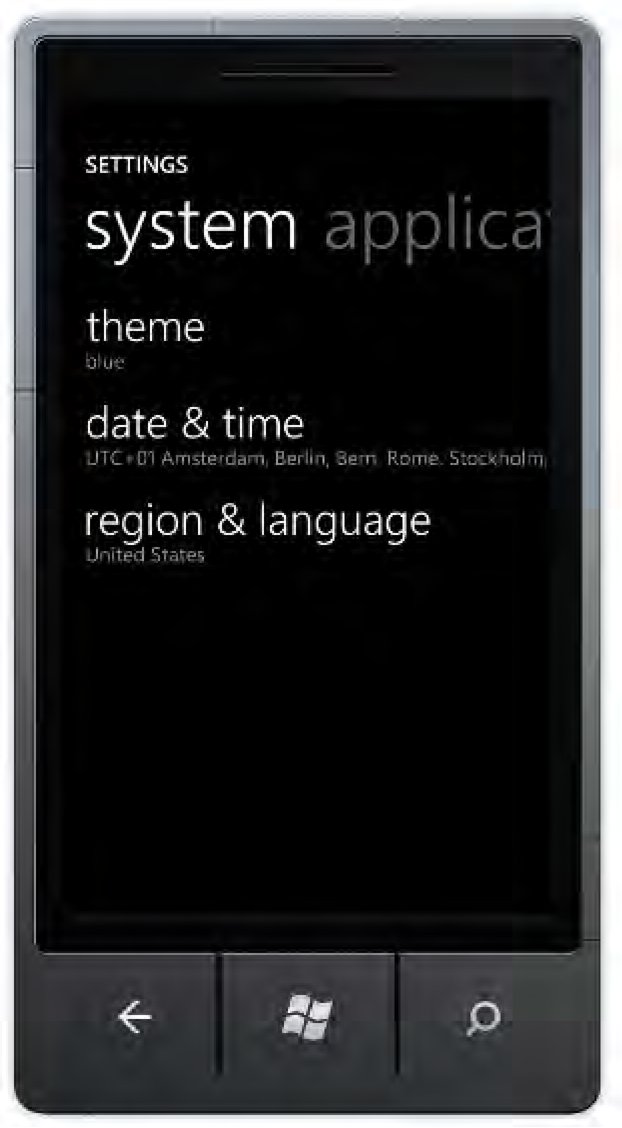
You need to develop a Windows Phone 7 application that provides a dynamic user interface that changes based on the user's choices of theme and font.

Solution

You can use the Windows Phone 7 predefined styles so that you are sure your user interface will change fonts and colors according to your user's setting changes.

How It Works

When you define the user interface of your Silverlight for Windows Phone 7 application, it is very common to add text blocks, text boxes, links, and so forth. You can specify their dimensions, colors, and positions, but you need to pay attention to the changes made by the user in the Settings system page (see Figure 3-10).



SETTINGS

system applica

theme
blue

date & time
UTC+01 Amsterdam, Berlin, Bern, Rome, Stockholm

region & language
United States

Figure 3-10. *The emulator's Settings page*

For example, by selecting the Theme menu item, the user can change the Phone Accent color. If your user interface provides links to other pages or external web pages, this color should be used to specify this information. By using those predefined styles, you can be sure that your link's color will change to the new user selection automatically.

■ **Note** The full list of predefined styles is available at the MSDN official page: `http://msdn.microsoft.com/en-us/library/ff769552(v=VS.92).aspx`.

As you saw in Recipe 3-4, the Windows Phone 7 theme is a set of resources such as background colors and phone accent color used to customize the phone's look. By using the predefined resource dictionary provided by the phone, you can be sure to maintain the consistency and compatibility of your application. Moreover, you can be pretty sure that your application will pass Marketplace approval.

When you need to use your own colors, fonts, and so forth, you can override the static resource in your application. Obviously, this change will be applied only to your application and not to the entire phone system.

You can specify the static resource either in an XAML file or in a code file. In the former, you can use the `{StaticResource}` markup extension together with the static resource name. This static resource will be added to your application when it starts. In the latter case, you can use the `Resources` property from the `Application` class, specifying the static resource name (as seen in Recipe 3-4).

The Code

To demonstrate this recipe, you will create the `PreDefinedSystemStylesDemo` Silverlight for Windows Phone 7 application. It uses the `Pivot` control (which you can learn more about in Recipe 3-7) to separate application content in different categories such as Brushes, Text Boxes, Fonts, and Text Styles.

The application is simply a visual reference to the static resource styles provided by the phone, so the code is pretty simple, all defined in the `MainPage.xaml` file.

It starts defining all the Brush styles applicable to a control such as the `Rectangle`. The `Fill` property of the `Rectangle` control contains different static resource styles defined by the Brush style.

```
<Grid x:Name="LayoutRoot" Background="YellowGreen">
    <controls:Pivot Title="Predefined styles">
        <controls:PivotItem Header="Brushes">
            <ListBox Margin="0,0,-12,0">
                <StackPanel Orientation="Vertical" Margin="0,0,0,17">
                    <StackPanel Orientation="Horizontal" Margin="0,0,5,5">
                        <Rectangle Width="100" Height="100"
                         Fill="{StaticResource PhoneAccentBrush}" />
                        <TextBlock Margin="5,0,0,0" Text="PhoneAccentBrush"
                         FontSize="{StaticResource PhoneFontSizeNormal}" />
                    </StackPanel>
                    <StackPanel Orientation="Horizontal" Margin="0,0,5,5">
                        <Rectangle Width="100" Height="100"
                         Fill="{StaticResource PhoneForegroundBrush}" />
                        <TextBlock Margin="5,0,0,0" Text="PhoneForegroundBrush"
                         FontSize="{StaticResource PhoneFontSizeNormal}" />
                    </StackPanel>
```

```
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100" Fill="{StaticResource
     PhoneBackgroundBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneBackgroundBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100" Fill="{StaticResource
     PhoneContrastBackgroundBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneContrastBackgroundBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100" Fill="{StaticResource
     PhoneContrastForegroundBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneContrastForegroundBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100"
     Fill="{StaticResource PhoneDisabledBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneDisabledBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100"
     Fill="{StaticResource PhoneSubtleBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneSubtleBrush"
    FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100"
     Fill="{StaticResource PhoneBorderBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneBorderBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100"
     Fill="{StaticResource TransparentBrush}" />
    <TextBlock Margin="5,0,0,0" Text="TransparentBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
<StackPanel Orientation="Horizontal" Margin="0,0,5,5">
    <Rectangle Width="100" Height="100"
     Fill="{StaticResource PhoneSemitransparentBrush}" />
    <TextBlock Margin="5,0,0,0" Text="PhoneSemitransparentBrush"
     FontSize="{StaticResource PhoneFontSizeNormal}" />
</StackPanel>
```

```
                    <StackPanel Orientation="Horizontal" Margin="0,0,5,5">
                        <Rectangle Width="100" Height="100"
                        Fill="{StaticResource PhoneChromeBrush}" />
                        <TextBlock Margin="5,0,0,0" Text="PhoneChromeBrush"
                        FontSize="{StaticResource PhoneFontSizeNormal}" />
                    </StackPanel>
                </StackPanel>
            </ListBox>
        </controls:PivotItem>
```

The second Pivot control contains the styles applicable to text boxes:

```
        <controls:PivotItem Header="TextBoxes">
            <ListBox Margin="0,0,-12,0">
                <StackPanel Orientation="Vertical" Margin="0,0,0,17">
                    <TextBox BorderBrush="{StaticResource PhoneTextBoxEditBorderBrush}"
                     Background="{StaticResource PhoneTextBoxEditBackgroundBrush}"
                     Foreground="{StaticResource PhoneTextBoxForegroundBrush}"
                     SelectionForeground="{StaticResource
                                           PhoneTextBoxSelectionForegroundBrush}" />
                    <TextBlock TextWrapping="Wrap"
                     Text="TextBox with PhoneTextBoxEditBorderBrush,
                           PhoneTextBoxEditBackgroundBrush,
                           PhoneTextCaretBrush, PhoneTextBoxForegroundBrush, and
                           PhoneTextBoxSelectionForegroundBrush styles." />
                </StackPanel>
                <StackPanel Orientation="Vertical" Margin="0,0,0,17">
                    <TextBox IsReadOnly="True"
                     Background="{StaticResource PhoneTextBoxReadOnlyBrush}"
                     Text="I'm a read-only textbox"/>
                    <TextBlock TextWrapping="Wrap"
                     Text="Read only TextBox with PhoneTextBoxReadOnlyBrush" />
                </StackPanel>
            </ListBox>
        </controls:PivotItem>
```

The third Pivot control contains the Fonts static resource styles. The FontFamily and FontSize properties of the TextBlock control are used to show the Font static resource styles:

```
        <controls:PivotItem Header="Fonts">
            <ListBox Margin="0,0,-12,0">
                <StackPanel Orientation="Vertical" Margin="0,0,0,17">
                    <TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
                               FontSize="{StaticResource PhoneFontSizeSmall}"
                               Text="PhoneFontFamilyNormal with PhoneFontSizeSmall" />
                    <TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
                               FontSize="{StaticResource PhoneFontSizeNormal}"
                               Text="PhoneFontFamilyNormal with PhoneFontSizeNormal" />
                    <TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
                               FohntSize="{StaticResource PhoneFontSizeMedium}"
                               Text="PhoneFontFamilyNormal with PhoneFontSizeMedium" />
```

```
<TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
           FontSize="{StaticResource PhoneFontSizeMediumLarge}"
           Text="PhoneFontFamilyNormal with
                 PhoneFontSizeMediumLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
           FontSize="{StaticResource PhoneFontSizeLarge}"
           Text="PhoneFontFamilyNormal with PhoneFontSizeLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
     FontSize="{StaticResource PhoneFontSizeExtraLarge}"
     Text="PhoneFontFamilyNormal with PhoneFontSizeExtraLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
   FontSize="{StaticResource PhoneFontSizeExtraExtraLarge}"
   Text="PhoneFontFamilyNormal with PhoneFontSizeExtraExtraLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyNormal}"
           FontSize="{StaticResource PhoneFontSizeHuge}"
           Text="PhoneFontFamilyNormal with PhoneFontSizeHuge" />

<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
           FontSize="{StaticResource PhoneFontSizeSmall}"
           Text="PhoneFontFamilyLight with PhoneFontSizeSmall" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
           FontSize="{StaticResource PhoneFontSizeNormal}"
           Text="PhoneFontFamilyLight with PhoneFontSizeNormal" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
           FontSize="{StaticResource PhoneFontSizeMedium}"
           Text="PhoneFontFamilyLight with PhoneFontSizeMedium" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
       FontSize="{StaticResource PhoneFontSizeMediumLarge}"
       Text="PhoneFontFamilyLight with PhoneFontSizeMediumLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
           FontSize="{StaticResource PhoneFontSizeLarge}"
           Text="PhoneFontFamilyLight with PhoneFontSizeLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
       FontSize="{StaticResource PhoneFontSizeExtraLarge}"
       Text="PhoneFontFamilyLight with PhoneFontSizeExtraLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
    FontSize="{StaticResource PhoneFontSizeExtraExtraLarge}"
    Text="PhoneFontFamilyLight with PhoneFontSizeExtraExtraLarge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilyLight}"
           FontSize="{StaticResource PhoneFontSizeHuge}"
           Text="PhoneFontFamilyLight with PhoneFontSizeHuge" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
          FontSize="{StaticResource PhoneFontSizeSmall}"
          Text="PhoneFontFamilySemiLight with PhoneFontSizeSmall" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
         FontSize="{StaticResource PhoneFontSizeNormal}"
         Text="PhoneFontFamilySemiLight with PhoneFontSizeNormal" />
<TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
         FontSize="{StaticResource PhoneFontSizeMedium}"
         Text="PhoneFontFamilySemiLight with PhoneFontSizeMedium" />
```

```
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
                            FontSize="{StaticResource PhoneFontSizeMediumLarge}"
                            Text="PhoneFontFamilySemiLight with PhoneFontSizeMediumLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
                            FontSize="{StaticResource PhoneFontSizeLarge}"
                            Text="PhoneFontFamilySemiLight with PhoneFontSizeLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
                             FontSize="{StaticResource PhoneFontSizeExtraLarge}"
                             Text="PhoneFontFamilySemiLight with PhoneFontSizeExtraLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
                        FontSize="{StaticResource PhoneFontSizeExtraExtraLarge}"
                        Text="PhoneFontFamilySemiLight with PhoneFontSizeExtraExtraLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiLight}"
                                   FontSize="{StaticResource PhoneFontSizeHuge}"
                                   Text="PhoneFontFamilySemiLight with PhoneFontSizeHuge" />

                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                                   FontSize="{StaticResource PhoneFontSizeSmall}"
                                   Text="PhoneFontFamilySemiBold with PhoneFontSizeSmall" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                                  FontSize="{StaticResource PhoneFontSizeNormal}"
                                  Text="PhoneFontFamilySemiBold with PhoneFontSizeNormal" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                                  FontSize="{StaticResource PhoneFontSizeMedium}"
                                  Text="PhoneFontFamilySemiBold with PhoneFontSizeMedium" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                             FontSize="{StaticResource PhoneFontSizeMediumLarge}"
                             Text="PhoneFontFamilySemiBold with PhoneFontSizeMediumLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                                   FontSize="{StaticResource PhoneFontSizeLarge}"
                                   Text="PhoneFontFamilySemiBold with PhoneFontSizeLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                              FontSize="{StaticResource PhoneFontSizeExtraLarge}"
                              Text="PhoneFontFamilySemiBold with PhoneFontSizeExtraLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                         FontSize="{StaticResource PhoneFontSizeExtraExtraLarge}"
                         Text="PhoneFontFamilySemiBold with PhoneFontSizeExtraExtraLarge" />
                        <TextBlock FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                                   FontSize="{StaticResource PhoneFontSizeHuge}"
                                   Text="PhoneFontFamilySemiBold with PhoneFontSizeHuge" />
                    </StackPanel>
                </ListBox>
            </controls:PivotItem>
```

The last **Pivot** control contains the static resource styles that are applicable to the text. In this case, you use the **TextBlock** control to demonstrate the effect of those resource styles:

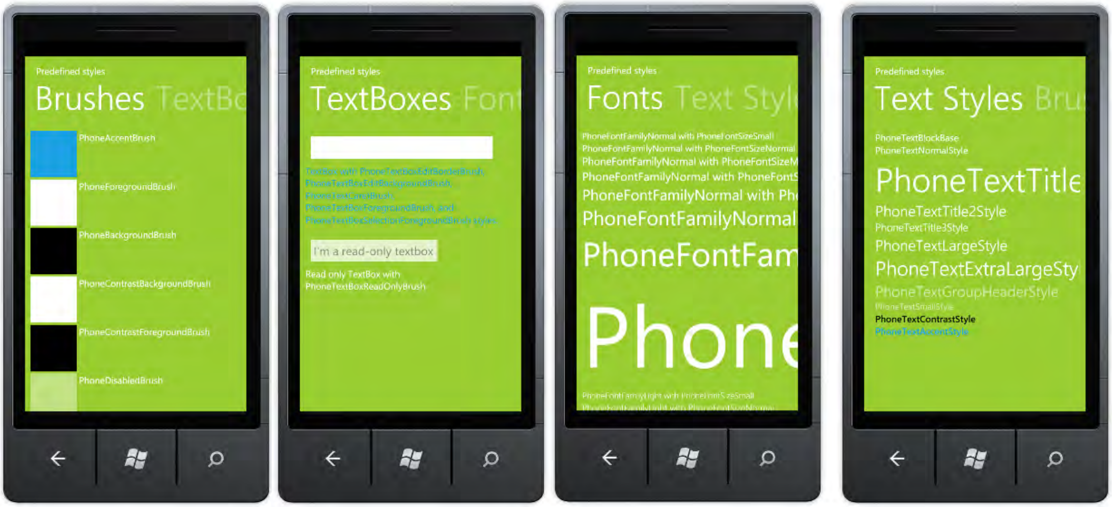
```
            <controls:PivotItem Header="Text Styles">
                <ListBox Margin="0,0,-12,0">
                    <StackPanel Orientation="Vertical" Margin="0,0,0,17">
                        <TextBlock Style="{StaticResource PhoneTextBlockBase}"
                         Text="PhoneTextBlockBase" />
                        <TextBlock Style="{StaticResource PhoneTextNormalStyle}"
                         Text="PhoneTextNormalStyle" />
                        <TextBlock Style="{StaticResource PhoneTextTitle1Style}"
                         Text="PhoneTextTitle1Style" />
                        <TextBlock Style="{StaticResource PhoneTextTitle2Style}"
                         Text="PhoneTextTitle2Style" />
                        <TextBlock Style="{StaticResource PhoneTextTitle3Style}"
                         Text="PhoneTextTitle3Style" />
                        <TextBlock Style="{StaticResource PhoneTextLargeStyle}"
                         Text="PhoneTextLargeStyle" />
                        <TextBlock Style="{StaticResource PhoneTextExtraLargeStyle}"
                         Text="PhoneTextExtraLargeStyle" />
                        <TextBlock Style="{StaticResource PhoneTextGroupHeaderStyle}"
                                          Text="PhoneTextGroupHeaderStyle" />
                        <TextBlock Style="{StaticResource PhoneTextSmallStyle}"
                                          Text="PhoneTextSmallStyle" />
                        <TextBlock Style="{StaticResource PhoneTextContrastStyle}"
                                          Text="PhoneTextContrastStyle" />
                        <TextBlock Style="{StaticResource PhoneTextAccentStyle}"
                                          Text="PhoneTextAccentStyle" />
                    </StackPanel>
                </ListBox>
            </controls:PivotItem>
        </controls:Pivot>
    </Grid>
```

This changes the application background color to `YellowGreen` so that system colors can be visible. Finally, all the predefined system resources are specified by using the `{StaticResource}` markup extension so as to have a visual representation of those resources at runtime.

Usage

From Visual Studio 2010, run the application by pressing Ctrl+F5. Depending on the target output, the application deploys either on the Windows Phone Emulator or the Windows Phone device.

The application starts showing all the available brushes; you have to scroll up and down to see them all. Flicking to the left brings you to the next page, which shows text box styles. Going further to the left shows all the predefined font styles. Finally, the last page shows the predefined text styles (see Figure 3-11).



TextBox with PhoneTextBoxEditBorderBrush, PhoneTextBoxEditBackgroundBrush, PhoneTextCaretBrush, PhoneTextBoxForegroundBrush, and PhoneTextBoxSelectionForegroundBrush styles.

I'm a read-only textbox

Read only TextBox with PhoneTextBoxReadOnlyBrush

Predefined styles
Fonts Text Style
PhoneFontFamilyNormal with PhoneFontSizeSmall
PhoneFontFamilyNormal with PhoneFontSizeNormal
PhoneFontFamilyNormal with PhoneFontSizeM
PhoneFontFamilyNormal with PhoneFontS
PhoneFontFamilyNormal with Pho
PhoneFontFamilyNormal
PhoneFontFam
Phone
PhoneFontFamilyLight with PhoneFontSizeSmall
PhoneFontFamilyLight with PhoneFontSizeNormal
Predefined styles
Text Styles Bru
PhoneTextBlockBase
PhoneTextNormalStyle
PhoneTextTitle
PhoneTextTitle2Style
PhoneTextTitle3Style
PhoneTextLargeStyle
PhoneTextExtraLargeSty
PhoneTextGroupHeaderStyle
PhoneTextSmallStyle
PhoneTextContrastStyle
PhoneTextAccentStyle

Figure 3-11. The `PreDefinedSystemStylesDemo` *application shows all the static resources provided by the phone.*

3-6. Localizing Your Application

Problem

You need to create an application that changes the user interface depending on the language and regional settings of the Windows Phone 7 operating system.

Solution

You can use the `CultureInfo` class and its `Name` property to retrieve the current language and regional settings. Moreover, by using the `Resources` files from Visual Studio 2010, you can define constant strings in different languages that can be shown according to the selected Windows Phone 7 operating system language.

How It Works

Localizing your application is an important task because by implementing different languages, you can distribute your application in various markets. Also, you can obtain automatic formatting of information that differs from country to country, such as dates, calendars, and money.

Visual Studio 2010 and Windows Phone 7 SDK give you all the necessary tools to easily implement a localized application. The `CultureInfo` class includes properties and methods to retrieve the current culture set in the user phone (see Figure 3-12 for the class diagram). An instance of the `CultureInfo` class is retrieved by using the `CurrentThread` static property provided by the `Thread` class. This class is defined in the `System.Threading` namespace, while the `CultureInfo` class is defined in the `System.Globalization` namespace.

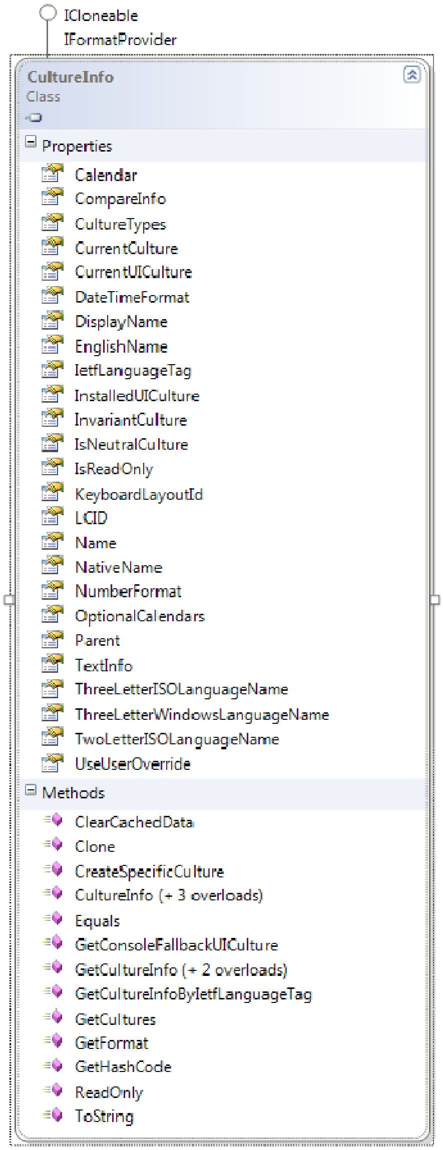


Figure 3-12. The `CultureInfo` class diagram

The Name property of the CultureInfo class returns the culture name. This value has a standard format such as en-US, it-IT, fr-FR, and so on. The name is divided into a lowercase two-letter part that indicates the language and an uppercase two-letter part that indicates the country or region. So, for example, the en-US name indicates the English language used in the United States, and the en-CA name indicates the English language in Canada.

By using Visual Studio 2010, you can add resource files in which you can put strings and constant values. If you specify the culture name in the resource filename (for example, the MyResources.fr-FR.resx filename), you can ensure that those values are automatically used when the user's phone is set to use French culture and language.

So when you build the user interface of your application, you should not use fixed values for text block names, button captions, and so forth, but instead use resource strings. You have to pay attention to text blocks, buttons, and general controls showing text because what will be shown in one language will not be the same in another language. For example, a button showing the text OK when using English should be sized to contain different text when another language is selected.

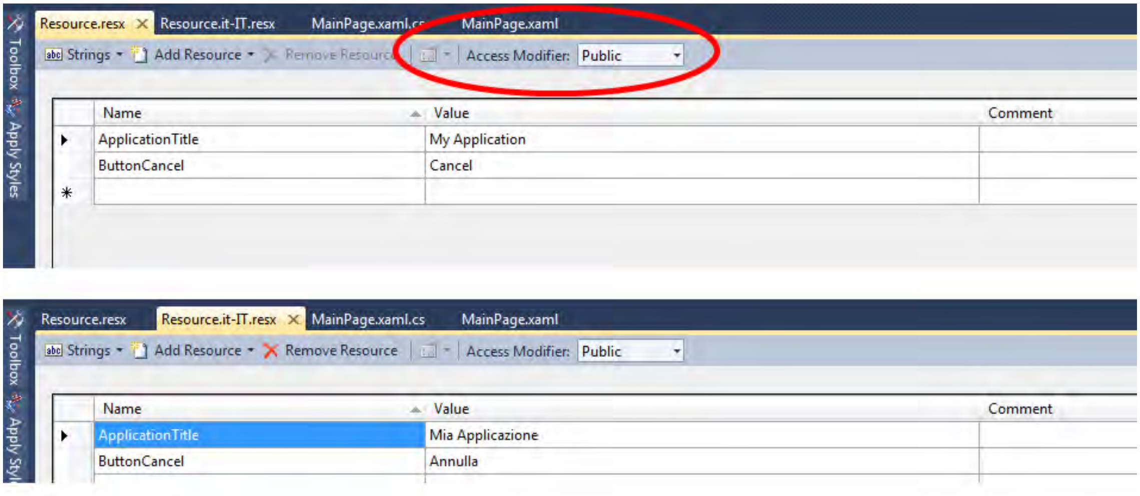
Using Visual Studio 2010, you have to create an invariant culture resource file that is used by default when no other localized resources are found in the application, and that doesn't have any culture specified in the filename. Finally, you will add a resource file for each culture you want to manage in your application.

The Code

To demonstrate this recipe, you will create the LocalizationDemo Silverlight for Windows Phone 7 application. Depending on the selected language and regional settings in the Windows Phone 7 operating system, the application changes its title, button captions, and image.

So, create a new Silverlight for Windows Phone 7 application and call it LocalizationDemo. Then select Add New Item from the Project menu and select the Resource File template from the Add New Item dialog box. You can give your own name to the file (we chose Resource.resx). Repeat this operation to add another resource file, but this time you have to append the culture name and region. In our case, being Italian, we added the resource file Resource.it-IT.resx.

Specify the same keys in the resource file but with different values. Figure 3-13 compares the two resource files.



Access Modifier: Public

Name	Value	Comment
ApplicationTitle	My Application	
ButtonCancel	Cancel	
*		

Access Modifier: Public

Name	Value	Comment
ApplicationTitle	Mia Applicazione	
ButtonCancel	Annulla	

Figure 3-13. The resource files compared

The circled Access Public combo box in Figure 3-13 has to be set to Public so that Visual Studio 2010 generates a class for you. This class—which has the same resource filename without the file extension—can be used directly in your code so that you can specify resources in the XAML file.

The `Resource` class (generated from the `Resource.resx` resource file) is instantiated into the custom `LocalizedString` class. In the class constructor, a new `Resource` object is created, and by using the `LocalizedResource` property, is returned to the caller. This class will be used in `MainPage.xaml` to retrieve keys from the resource file.

```
public class LocalizedString
{
    private Resource m_LocalizedResource;

    public LocalizedString()
    {
        m_LocalizedResource = new Resource();
    }

    public Resource LocalizedResource { get { return m_LocalizedResource; } }
}
```

Before designing the user interface and specifying resources, you have to inform the application that you want to use the resources. This is accomplished by specifying the class name containing the `Resource` class instance between the `Application.Resource` tags in the `App.xaml` file:

```
<Application
    x:Class="LocalizationDemo.App"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:local="clr-namespace:LocalizationDemo">

    <!--Application Resources-->
    <Application.Resources>
        <local:LocalizedString x:Key="LocalizedString" />
    </Application.Resources>
. . .
```

In the MainPage.xaml page, you add a button and an image control. The image will be changed depending on the selected language and region in the code, while the button's content string will be changed automatically by reading the strings from the resource. To obtain this behavior, you have to specify to bind the button's content to the ButtonCancel key returned by the LocalizedResource property that the runtime engine can find in the LocalizedString source. The same is valid for the application title that points to the ApplicationTitle resource key.

```
. . .
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <StackPanel>
                <Image x:Name="imgBanner" />
                <Button Content="{Binding Path=LocalizedResource.ButtonCancel,
                        Source={StaticResource LocalizedString}}" />
            </StackPanel>
        </Grid>
```

In the MainPage.xaml.cs file, you define the Loaded event handler, where you use the CurrentCulture property to retrieve an instance from the CultureInfo class. The CurrentCulture property is provided by the Thread class with its own static CurrentThread property. You use the Name property of the CultureInfo class to format the string used by the Uri class's constructor. This is accomplished in order to retrieve the localized image you have stored in the appropriate folder. For example, if the application retrieves the user using the Italian language and regional settings, the it-IT culture name is used to pick the right image from the it-IT folder created in the Visual Studio solution.

```
        private void PhoneApplicationPage_Loaded(object sender, RoutedEventArgs e)
        {
            CultureInfo ci = Thread.CurrentThread.CurrentCulture;
            imgBanner.Source = new BitmapImage(new Uri(string.Format("{0}/amazon.png",
                                                   ci.Name), UriKind.Relative));
        }
```

Usage

Press Ctrl+F5 to execute the application. The application deploys either on the emulator or the device, depending on the target output chosen.

In our case, the emulator starts with the English language set as the culture, so the application shows the title, the button caption, and the image taken from the English resource file (see the left part of Figure 3-14).

■ **Note** This is the invariant culture resource file, so you will see the English language even if you chose other unsupported languages such as French or Spanish.

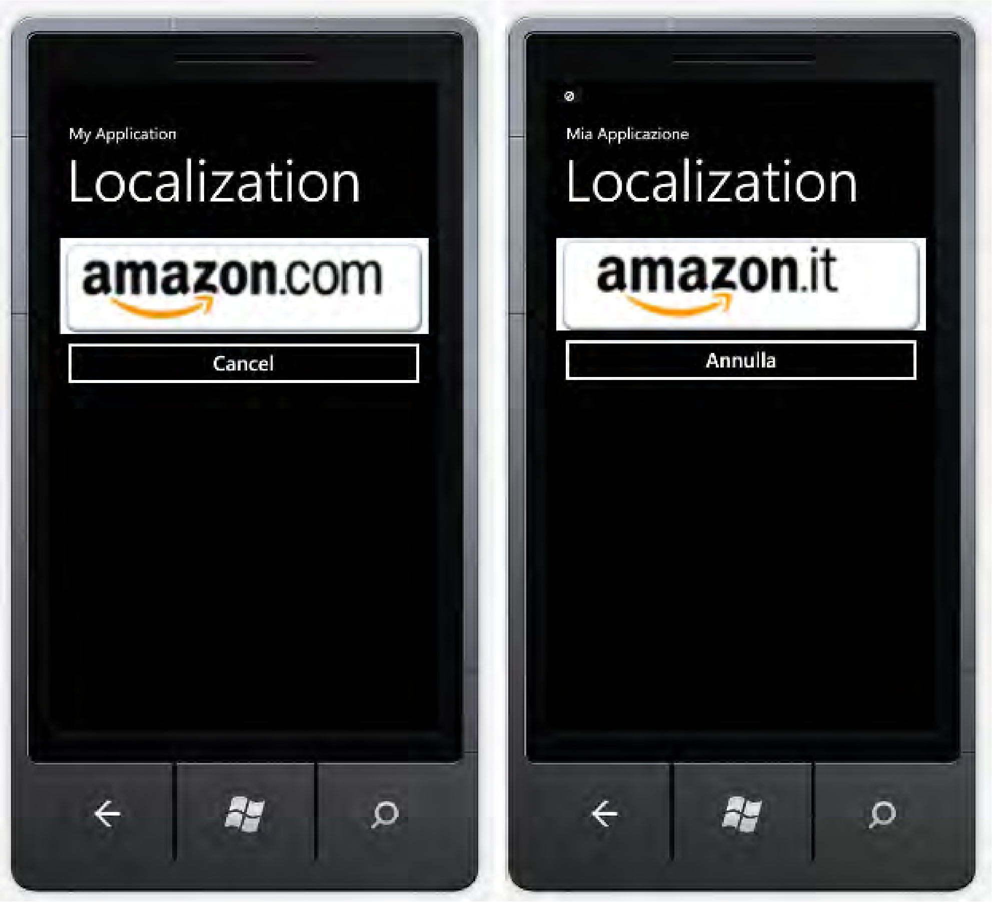
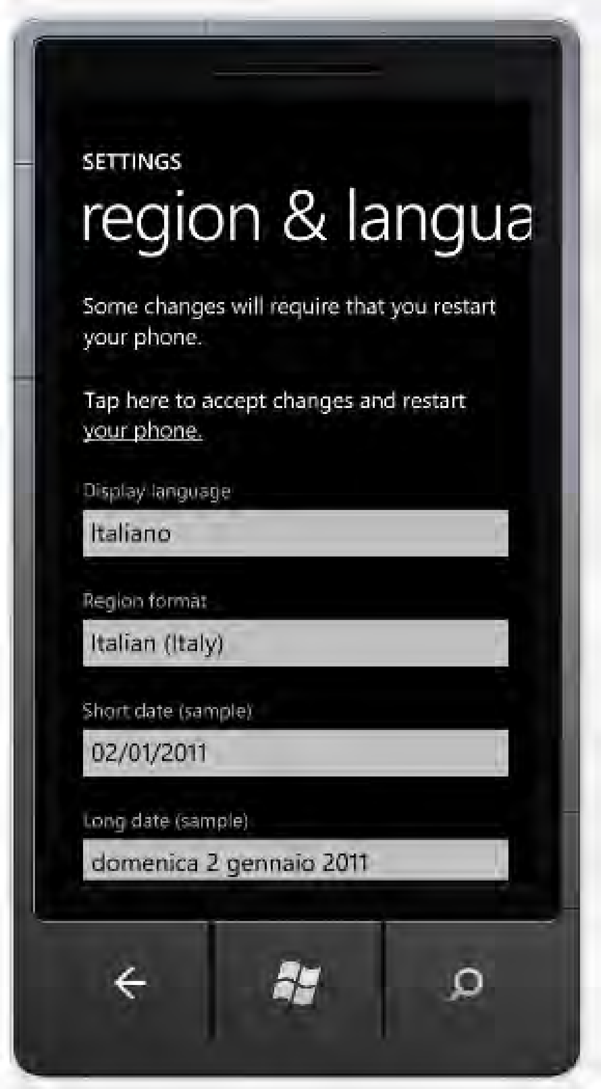


Figure 3-14. *The* **`LocalizationDemo`** *application showing both supported languages*

Now go to the Start menu by pressing the hardware Start button. Tap the top-right circled arrow to access the application list and then tap the Settings app. From the Region & Language menu, select the

Italiano language. Finally, tap the Tap Here To Accept Changes And Restart Your Phone link to accept the new language (see Figure 3-15).



SETTINGS

region & langua

Some changes will require that you restart your phone.

Tap here to accept changes and restart your phone.

Display language

Italiano

Region format

Italian (Italy)

Short date (sample)

02/01/2011

Long date (sample)

domenica 2 gennaio 2011

Figure 3-15. The Region & Language settings page

The phone restarts, and you can go to the application list and again execute the `LocalizationDemo` application. This time, it will show the Italian language and the localized image (see the right part of Figure 3-14).

3-7. Using Panorama and Pivot Controls

Problem

You need to develop an application that shows a lot of information that is separated into categories or groups. You don't want to put this information on separate pages and provide a navigation system; you would prefer to have them on the same main page of the application.

Solution

You can use either a Panorama control or a Pivot control provided by the Microsoft.Phone.Controls assembly.

How It Works

Both controls are similar in their programming and final output, so you can choose which one to use in your application. Each provides a Title property used to specify a title for the application. Each also provides the xxxItem child control (where xxx can be either a Pivot or Panorama control) used to specify a category or a group of information. You can specify whatever you want within this child control because it derives from ContentControl. The common implementation provides a ListBox control with its own template providing an image and some related text.

In the Windows Phone 7 operating system, you can see the Panorama control in action, executing the Marketplace application. On the other hand, execute the Settings application to see the Pivot control in action. As you can see, the main difference between these two controls is the background image provided by the Panorama control. The Title property in the Panorama control uses a larger font respect to the one provided by the Pivot control. Indeed, with the Panorama control, the title gives the panorama effect, because the full title is readable only by scrolling between panorama's items.

The Code

In this recipe, you will create an application that shows today's BBC program schedule by using both a Panorama and a Pivot control. The TV schedule is provided by a web service from the www.bleb.org site (see more on how to use web services in your application in Chapter 9).

The first operation to perform is to add a reference to the Microsoft.Phone.Controls.dll assembly, only if you haven't created the application from the Windows Phone Panorama Application or the Windows Phone Pivot Application Visual Studio 2010 template.

In this case, we started the TvSchedule7 application (and the TvSchedulePivot7 application too) from the Visual Studio 2010 template, so we already have all that is needed to use both Panorama and Pivot controls. This template implements the Model-View-ViewModel (MVVM) architecture, so you will find the ViewModels folder in the Visual Studio solution containing two files: ItemViewModel.cs and MainViewModel.cs. Thanks to this architecture, you can separate data into its visual representation.

In ItemViewModel.cs, you have to describe and define the item's characteristics. So you have to define properties representing your data. In this case, a TV program is defined by a title, a description, and the scheduled time. So you add three properties into the ItemViewModel.cs file:

```
public class ItemViewModel : INotifyPropertyChanged
```

```
{
    private string _title;
    /// <summary>
    /// Programme title
    /// </summary>
    /// <returns></returns>
    public string Title
    {
        get
        {
            return _title;
        }
        set
        {
            if (value != _title)
            {
                _title = value;
                NotifyPropertyChanged("Title");
            }
        }
    }

    private string _startEnd;
    /// <summary>
    /// Programme start end.
    /// </summary>
    /// <returns></returns>
    public string StartEnd
    {
        get
        {
            return _startEnd;
        }
        set
        {
            if (value != _startEnd)
            {
                _startEnd = value;
                NotifyPropertyChanged("StartEnd");
            }
        }
    }
```

```
        private string _description;
        /// <summary>
        /// Sample ViewModel property; this property is used in the view to display its
        /// value using a Binding.
        /// </summary>
        /// <returns></returns>
        public string Description
        {
            get
            {
                return _description;
            }
            set
            {
                if (value != _description)
                {
                    _description = value;
                    NotifyPropertyChanged("Description");
                }
            }
        }

        public event PropertyChangedEventHandler PropertyChanged;
        private void NotifyPropertyChanged(String propertyName)
        {
            PropertyChangedEventHandler handler = PropertyChanged;
            if (null != handler)
            {
                handler(this, new PropertyChangedEventArgs(propertyName));
            }
        }
    }
```

In the `MainViewModel.cs` code file, you add the logic to gather information from the web service. First of all, you define an `ObservableCollection` generic collection for each group of items you need to show:

```
    public class MainViewModel : INotifyPropertyChanged
    {
        public MainViewModel()
        {
            this.BBC1Items = new ObservableCollection<ItemViewModel>();
            this.BBC2Items = new ObservableCollection<ItemViewModel>();
            this.ITV1Items = new ObservableCollection<ItemViewModel>();
        }
        /// <summary>
        /// A collection for ItemViewModel objects.
        /// </summary>
        public ObservableCollection<ItemViewModel> BBC1Items { get; private set; }
        public ObservableCollection<ItemViewModel> BBC2Items { get; private set; }
        public ObservableCollection<ItemViewModel> ITV1Items { get; private set; }
. . .
```

Then in the LoadData method, you define the code to load the TV schedule from the web service. So you create a new WebClient object and hook its own DownloadStringCompleted event. This is raised when the call to the DownloadStringAsync method is completed. You call this method to retrieve information from the web service. The last method parameter represents a user token string that is passed as a parameter to the DownloadStringCompleted event handler. You use it to determine which TV channel is required for the web service and which is the next channel to retrieve.

```
public void LoadData()
{
    web = new WebClient();

    web.DownloadStringAsync(new Uri("http://www.bleb.org/tv/data/listings/0/bbc1.xml"),
                            "BBC1");
    web.DownloadStringCompleted +=
                new DownloadStringCompletedEventHandler(web_DownloadStringCompleted);
}
```

The real data loading is in the DownloadStringCompleted event handler. Because the web service returns XML content, you use the LINQ to XML library to load and manage this result. A snippet of the XML content is shown here:

```
<?xml version="1.0" encoding="UTF-8"?>
<!-- produced for the bleb.org TV system at Sun Mar  6 08:39:03 2011 -->
<channel id="bbc1" source="XMLTV" date="06/03/2011">
  <programme>
    <flags>(S)</flags>
    <desc>The latest news, sports, business and weather from the BBC's Breakfast
          team.</desc>
    <title>Breakfast</title>
    <end>0735</end>
    <start>0600</start>
    </programme>
. . .
```

The Parse method from the XElement class loads and parses the XML and then goes through its programme elements filling the MainViewModel collections with related items. Then, checking the user token string, you again call the DownloadStringAsync method to retrieve the next TV channel schedule.

■ **Note** It is not possible to call the DownloadStringAsync method again, until the DownloadStringCompleted event is raised. Otherwise, the application retrieves an exception.

Finally, you set the IsDataLoaded property to true to indicate that the loading operations are concluded:

```
void web_DownloadStringCompleted(object sender, DownloadStringCompletedEventArgs e)
{
    if (e.Error != null && e.Error.Message != string.Empty)
        return;

    if (e.Cancelled)
        return;

    string result = e.Result;
    XElement xml = XElement.Parse(result);

    if (xml != null)
    {
        foreach (XElement programme in xml.Descendants("programme"))
        {
            ItemViewModel item = new ItemViewModel();
            item.Description = programme.Element("desc").Value;
            item.Title = programme.Element("title").Value;
            item.StartEnd = programme.Element("start").Value + " - " +
                            programme.Element("end").Value;

            switch ((string)e.UserState)
            {
                case "BBC1":
                    this.BBC1Items.Add(item);
                    break;
                case "BBC2":
                    this.BBC2Items.Add(item);
                    break;
                case "ITV1":
                    this.ITV1Items.Add(item);
                    break;
            }
        }
    }

    switch ((string)e.UserState)
    {
        case "BBC1":
            web.DownloadStringAsync(
                new Uri("http://www.bleb.org/tv/data/listings/0/bbc2.xml"), "BBC2");
            break;
        case "BBC2":
            web.DownloadStringAsync(
                new Uri("http://www.bleb.org/tv/data/listings/0/itv1.xml"), "ITV1");
            break;
    }
```

```
            this.IsDataLoaded = true;
        }
```

The code shown to this point is common to both the Panorama and Pivot examples because it manages the model and data part of the MVVM architecture. Now you can focus your attention on how to visually represent this data.

Both the Panorama and Pivot item children controls have defined a ListBox with a template including an image control, and two TextBlocks within a stack panel. The ListBox—as with most of the controls—provides the binding feature used to populate the control reading data from a data source. The ItemsSource attribute from the ListBox control accepts the binding to the collections defined in the MainViewModel properties such as BBC1Items, BBC2Items, and ITV1Items. The binding mechanism is pretty smart to add a ListBox item for each related item in the collection. We don't need to write any code lines. By always using the binding feature, you can specify which ItemViewModel property to use to print the text blocks' text:

```
. . .
<ListBox Margin="0,0,-12,0" ItemsSource="{Binding BBC1Items}"
    SelectionChanged="lb_SelectionChanged" x:Name="lbBBC1">
    <ListBox.ItemTemplate>
        <DataTemplate>
            <StackPanel Orientation="Horizontal" Margin="0,0,0,17">
            <Image Source="images/bbc1.png" Height="100" Width="100" />
            <StackPanel Width="311">
                <TextBlock Text="{Binding Title}" TextWrapping="Wrap"
                           Style="{StaticResource PhoneTextExtraLargeStyle}"/>
                <TextBlock Text="{Binding StartEnd}" TextWrapping="Wrap"
                           Margin="12,-6,12,0"
                           Style="{StaticResource PhoneTextSubtleStyle}"/>
            </StackPanel>
            </StackPanel>
        </DataTemplate>
    </ListBox.ItemTemplate>
</ListBox>
. . .
```

■ **Note** The ListBox control defines the SelectionChanged event handler used to retrieve when the user taps on a list item. In this application, this event handler is used to show program details. By the way, this is not the proper implementation if you want to write code using the pure MVVM pattern. Chapter 10 covers the MVVM pattern.

Now let's see the differences in the XAML code in order to define either a Panorama or a Pivot control. The Panorama has a background that is not provided by the Pivot, but the rest of code is really similar.

Here is the Pivot control definition with one item:

```
. . .
    <!--LayoutRoot is the root grid where all page content is placed-->
    <Grid x:Name="LayoutRoot" Background="Transparent">
        <!--Pivot Control-->
        <controls:Pivot Title="TvSchedule7">
            <!--Pivot item one-->
            <controls:PivotItem Header="BBC1">
                <!--Double line list with text wrapping-->
. . .
```

And here is the Panorama definition:

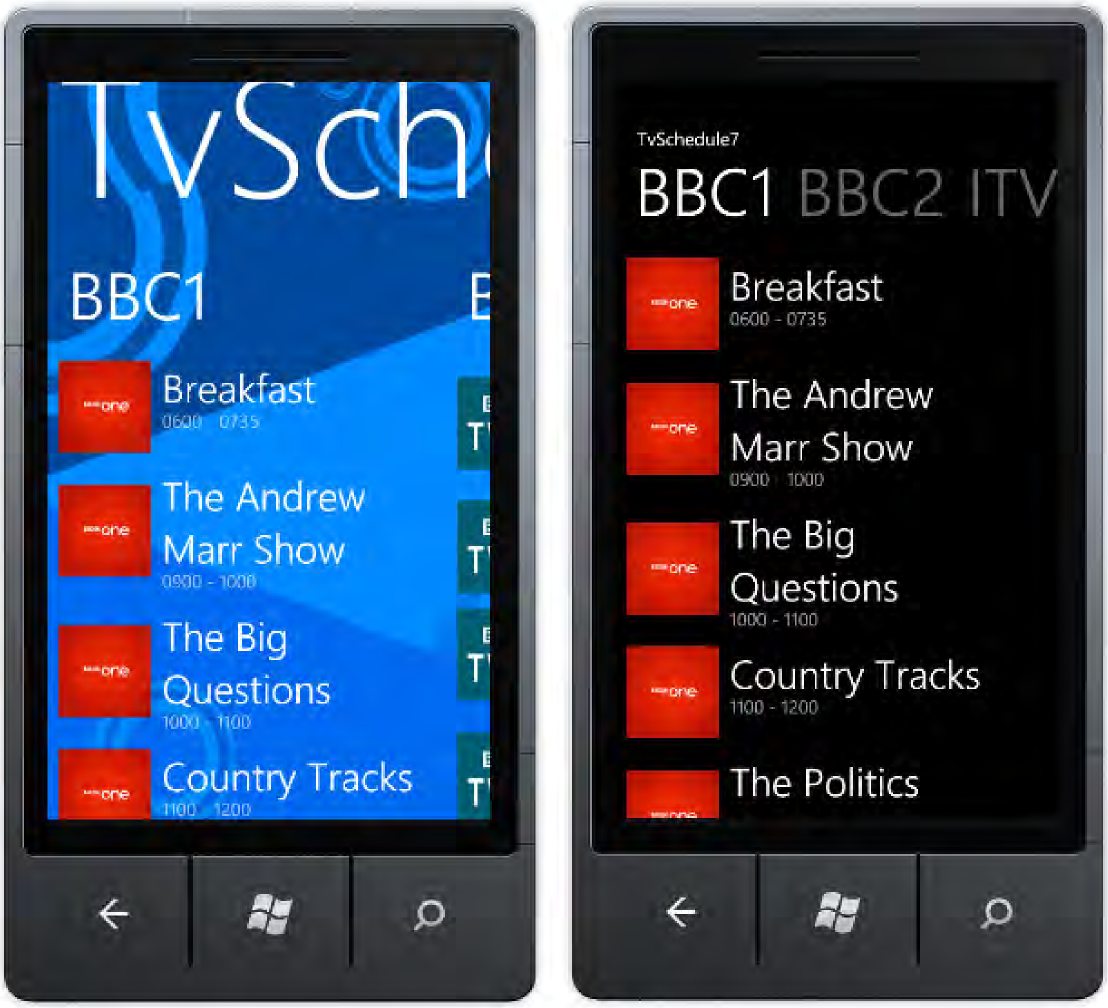
```
. . .
    <!--LayoutRoot is the root grid where all page content is placed-->
    <Grid x:Name="LayoutRoot" Background="Transparent">

        <!--Panorama control-->
        <controls:Panorama Title="TvSchedule7">
            <controls:Panorama.Background>
                <ImageBrush ImageSource="PanoramaBackground.png"/>
            </controls:Panorama.Background>

            <!--Panorama item one-->
            <controls:PanoramaItem Header="BBC1">
. . .
```

That's it. The code defines the other two control items with the other two TV channels, but the code is pretty much the same (it differs only in its ID and header text).

Usage

We have two projects: TvSchedule7 that uses the Panorama control, and TvSchedulePivot7 that uses the Pivot control. So open two Visual Studio 2010 program instances and load these two projects. Press Ctrl+F5 from one Visual Studio 2010 instance and wait until the application is deployed and started. For example, starting with the TvSchedule7 example, you will see the Panorama control showing a background with BBC1 TV scheduled programs and part of BBC2 TV scheduled programs (see the left part of Figure 3-16). You can flick to the left so that the Panorama control shows some other part of the title and the BBC2's program schedules. When you reach the last item of the Panorama control and flick again to the left, the control will show you the first page.

Leaving the emulator in execution, launch the other project. The `Pivot` control will briefly show the same information but with a different user interface (see the right-hand side of Figure 3-16). The title is fully readable, and there are more list box items visible. Even with the `Pivot` control, you can flick either left or right to navigate through items.



TvSch
BBC1
Breakfast
0600 0735
The Andrew Marr Show
0900 - 1000
The Big Questions
1000 1100
Country Tracks
1100 1200

TvSchedule7
BBC1 BBC2 ITV
Breakfast
0600 - 0735
The Andrew Marr Show
0900 1000
The Big Questions
1000 - 1100
Country Tracks
1100 - 1200
The Politics

Figure 3-16. Panorama vs `Pivot` *controls*

3-8. Spicing Up the User Interface with the Silverlight Toolkit

Problem

You would like to enhance your user interface with some new controls but don't want to spend time making them.

Solution

You can use the Silverlight for Windows Phone Toolkit, which is available from CodePlex at `http://silverlight.codeplex.com`.

How It Works

The `Microsoft.Phone.Controls.Toolkit.dll` assembly that you download from the CodePlex site has 12 controls. Some are new controls, and others are enhanced versions of existing controls.

At the time of this writing, the Silverlight for Windows Phone Toolkit is the February 2011 version. It contains the following controls:

- The `AutoCompleteBox` control is an enhanced version of the `TextBox` control that implements the autocomplete feature. While you are writing text, a pop-up appears, suggesting similar words.
- The `ContextMenu` control , as its name indicates, provides a context menu. Tapping and holding a control results in a pop-up being shown with menu items. You can define different event handlers to respond to menu item selection.
- The `DatePicker` and `TimePicker` controls allow users to easily select a date and a time, respectively.
- The `GestureService/GestureListener` controls help developers to easily manage gestures in a Silverlight application (see Recipe 5-4 in Chapter 5).
- The `ListPicker` control is a sort of combo box allowing users to pick a value from a list. Depending on its attributes, the list can either be shown as a pop-up or can fill the full screen.
- The `LongListSelector` control, as its name suggests, provides a list that is capable of containing a lot of items and of automatically adding a scrollbar when needed.
- The `Page Transitions` are a set of classes dedicated to adding page transition effects during page navigation.
- The `PerformanceProgressBar` control is an enhanced version of the `ProgressBar` control that uses the compositor thread to paint itself. Differing from the user interface thread, the compositor is a separate thread that manages animation and other dedicated tasks. This thread performs better than the user interface thread, and this control uses it to create the progress bar animation.

- The TiltEffect control provides a highly required animation from the Internet community: the tilt effect. The tilt animation is applied to controls that implement the Click event adding a shaking effect when the control is clicked. The TiltEffect control provides an attached property set to a container control such as the Page that adds the tilt effect to its own controls.
- The ToggleSwitch control is used to turn on or off settings or features that you have added to your application. For example, the Windows Phone 7 operating system uses this control on its Settings page to activate or deactivate Airplane mode.
- The WrapPanel control is an enhanced version of the StackPanel that implements a wrap feature for the controls it contains.

The Code

To demonstrate this recipe, we have borrowed the official example that ships with the Silverlight for Windows Phone Toolkit library. To use it in your code, you first need to add a reference to the library that usually is installed in the %Program Files%\Microsoft SDKs\Windows Phone\v7.0\Toolkit path.

The PhoneToolkitSample application has a main page with 11 buttons. Each of them points to a control demo. (The date and time pickers have been grouped together, so there are really 12 controls, as stated earlier.)

The AutoCompleteBox control is defined in the AutoCompleteBoxSample.xaml page. First of all, it is worth noting the toolkit namespace added to the Page tag (this is common to all pages using the toolkit controls):

```
<phone:PhoneApplicationPage
    x:Class="PhoneToolkitSample.Samples.AutoCompleteBoxSample"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:toolkit="clr-
           namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone.Controls.Toolkit"
. . .
```

The usual ContentPanel grid is replaced by a stack panel containing two TextBlock controls and two AutoCompleteBox controls. The ItemSource property is used to define the source from which suggestions are picked and shown. The second AutoCompleteBox control uses a two-line suggestion, such as the one used by Internet Explorer that shows both page title and its URL.

```
        <StackPanel x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <TextBlock Text="AutoCompleteBox, single-line items"
             Style="{StaticResource PhoneTextNormalStyle}"/>
            <toolkit:AutoCompleteBox VerticalAlignment="Top"
             ItemsSource="{StaticResource words}" Margin="0,12"/>
            <TextBlock Text="AutoCompleteBox, double-line items"
             Style="{StaticResource PhoneTextNormalStyle}"/>
            <toolkit:AutoCompleteBox
                InputScope="Url"
                ItemsSource="{StaticResource websites}"
                Margin="0,12"
                ValueMemberPath="Item1">
                <toolkit:AutoCompleteBox.ItemTemplate>
                    <DataTemplate>
                        <StackPanel Margin="0,7">
                            <TextBlock
                                Margin="8,0"
                                Text="{Binding Item1}"/>
                            <TextBlock
                                FontSize="{StaticResource PhoneFontSizeNormal}"
                                Foreground="#ff666666"
                                Margin="8,-6,8,2"
                                Text="{Binding Item2}"/>
                        </StackPanel>
                    </DataTemplate>
                </toolkit:AutoCompleteBox.ItemTemplate>
            </toolkit:AutoCompleteBox>
        </StackPanel>
```

The ContextMenu control is demonstrated in the ContextMenuSample.xaml page. The menu items composing the context menu have to be defined within the ContextMenu tags. Those tags have to be nested within the ContextMenuService.ContextMenu tags. Each menu item is defined by the MenuItem tag that provides the Header attribute used to specify the menu item text and the Click event handler.

```
. . .
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <StackPanel VerticalAlignment="Top">
                <TextBlock Text="last selection:"
                           Style="{StaticResource PhoneTextSubtleStyle}"/>
                <TextBlock x:Name="lastSelection"
                           Style="{StaticResource PhoneTextNormalStyle}"/>
            </StackPanel>
            <StackPanel VerticalAlignment="Center">
                <Border Margin="0,12" BorderBrush="{StaticResource PhoneForegroundBrush}"
                    BorderThickness="2" Background="Transparent"
                    VerticalAlignment="Center" Padding="16">
                    <toolkit:ContextMenuService.ContextMenu>
                        <toolkit:ContextMenu>
                            <toolkit:MenuItem
                            Header="this is a menu item"
                            Click="MenuItem_Click"/>
                            <toolkit:MenuItem
                            Header="this is another menu item"
                            Click="MenuItem_Click"/>
                            <toolkit:MenuItem
                            Header="this is a yet another menu item"
                            Click="MenuItem_Click"/>
                        </toolkit:ContextMenu>
```

```
    </toolkit:ContextMenuService.ContextMenu>
    <TextBlock Text="Tap and hold here to invoke a ContextMenu"
     Style="{StaticResource PhoneTextNormalStyle}"/>
</Border>
<Border Margin="0,12" BorderBrush="{StaticResource PhoneForegroundBrush}"
        BorderThickness="2" Background="Transparent"
        VerticalAlignment="Center" Padding="16">
    <toolkit:ContextMenuService.ContextMenu>
        <toolkit:ContextMenu>
            <toolkit:MenuItem
            Header="Always-on item"
            Command="{Binding AlwaysCommand}"/>
            <toolkit:MenuItem
            Header="Intermittent item"
            Command="{Binding IntermittentCommand}"/>
            <toolkit:MenuItem
            Header="Always-on item with param"
            Command="{Binding AlwaysCommand}"
            CommandParameter="param1"/>
            <toolkit:MenuItem
            Header="Intermittent item with param"
            Command="{Binding IntermittentCommand}"
            CommandParameter="param2"/>
        </toolkit:ContextMenu>
    </toolkit:ContextMenuService.ContextMenu>
    <TextBlock Text="Tap and hold here to invoke a
               ContextMenu with items bound to ICommands"
               Style="{StaticResource PhoneTextNormalStyle}"
               TextWrapping="Wrap"/>
</Border>
<Border Margin="0,12" BorderBrush="{StaticResource PhoneForegroundBrush}"
        BorderThickness="2" Background="Transparent"
        VerticalAlignment="Center" Padding="16">
    <toolkit:ContextMenuService.ContextMenu>
        <toolkit:ContextMenu IsZoomEnabled="false">
            <toolkit:MenuItem
            Header="option 1"
            Click="MenuItem_Click"/>
            <toolkit:MenuItem
            Header="option 2"
            Click="MenuItem_Click"/>
            <toolkit:MenuItem
            Header="option 3"
            Click="MenuItem_Click"/>
        </toolkit:ContextMenu>
    </toolkit:ContextMenuService.ContextMenu>
```

```
                <TextBlock
               Text="Tap and hold here to invoke a ContextMenu with IsZoomEnabled=false"
               Style="{StaticResource PhoneTextNormalStyle}" TextWrapping="Wrap"/>
            </Border>
        </StackPanel>
    </Grid>
```

The DatePicker control and TimePicker control are shown in the DateTimePickerSample.xaml page. Within the ContentPanel code section, the DatePicker and TimePicker are defined with the ValueChanged event management.

```
. . .
    <StackPanel x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
        <TextBlock Text="select date" Style="{StaticResource PhoneTextNormalStyle}"/>
        <toolkit:DatePicker ValueChanged="DatePicker_ValueChanged"/>
        <TextBlock Text="select time" Style="{StaticResource PhoneTextNormalStyle}"/>
        <toolkit:TimePicker ValueChanged="TimePicker_ValueChanged"/>
        <TextBlock Text="note" Style="{StaticResource PhoneTextLargeStyle}"/>
        <TextBlock TextWrapping="Wrap" Style="{StaticResource PhoneTextNormalStyle}">
            <TextBlock.Text>
                To see the correct ApplicationBar icons in the DatePicker and
                TimePicker, you will need to create a folder in the root of your project
                called "Toolkit.Content" and put the icons in there. You can copy them
                from this project. They must be named "ApplicationBar.Cancel.png" and
                "ApplicationBar.Check.png", and the build action must be "Content".
            </TextBlock.Text>
        </TextBlock>
    </StackPanel>
. . .
```

The ListPickerSample.xaml file contains the demonstration of the ListPicker control. Two list pickers are defined. The first is the simple version providing the Header attribute that is shown as a title and some fixed values defined as system strings. The second list picker control is composed by two item templates: the ItemTemplate tag defines the item when the value has been selected and the list picker is closed, and the FullModeItemTemplate tag defines the list of available items that will be shown in full-screen mode. In this example, both item templates define a rectangle and a text block with predefined colors:

```
. . .
    <StackPanel Grid.Row="1" Margin="12,0,12,0">
        <toolkit:ListPicker Header="background">
            <sys:String>dark</sys:String>
            <sys:String>light</sys:String>
            <sys:String>dazzle</sys:String>
        </toolkit:ListPicker>

        <!-- For best performance, set the CacheMode on items below a ListPicker -->
        <!-- that will be dropping down. -->

        <toolkit:ListPicker ItemsSource="{Binding}" Header="accent color"
            FullModeHeader="ACCENTS" CacheMode="BitmapCache">
```

```
                <toolkit:ListPicker.ItemTemplate>
                    <DataTemplate>
                        <StackPanel Orientation="Horizontal">
                            <Rectangle Fill="{Binding}" Width="24" Height="24"/>
                            <TextBlock Text="{Binding}" Margin="12 0 0 0"/>
                        </StackPanel>
                    </DataTemplate>
                </toolkit:ListPicker.ItemTemplate>
                <toolkit:ListPicker.FullModeItemTemplate>
                    <DataTemplate>
                        <StackPanel Orientation="Horizontal" Margin="16 21 0 20">
                            <Rectangle Fill="{Binding}" Width="43" Height="43"/>
                            <TextBlock Text="{Binding}" Margin="16 0 0 0" FontSize="43"
                                   FontFamily="{StaticResource PhoneFontFamilyLight}"/>
                        </StackPanel>
                    </DataTemplate>
                </toolkit:ListPicker.FullModeItemTemplate>

            </toolkit:ListPicker>
```

The LongListSelector control is shown in the LongListSelectorSample.xaml file. This page implements the Pivot control you saw in the previous recipe. In the first part of the LongListSelectorSample.xaml code, the resources used to populate the LongListSelector control are defined. Data is taken from reading some external source text files and using classes contained in the Data folder of the project. As shown in the following code, the data is movie resources.

```
. . .
    <phone:PhoneApplicationPage.Resources>

        <!-- MOVIE RESOURCES -->

        <!-- The template for the list header. This will scroll as a part of the list. -->
        <DataTemplate x:Key="movieListHeader">
            <TextBlock Text="new releases" Style="{StaticResource PhoneTextTitle1Style}"/>
        </DataTemplate>

        <!-- The group header template, for groups in the main list -->
        <DataTemplate x:Key="movieGroupHeader">
            <Border Background="{StaticResource PhoneAccentBrush}"
                          Padding="{StaticResource PhoneTouchTargetOverhang}">
                <TextBlock Text="{Binding Key}"
                          Style="{StaticResource PhoneTextLargeStyle}"/>
            </Border>
        </DataTemplate>
        <!-- The template for groups when they are items in the "jump list". Not setting -->
        <!-- the GroupItemTemplate property will disable "jump list" functionality. -->
        <DataTemplate x:Key="groupItemHeader">
            <Border Background="{StaticResource PhoneAccentBrush}"
                    Margin="{StaticResource PhoneTouchTargetOverhang}"
                    Padding="{StaticResource PhoneTouchTargetOverhang}">
                <TextBlock Text="{Binding Key}"
                           Style="{StaticResource PhoneTextLargeStyle}"/>
            </Border>
        </DataTemplate>

        <!-- The template for movie items -->
        <DataTemplate x:Key="movieItemTemplate">
            <Grid Margin="{StaticResource PhoneTouchTargetOverhang}">
                <Grid.ColumnDefinitions>
                    <ColumnDefinition Width="Auto"/>
                    <ColumnDefinition Width="*"/>
                </Grid.ColumnDefinitions>
                <Image Width="110" Height="150" Source="{Binding ImageUrl}"
                       VerticalAlignment="Top"/>
                <StackPanel Grid.Column="1" VerticalAlignment="Top">
                    <TextBlock Text="{Binding Title}"
                               Style="{StaticResource PhoneTextLargeStyle}"
                               FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                               TextWrapping="Wrap" Margin="12,-12,12,6"/>
                    <TextBlock Text="{Binding Stars}"
                               Style="{StaticResource PhoneTextNormalStyle}"
                               TextWrapping="Wrap"
                               FontFamily="{StaticResource PhoneFontFamilySemiBold}"/>
                    <TextBlock Text="{Binding Information}"
                               Style="{StaticResource PhoneTextSmallStyle}"
                               FontFamily="{StaticResource PhoneFontFamilySemiBold}"/>
                    <TextBlock Text="{Binding Description}"
                               Style="{StaticResource PhoneTextNormalStyle}"
                               TextWrapping="Wrap"
                               FontFamily="{StaticResource PhoneFontFamilySemiLight}"/>
                </StackPanel>
            </Grid>
        </DataTemplate>

        <data:MoviesByCategory x:Key="movies"/>
        <data:MoreCommand x:Key="moreCommand"/>

        <!-- BUDDIES RESOURCES -->
        <data:PeopleByFirstName x:Key="buddies"/>

        <data:GroupToBrushValueConverter x:Key="groupBrush"/>

    </phone:PhoneApplicationPage.Resources>
```

In the first Pivot item, the basic version of the LongListSelector is used to show movies separated by categories. These data are retrieved by using a LINQ query that is assigned to the ItemSource property in the code. Each LongListSelector section is associated to the resources defined in the preceding code . The ListHeaderTemplate is used to add some header text to the list. The GroupHeaderTemplate and GroupItemTemplate are used when a grouping operation is accomplished on the data. Finally, ItemTemplate is the template used to show items.

```
<Grid x:Name="LayoutRoot" Background="Transparent">
    <controls:Pivot Title="LONGLISTSELECTOR SAMPLES">
        <controls:PivotItem Header="linq">
            <toolkit:LongListSelector x:Name="linqMovies" Background="Transparent"
                ListHeaderTemplate="{StaticResource movieListHeader}"
                GroupHeaderTemplate="{StaticResource movieGroupHeader}"
                GroupItemTemplate="{StaticResource groupItemHeader}"
                ItemTemplate="{StaticResource movieItemTemplate}">
            </toolkit:LongListSelector>
        </controls:PivotItem>
```

The next Pivot item provides a LongListSelector that has a GroupFooterTemplate defined to add a button that shows other results when pressed.

```
        <controls:PivotItem Header="code">
            <toolkit:LongListSelector x:Name="codeMovies" Background="Transparent"
                ItemsSource="{StaticResource movies}"
                ListHeaderTemplate="{StaticResource movieListHeader}"
                GroupHeaderTemplate="{StaticResource movieGroupHeader}"
                GroupItemTemplate="{StaticResource groupItemHeader}"
                ItemTemplate="{StaticResource movieItemTemplate}">

                <!-- The group footer template, for groups in the main list -->
                <toolkit:LongListSelector.GroupFooterTemplate>
                    <DataTemplate>
                        <local:CommandButton DataContext="{Binding}"
                                Content="{Binding GetMore}"
                                Command="{StaticResource moreCommand}"
                                CommandParameter="{Binding}"/>
                    </DataTemplate>
                </toolkit:LongListSelector.GroupFooterTemplate>

            </toolkit:LongListSelector>

        </controls:PivotItem>
```

The third Pivot item contains a LongListSelector control in which each section is defined by a DataTemplate different from the one defined in the resources. This is because the information to show is different; in this case, a list of people is retrieved by using the PeopleByFirstName class. The LongListSelector provides the item’s selection too. In the code behind the XAML file, in the class’s constructor, the SelectionChanged event is hooked and the personal details are shown on a different page.

```
        <controls:PivotItem Header="buddies">
```

```
<toolkit:LongListSelector x:Name="buddies" Background="Transparent"
    ItemsSource="{StaticResource buddies}">

    <toolkit:LongListSelector.GroupItemsPanel>
        <ItemsPanelTemplate>
            <toolkit:WrapPanel Orientation="Horizontal"/>
        </ItemsPanelTemplate>
    </toolkit:LongListSelector.GroupItemsPanel>
    <toolkit:LongListSelector.GroupItemTemplate>
        <DataTemplate>
            <Border
             Background="{Binding Converter={StaticResource groupBrush}}"
             Width="99" Height="99" Margin="6"
             IsHitTestVisible="{Binding HasItems}">
                <TextBlock Text="{Binding Key}"
                       FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                       FontSize="36"
                       Margin="{StaticResource PhoneTouchTargetOverhang}"
                       Foreground="{StaticResource PhoneForegroundBrush}"
                       VerticalAlignment="Bottom"/>
            </Border>
        </DataTemplate>
    </toolkit:LongListSelector.GroupItemTemplate>

    <toolkit:LongListSelector.GroupHeaderTemplate>
        <DataTemplate>
            <Border Background="Transparent">
                <Border Background="{StaticResource PhoneAccentBrush}"
                 Width="75" Height="75" HorizontalAlignment="Left">
                    <TextBlock Text="{Binding Key}"
                          Foreground="{StaticResource PhoneForegroundBrush}"
                          Style="{StaticResource PhoneTextExtraLargeStyle}"
                          VerticalAlignment="Bottom"/>
                </Border>
            </Border>
        </DataTemplate>
    </toolkit:LongListSelector.GroupHeaderTemplate>

    <toolkit:LongListSelector.ItemTemplate>
        <DataTemplate>
            <Grid Margin="{StaticResource PhoneTouchTargetOverhang}">
                <Grid.ColumnDefinitions>
                    <ColumnDefinition Width="Auto"/>
                    <ColumnDefinition Width="*"/>
                </Grid.ColumnDefinitions>
                <Image Width="110" Height="150" Source="{Binding ImageUrl}"
                       VerticalAlignment="Top"/>
```

```
                                    <StackPanel Grid.Column="1" VerticalAlignment="Top">
                                        <TextBlock Text="{Binding FullName}"
                                         Style="{StaticResource PhoneTextLargeStyle}"
                                         FontFamily="{StaticResource PhoneFontFamilySemiBold}"
                                         Margin="12,-12,12,6"/>
                                        <TextBlock Text="{Binding Email}"
                               Style="{StaticResource PhoneTextNormalStyle}" TextWrapping="Wrap"
                               FontFamily="{StaticResource PhoneFontFamilySemiBold}"/>
                                        <StackPanel Orientation="Horizontal">
                                            <TextBlock Text="Mobile:"
                                             Style="{StaticResource PhoneTextSmallStyle}"/>
                                            <TextBlock Text="{Binding Mobile}"
                                             Style="{StaticResource PhoneTextSmallStyle}"
                                        FontFamily="{StaticResource PhoneFontFamilySemiBold}"/>
                                        </StackPanel>
                                        <StackPanel Orientation="Horizontal">
                                            <TextBlock Text="Home:"
                                             Style="{StaticResource PhoneTextSmallStyle}"/>
                                            <TextBlock Text="{Binding Home}"
                                             Style="{StaticResource PhoneTextSmallStyle}"
                                        FontFamily="{StaticResource PhoneFontFamilySemiBold}"/>
                                        </StackPanel>
                                    </StackPanel>
                                </Grid>
                            </DataTemplate>
                        </toolkit:LongListSelector.ItemTemplate>

                    </toolkit:LongListSelector>

                </controls:PivotItem>

            </controls:Pivot>
        </Grid>
. . .
```

The PerformanceProgressBar control is defined in the PerformanceProgressBarSample.xaml file. This is an enhanced version of the ProgressBar control because it uses the compositor thread. Its usage is very simple; you can specify the PerformanceProgressBar tag as shown in the following code.

```
. . .
        <toolkit:PerformanceProgressBar
            VerticalAlignment="Top"
            x:Name="_performanceProgressBar"/>
. . .
```

This progress bar is activated by setting its IsIndeterminate property to true, and deactivated by setting it to false. In this example, this property is both activated and deactivated by a check box that uses a Silverlight binding feature. It binds its own IsChecked Boolean property to the IsIndeterminate property so that when the check box is selected, the progress bar appears at the top of the screen.

```
. . .
                <CheckBox Content="Show performance progress bar"
                      IsChecked="{Binding IsIndeterminate,
                                 ElementName=_performanceProgressBar, Mode=TwoWay}"/>
. . .
```

The ToggleSwitch control is shown in the ToggleSwitchSample.xaml file. This control is a switch that assumes two states: on and off. It provides the Header property used to show text associated with the control. When you need to show more text or other controls near the switch control, you can define how the template should look by using both the HeaderTemplate and the ContentTemplate.

```
<StackPanel x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
    <toolkit:ToggleSwitch Header="Wi Fi networking"/>
    <toolkit:ToggleSwitch Header="Set automatically"/>
    <toolkit:ToggleSwitch Header="5:45 AM">
        <toolkit:ToggleSwitch.HeaderTemplate>
            <DataTemplate>
                <ContentControl FontSize="{StaticResource PhoneFontSizeLarge}"
                 Foreground="{StaticResource PhoneForegroundBrush}"
                 Content="{Binding}"/>
            </DataTemplate>
        </toolkit:ToggleSwitch.HeaderTemplate>
        <toolkit:ToggleSwitch.ContentTemplate>
            <DataTemplate>
                <StackPanel>
                    <StackPanel Orientation="Horizontal">
                        <TextBlock Text="Alarm: "
                         FontSize="{StaticResource PhoneFontSizeSmall}"/>
                        <ContentControl HorizontalAlignment="Left"
                         FontSize="{StaticResource PhoneFontSizeSmall}"
                         Content="{Binding}"/>
                    </StackPanel>
                    <TextBlock Text="every schoolday"
                     FontSize="{StaticResource PhoneFontSizeSmall}"
                     Foreground="{StaticResource PhoneSubtleBrush}"/>
                </StackPanel>
            </DataTemplate>
        </toolkit:ToggleSwitch.ContentTemplate>
    </toolkit:ToggleSwitch>
</StackPanel>
```

The TiltEffect control is demonstrated in the TiltEffectSample.xaml file. Activating the tilt effect on a page is as easy as adding a PhoneApplicationPage attribute. Every control that responds to a tapping gesture will automatically provide the tilt effect animation.

```
<phone:PhoneApplicationPage
    x:Class="PhoneToolkitSample.Samples.TiltEffectSample"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    xmlns:toolkit="clr-
namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone.Controls.Toolkit"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="PortraitOrLandscape"
    Orientation="Portrait"
    mc:Ignorable="d" d:DesignHeight="768" d:DesignWidth="480"
    shell:SystemTray.IsVisible="True"
    toolkit:TiltEffect.IsTiltEnabled="True">
. . .
```

The `Transitions` effects are shown in the `TransitionsSample.xaml` file. The Silverlight for Windows Phone Toolkit library gives you two possibilities: the transition between pages during the navigation and the transition effect on the page itself. In the `TransitionsSample.xaml` file (and in all the pages seen until now as well), between the `PhoneApplicationPage` tags, are the `NavigationInTransition` and `NavigationOutTransition` tags, which define the transition effects when the page is loaded and before it is unloaded, respectively.

```
. . .
    <toolkit:TransitionService.NavigationInTransition>
        <toolkit:NavigationInTransition>
            <toolkit:NavigationInTransition.Backward>
                <toolkit:TurnstileTransition Mode="BackwardIn"/>
            </toolkit:NavigationInTransition.Backward>
            <toolkit:NavigationInTransition.Forward>
                <toolkit:TurnstileTransition Mode="ForwardIn"/>
            </toolkit:NavigationInTransition.Forward>
        </toolkit:NavigationInTransition>
    </toolkit:TransitionService.NavigationInTransition>
    <toolkit:TransitionService.NavigationOutTransition>
        <toolkit:NavigationOutTransition>
            <toolkit:NavigationOutTransition.Backward>
                <toolkit:TurnstileTransition Mode="BackwardOut"/>
            </toolkit:NavigationOutTransition.Backward>
            <toolkit:NavigationOutTransition.Forward>
                <toolkit:TurnstileTransition Mode="ForwardOut"/>
            </toolkit:NavigationOutTransition.Forward>
        </toolkit:NavigationOutTransition>
    </toolkit:TransitionService.NavigationOutTransition>
. . .
```

The `TransitionsSample.xaml` file contains two buttons and two list picker controls. One button starts the transition effect on the page itself, picking the transition type from both the list pickers. The other button shows page navigation transition effects in the same way as described earlier. So let's focus on the first button and the code behind the Click event.

The See method is called when the button is clicked so that the selected transition from the family list picker is started. The code checks whether the selected transition type (or family) is Roll, because that is the only transition type that doesn't have an associated transition mode. The Roll effect simply rolls the page in a unique way; there is no way to choose the way it rolls. On the other hand, the other transition families have different modes. Those families are Rotate, Slide, Swivel, and Turnstile and support different modes. They are returned from the EnumConverter class that, depending on the transition family, returns a List collection filled with all the supported modes.

Depending on the selected transition family, a new transition object is created and associated to the page. The available classes are RollTransition, RotateTransition, SlideTransition, SwivelTransition, and TurnstileTransition. Each class—except the RollTransition class—accepts a transition mode as the class constructor's parameter. Finally, the reference to the PhoneApplicationPage is used to associate the new transition that is started by calling the Begin method. When the transition is completed, the Completed event is raised and the Stop method is called.

```
        private void See(object sender, RoutedEventArgs e)
        {
            string family = (string)Family.SelectedItem;
            string mode = (string)Mode.SelectedItem;
            TransitionElement transitionElement = null;
            if (family.Equals("Roll"))
            {
                transitionElement = new RollTransition();
            }
            else
            {
                transitionElement = TransitionElement(family, mode);
            }
            PhoneApplicationPage phoneApplicationPage =
    (PhoneApplicationPage)(((PhoneApplicationFrame)Application.Current.RootVisual)).Content;
            ITransition transition = transitionElement.GetTransition(phoneApplicationPage);
            transition.Completed += delegate
            {
                transition.Stop();
            };
            transition.Begin();
        }

    public class EnumConverter : IValueConverter
    {
        public object Convert(object value, Type targetType, object parameter,
                              CultureInfo culture)
        {
            string s = value as string;
            if (s == null)
            {
                return null;
            }
            switch (s)
            {
                case "Roll":
                    return new List<string>();
                case "Rotate":
                    return new List<string>
                    {
                        "In90Clockwise",
                        "In90Counterclockwise",
                        "In180Clockwise",
                        "In180Counterclockwise",
                        "Out90Clockwise",
                        "Out90Counterclockwise",
                        "Out180Clockwise",
                        "Out180Counterclockwise"
                    };
                case "Slide":
                    return new List<string>
                    {
                        "SlideUpFadeIn",
                        "SlideUpFadeOut",
                        "SlideDownFadeIn",
                        "SlideDownFadeOut",
                        "SlideLeftFadeIn",
                        "SlideLeftFadeOut",
                        "SlideRightFadeIn",
                        "SlideRightFadeOut"
                    };
                case "Swivel":
                    return new List<string>
                    {
                        "FullScreenIn",
                        "FullScreenOut",
                        "ForwardIn",
                        "ForwardOut",
                        "BackwardIn",
                        "BackwardOut"
                    };
                case "Turnstile":
                    return new List<string>
                    {
                        "ForwardIn",
                        "ForwardOut",
                        "BackwardIn",
                        "BackwardOut"
                    };
            }
            return null;
        }
    }
```

The WrapPanel is shown in the WrapPanelSample.xaml page. Depending on the Orientation property value, the items are aligned from left to right (or from top to bottom), breaking them in a new line when the container edge is reached. Adding to your page is as easy as specifying the WrapPanel tag in the page.

```
<toolkit:WrapPanel x:Name="wrapPanel" Orientation="Vertical"/>
```

Usage

From Visual Studio 2010, press Ctrl+F5 and then check that the target output is set to Windows Phone 7 Emulator. The application deploys to the emulator and starts, briefly showing the main page, as in Figure 3-17.

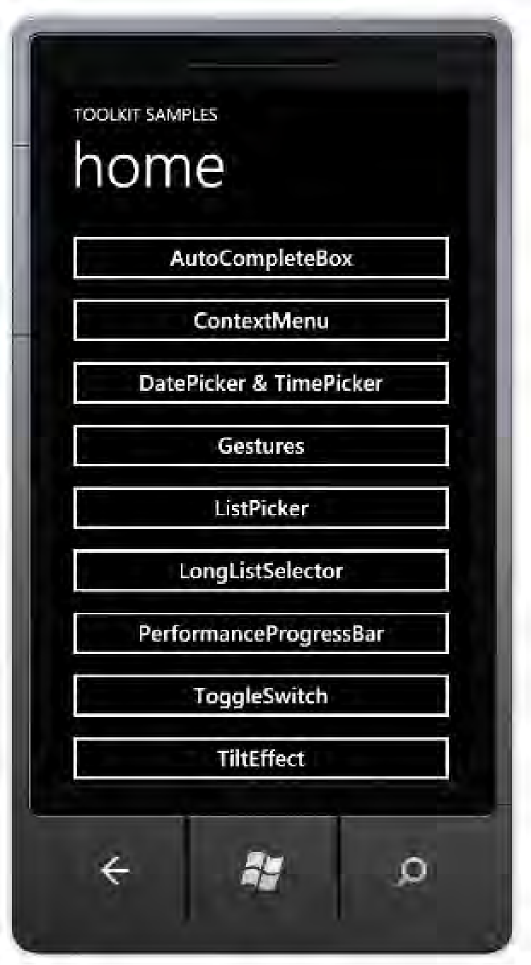


Figure 3-17. *The Silverlight for Windows Phone Toolkit official application*

The application is composed of 11 buttons that you can see if you drag up and down the page. If you tap one button, you will navigate to the related page containing that control. For example, to see the

`AutoCompleteBox` in action, tap the AutoCompleteBox button and you will be redirected to the `AutoCompleteBoxSample.xaml` page (see Figure 3-18).

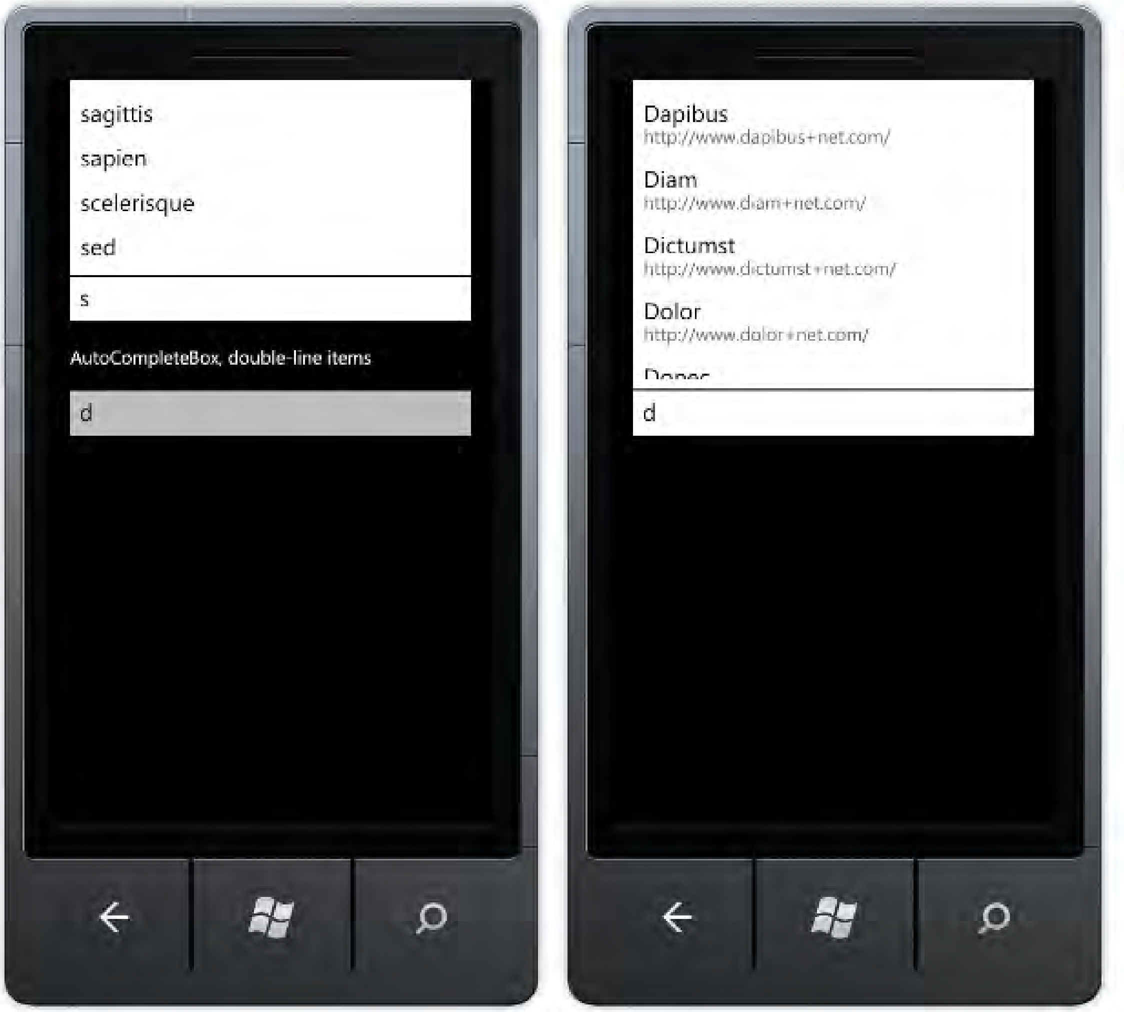

sagittis
sapien
scelerisque
sed
s
AutoCompleteBox, double-line items
d
Dapibus
http://www.dapibus+net.com/
Diam
http://www.diam+net.com/
Dictumst
http://www.dictumst+net.com/
Dolor
http://www.dolor+net.com/
Donec
d

Figure 3-18. The `AutoCompleteBox` *control showing both one-line and two-line suggestions*

You can continue by trying every control and seeing it in action on the related page.

3-9. Using Launchers and Choosers

Problem

You have to add interaction between your application and external phone applications such as Phone, Search, and Marketplace.

Solution

You can add interaction between your application and your phone applications by using launchers and choosers classes.

How It Works

Windows Phone 7 applications have their own private storage and cannot interact with other applications installed on the phone. In some cases, you need to perform a particular task in your application that requires use of existing Windows Phone applications. In those cases you can use both launchers and choosers to add interaction with particular Windows Phone applications.

Indeed, there is no way to add interaction between two applications with launchers and choosers. You can only integrate into your application common tasks such as a phone call, an e-mail composer, the Marketplace, the photo camera, the web browser, and the search function.

The main difference between launchers and choosers is that launchers don't return any kind of data to the application caller. The choosers implement an asynchronous event handler that is called after the operation is completed, returning the data to the application caller.

After having used a launcher or a chooser, the application caller is closed, so it's very important to correctly manage tombstoning (see Recipe 2-5 and Recipe 2-6 in Chapter 2). Indeed, when the launcher or chooser has completed its operations, the application caller is launched again with the tombstoning feature.

In Table 3-2 and Table 3-3, you can find the names and descriptions of each launcher and chooser available from the `Microsoft.Phone.Tasks` namespace, respectively.

Table 3-2. *launchers Available from the Windows Phone 7 SDK*

Launcher	Description
`EmailComposeTask`	Launches the e-mail application and optionally fills an e-mail field such as Body, To, Cc, and so on.
`MarketplaceDetailTask`	Launches the Marketplace application, showing details either on the current application or the application specified by its identifier.
`MarketplaceHubTask`	Launches the Marketplace application, showing either the Application section or the Music section.

Launcher	Description
`MarketplaceReviewTask`	Launches the Marketplace application, showing the review form to add a comment to your application.
`MarketplaceSearchTask`	Launches the Marketplace application, showing the search form with results based on the text you provided.
`MediaPlayerLauncher`	Launches the Media Player application playing the specified media file.
`PhoneCallTask`	Launches the Phone application, showing the phone number and display name. The phone call is not automatically started.
`SearchTask`	Launches the Search application, performing the query with the provided text.
`SmsComposeTask`	Launches the Messaging application with a new SMS filled with provided arguments such as the Body and To data.
`WebBrowserTask`	Launches the Internet Explorer application, displaying the provided URL.

Table 3-3. Choosers Available from the Windows Phone 7 SDK

Chooser	Description
`CameraCaptureTask`	Launches the Camera application, and if the user takes the photo, the photo is returned to the application caller
`EmailAddressChooserTask`	Launches the Contact application, allowing users to select a contact whose e-mail is returned to the application caller
`PhoneNumberChooserTask`	Launches the Contact application, allowing users to select a contact whose phone number is returned to the application caller
`PhotoChooserTask`	Launches the Photo Picker application, allowing users to pick a photo from the media library
`SaveEmailAddressTask`	Saves the provided e-mail address into the Contact application
`SavePhoneNumberTask`	Saves the phone number into the Contact application

The Code

In this recipe, you will create a Silverlight for Windows Phone 7 application called LaunchersAndChoosersDemo that implements the Pivot control with two items, launchers and choosers. Every pivot item contains a ListBox with an item for each launcher and for each chooser. After the user selects a list box item the application will launch either the related launcher or chooser.

In the MainPage.xaml file, the Pivot control contains two items, both of which fill a ListBox with the complete list of launchers and choosers. The SelectionChanged event from the ListBox is managed to retrieve the selected item and show the related launcher or chooser.

```
. . .
        <controls:Pivot Title="LAUNCHERS AND CHOOSERS">
            <!--Pivot item one-->
            <controls:PivotItem Header="Launchers">
                <!--Double line list with text wrapping-->
                <ListBox x:Name="FirstListBox" Margin="0,0,-12,0"
                         SelectionChanged="FirstListBox_SelectionChanged">
                    <ListBoxItem x:Name="iEmailComposeTask" Content="EmailComposeTask"
                         HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iMarketplaceDetailTask"
                         Content="MarketplaceDetailTask"
                         HorizontalAlignment="Center" Height="55" />
                    <ListBoxItem x:Name="iMarketplaceHubTask" Content="MarketplaceHubTask"
                         HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iMarketplaceReviewTask"
                        Content="MarketplaceReviewTask"
                        HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iMarketplaceSearchTask"
                        Content="MarketplaceSearchTask"
                        HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iMediaPlayerLauncher" Content="MediaPlayerLauncher"
                        HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iPhoneCallTask" Content="PhoneCallTask"
                        HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iSearchTask" Content="SearchTask"
                        HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iSmsComposeTask" Content="SmsComposeTask"
                        HorizontalAlignment="Center" Height="55"/>
                    <ListBoxItem x:Name="iWebBrowserTask" Content="WebBrowserTask"
                        HorizontalAlignment="Center" Height="55"/>
                </ListBox>
            </controls:PivotItem>

            <!--Pivot item two-->
            <controls:PivotItem Header="Choosers">
                <ListBox x:Name="SecondListBox" Margin="0,0,-12,0"
                         SelectionChanged="SecondListBox_SelectionChanged">
                    <ListBoxItem x:Name="iCameraCaptureTask" Content="CameraCaptureTask"
                         HorizontalAlignment="Center"
                         Height="95" VerticalAlignment="Center" />
                    <ListBoxItem x:Name="iEmailAddressChooserTask"
                         Content="EmailAddressChooserTask"
                         HorizontalAlignment="Center" Height="95"
                         VerticalAlignment="Center"  />
                    <ListBoxItem x:Name="iPhoneNumberChooserTask"
                         Content="PhoneNumberChooserTask" HorizontalAlignment="Center"
                         Height="95" VerticalAlignment="Center" />
                    <ListBoxItem x:Name="iPhotoChooserTask" Content="PhotoChooserTask"
                         HorizontalAlignment="Center" Height="95"
                         VerticalAlignment="Center" />
                    <ListBoxItem x:Name="iSaveEmailAddressTask"
                         Content="SaveEmailAddressTask" HorizontalAlignment="Center"
                         Height="95" VerticalAlignment="Center" />
                    <ListBoxItem x:Name="iSavePhoneNumberTask"
                         Content="SavePhoneNumberTask" HorizontalAlignment="Center"
                         Height="95" VerticalAlignment="Center" />
                </ListBox>
            </controls:PivotItem>
        </controls:Pivot>
. . .
```

In the MainPage.xaml.cs file, there is the SelectionChanged event handler for both list boxes. Within the event handlers, a switch case is used to retrieve the selected item and execute the related launcher or chooser. Let's start analyzing each launcher.

When the iEmailComposeTask list box item is selected, a new EmailComposeTask object is created and its own properties are filled with some values. You can specify the destination address by using the To property, the e-mail subject by using Subject, the e-mail body by using Body, and eventually a carbon copy address by using the Cc property. Finally, by calling the Show method, the launcher is executed and a new e-mail is created.

```
      private void FirstListBox_SelectionChanged(object sender,
                                           SelectionChangedEventArgs e)
      {
            switch ((e.AddedItems[0] as ListBoxItem).Name)
            {
                case "iEmailComposeTask":
                    EmailComposeTask ect = new EmailComposeTask();
                    ect.To = "some.email@address.com";
                    ect.Subject = "Some subject";
                    ect.Body = "email content here";
                    ect.Show();
                    break;
. . .
```

The next launchers are used to interact with the Marketplace. The MarketplaceDetailTask class provides two properties: the ContentType can be set only to the MarketplaceContentType.Applications value, and the ContentIdentifier can be either omitted to retrieve detail for the current application or set to an application identifier.

The MarketplaceHubTask class provides the ContentType property that can be set to either MarketplaceContentType.Applications or MarketplaceContentType.Music so that the Marketplace application starts by showing either the Applications section or the Music section, respectively.

The MarketplaceReviewTask class provides only the Show method, because it opens the Marketplace, allowing users to review the current application.

The MarketplaceSearchTask class provides the SearchTerms property for specifying the text that has to be searched in the context set by the ContentType property.

```
. . .
                case "iMarketplaceDetailTask":
                    MarketplaceDetailTask mdt = new MarketplaceDetailTask();
                    mdt.ContentType = MarketplaceContentType.Applications;
                    mdt.Show();
                    break;
                case "iMarketplaceHubTask":
                    MarketplaceHubTask mht = new MarketplaceHubTask();
                    mht.ContentType = MarketplaceContentType.Applications;
                    mht.Show();
                    break;
                case "iMarketplaceReviewTask":
                    MarketplaceReviewTask mrt = new MarketplaceReviewTask();
                    mrt.Show();
                    break;
                case "iMarketplaceSearchTask":
                    MarketplaceSearchTask mst = new MarketplaceSearchTask();
                    mst.ContentType = MarketplaceContentType.Music;
                    mst.SearchTerms = "Radiohead";
                    mst.Show();
                    break;
. . .
```

The MediaPlayerLauncher class provides the Media property, which is used to specify the URL of the media file to be played. The file has to be saved in the isolated storage either by the application itself or when the application is deployed on the phone. The Location property defines where the media file is located, either in the installation file or in the isolated storage. Finally, the Controls property is used to specify which buttons the media player has to show.

```
. . .
                case "iMediaPlayerLauncher":
                    MediaPlayerLauncher mpl = new MediaPlayerLauncher();
                    mpl.Media = new Uri("video.wmv", UriKind.Relative);
                    mpl.Location = MediaLocationType.Data;
                    mpl.Controls = MediaPlaybackControls.Pause |
                                   MediaPlaybackControls.Stop |
                                   MediaPlaybackControls.Rewind;
                    mpl.Show();
                    break;
. . .
```

The PhoneCallTask launcher provides the PhoneNumber property used to specify the phone number to call and the DisplayName property to display the contact name.

```
. . .
                case "iPhoneCallTask":
                    PhoneCallTask pct = new PhoneCallTask();
                    pct.DisplayName = "My contact";
                    pct.PhoneNumber = "55512345678";
                    pct.Show();
                    break;
. . .
```

The SearchTask launcher provides the SearchQuery property used to specify the text to search both on the Web and locally.

```
. . .
                case "iSearchTask":
                    SearchTask st = new SearchTask();
                    st.SearchQuery = "Facebook";
                    st.Show();
                    break;
. . .
```

The SmsComposeTask launcher provides classic properties such as To and Body to fill the message recipient and message content fields. If you don't specify these properties, an empty message will be created. The message will not be sent until the user sends it.

```
. . .
                case "iSmsComposeTask":
                    SmsComposeTask sct = new SmsComposeTask();
                    sct.To = "My contact";
                    sct.Body = "sms content";
                    sct.Show();
                    break;
. . .
```

The WebBrowserTask class provides the URL property to specify which Internet address has to be shown in the web browser application.

```
. . .
                case "iWebBrowserTask":
                    WebBrowserTask wbt = new WebBrowserTask();
                    wbt.URL = "http://www.apress.com";
                    wbt.Show();
                    break;
            }
        }
```

■ **Note** Each launcher class and each chooser class provides the Show method that is responsible for performing the related action, such as showing the web browser, opening the e-mail composer, and so on.

In the other SelectionChanged event handler of the Choosers list box, there is another switch case that is executed by the code related to the user's choice. The first two cases are just an introduction; in Chapter 7, these two choosers are explained more completely.

```
     private void SecondListBox_SelectionChanged(object sender,
                                            SelectionChangedEventArgs e)
     {
            switch ((e.AddedItems[0] as ListBoxItem).Name)
            {
                case "iCameraCaptureTask":
                    MessageBox.Show("See recipe 7-1 for
                                     CameraCaptureTask chooser explanation.");
                    break;
                case "iPhotoChooserTask":
                    MessageBox.Show("See recipe 7-2 for
                                     PhotoChooserTask chooser explanation.");
                    break;
. . .
```

The EmailAddressChooserTask executes the Contact application and raises the Completed event after the user has chosen a contact.

```
. . .
                case "iEmailAddressChooserTask":
                    EmailAddressChooserTask eact = new EmailAddressChooserTask();
                    eact.Completed +=
                         new EventHandler<EmailResult>(EmailAddressChooserTask_Completed);
                    eact.Show();
                    break;
. . .
```

The Completed event handler provides the EmailResult parameter with the Email property containing the e-mail address of the selected contact.

```
        void EmailAddressChooserTask_Completed(object sender, EmailResult e)
        {
            if (e.TaskResult == TaskResult.OK)
                MessageBox.Show(e.Email);
        }
```

Similar to the previous chooser, the PhoneNumberChooserTask class opens the Contact application and raises the Completed event when the user has finished selecting a contact. This time, the returning parameter of the Completed event handler will be the contact's phone number.

```
. . .
                case "iPhoneNumberChooserTask":
                    PhoneNumberChooserTask pnct = new PhoneNumberChooserTask();
                    pnct.Completed +=
                      new EventHandler<PhoneNumberResult>(PhoneNumberChooserTask_Completed);
                    pnct.Show();
                    break;
. . .

        void PhoneNumberChooserTask_Completed(object sender, PhoneNumberResult e)
        {
            if (e.TaskResult == TaskResult.OK)
                MessageBox.Show(e.PhoneNumber);
        }
```

Finally, the SaveEmailAddressTask and SavePhoneNumberTask choosers save a new e-mail address and a new phone number when adding a new contact, respectively. Neither chooser returns a value from the Completed event handler—just the result of whether the operation has been completed successfully or has been aborted by the user.

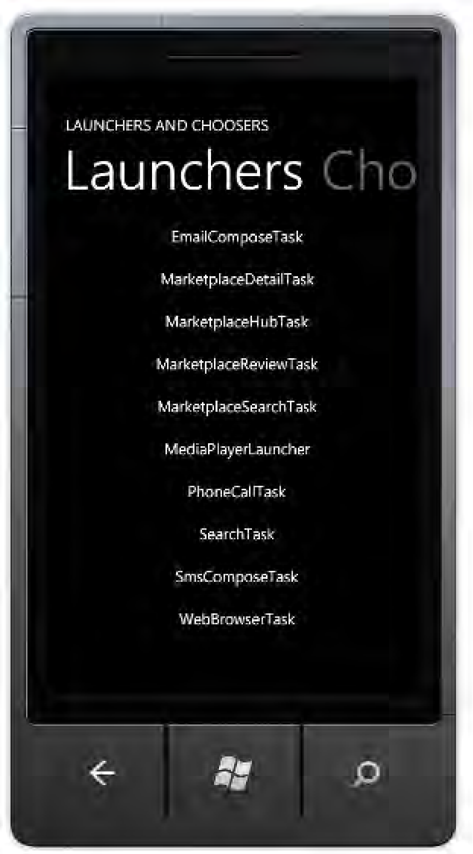
```
. . .
                case "iSaveEmailAddressTask":
                    SaveEmailAddressTask seat = new SaveEmailAddressTask();
                    seat.Completed +=
                         new EventHandler<TaskEventArgs>(SaveEmailAddressTask_Completed);
                    seat.Email = "some.email@address.com";
                    seat.Show();
                    break;
                case "iSavePhoneNumberTask":
                    SavePhoneNumberTask spnt = new SavePhoneNumberTask();
                    spnt.PhoneNumber = "55512345678";
                    spnt.Completed +=
                         new EventHandler<TaskEventArgs>(SavePhoneNumberTask_Completed);
                    spnt.Show();
                    break;
            }
        }

        void SavePhoneNumberTask_Completed(object sender, TaskEventArgs e)
        {
            if (e.TaskResult == TaskResult.OK)
                MessageBox.Show("Phone numeber saved correctly");
            else if (e.TaskResult == TaskResult.Cancel)
                MessageBox.Show("Save operation cancelled");
        }
```

```
void SaveEmailAddressTask_Completed(object sender, TaskEventArgs e)
{
    if (e.TaskResult == TaskResult.OK)
        MessageBox.Show("Email saved correctly");
    else if (e.TaskResult == TaskResult.Cancel)
        MessageBox.Show("Save operation cancelled");
}
```

Usage

From Visual Studio 2010, press Ctrl+F5. Depending on the target output, the application deploys either on the physical device or the emulator.

The LaunchersAndChoosersDemo application will run, briefly showing the Launchers pivot item with its own list box filled with launchers (see Figure 3-19).



LAUNCHERS AND CHOOSERS

Launchers Cho

EmailComposeTask

MarketplaceDetailTask

MarketplaceHubTask

MarketplaceReviewTask

MarketplaceSearchTask

MediaPlayerLauncher

PhoneCallTask

SearchTask

SmsComposeTask

WebBrowserTask

Figure 3-19. The LaunchersAndChoosersDemo application in action

If you flick to the left, the application will show the second pivot item filled with all the available choosers (see Figure 3-20).

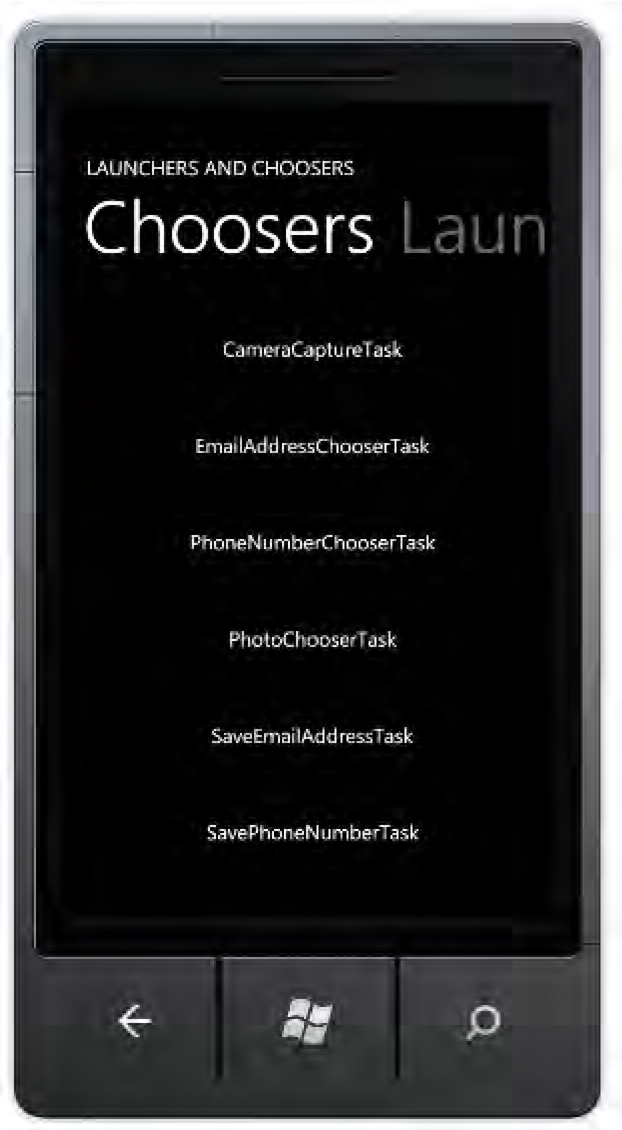
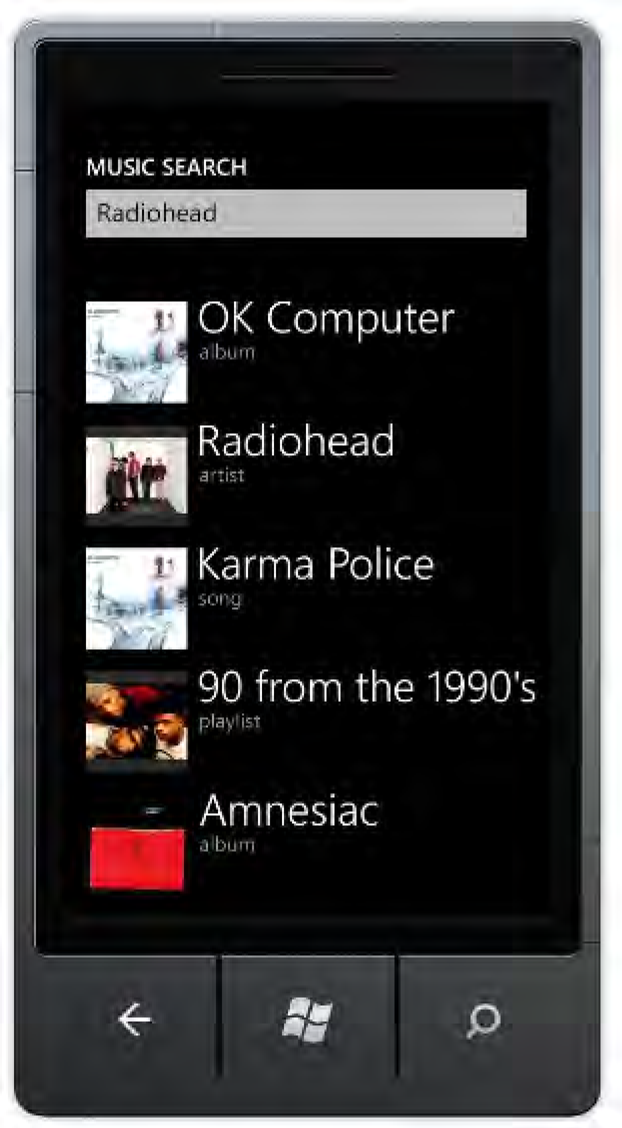


***Figure 3-20.** The Choosers pivot item showing all available choosers*

Now you can tap a list box item and see the related functionality. For example, Figure 3-21 shows the `MarketplaceSearchTask` launcher.



MUSIC SEARCH

Radiohead

OK Computer
album

Radiohead
artist

Karma Police
song

90 from the 1990's
playlist

Amnesiac
album

Figure 3-21. *The* `MarketplaceSearchTask` *launcher in action*

■ **Note** The `EmailComposeTask` launcher cannot be tested on the emulator because it doesn't provide an e-mail composer application. Moreover, the `MarketplaceDetailTask` launcher doesn't work in either target output until the Marketplace accepts your application.

CHAPTER 4

User Interface With Expression Blend

This chapter explains how easy it is to customize controls in Silverlight for Windows Phone. We also wanted to show the use of special effects, but unfortunately, the fact that in the official release haven't been included requires us to not include them in this chapter.

But before starting with the recipes, you need to remember some fundamental concepts, such as the importance of a good user experience. In addition, it is essential for you to follow the user interface guidelines provided by Microsoft to ensure that your application is not rejected from the Marketplace, even if it is extremely functional. Before starting with the customization of controls, read the "UI Design and Interaction Guide for Windows Phone 7" document published by Microsoft and available at `http://msdn.microsoft.com/en-us/library/ff637515(v=vs.92).aspx`. This site also includes a series of templates for Photoshop.

The recipes in this chapter describe how to do the following:

- 4-1. Create a data template that will enable your application to display well with a light or dark theme
- 4-2. Change the skin of your app
- 4-3. Create some cool animation4-4. Customize a control

4-1. Getting Ready for Light and Dark

Problem

You want your application to display a list of items inside a list box. This list box needs a custom layout that enables you to display a rectangle next to each list item. The rectangle will appear when the item is selected. You also want to test the display of the list box by using various combinations of themes allowed by Windows Phone.

Solution

To create the layout of your list, you must create an `ItemTemplate` template and an `ItemContainerTemplate`. Then you must interact with the Device panel in Expression Blend to change between various combinations of themes.

How It Works

The data template is a powerful tool put in the hands of developers and designers that provides significant control over customizing UI elements (including, for example, a list box). These templates allow you to create a custom organization of UI elements that is based on the way you want users to visualize the information and that allows users to easily find what they need. By combining the power of the data template with the Device panel of Blend at design time, you can try out various combinations of themes and accent colors to determine what the user's feedback will be.

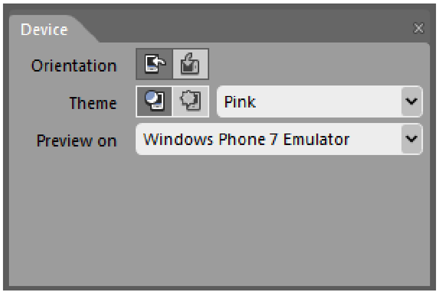
The Code

It is important that your application be able to adapt to the user's visual choices. I If you don't use a color scheme suited to the theme chosen by the user, your application could become unused. Of course, some applications can impose a schema of color that differs from the choices of the user, while still providing a great user experience, by adapting the needs of the user to that graphic style (look at Facebook). In other cases, however, you won't be able to boast with such boldness and you'll want your application to be in line with the user's choices

Suppose that on the main page, your application has a list box. Without having any customization on brushes, you use system colors. Then, when the user changes the theme, your application is still in line with it.

Problems arise when you decide that you don't want to design an application similar to others. Instead, you want one that reflects, for example, the web version of your application. You want to use your color scheme, and would like it if we use the light or dark theme.

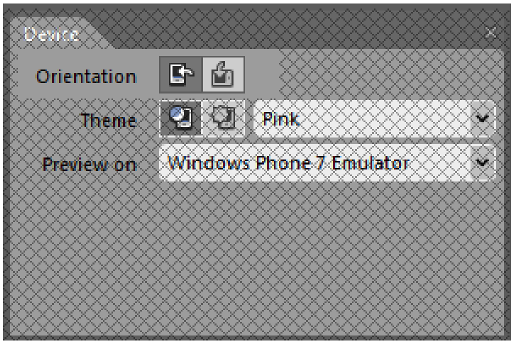
Well, the first thing to know is that you don't need to make ongoing changes to the settings of your device or emulator. Blend already supports (at design time) the change of themes by providing an instant preview. So before we show you how to customize your application, we will show you how to use the Device panel of Microsoft Expression Blend (shown in Figure 4-1)—because it's important to become familiar with the tool that you will be using over the course of this chapter.



Orientation
Theme: Pink
Preview on: Windows Phone 7 Emulator

Figure 4-1. Device panel inside Blend

By clicking one of the two buttons highlighted in Figure 4-2, you can rotate the preview in landscape or portrait orientation, and then immediately test whether the application is ready for the two display modes. Of course, if your application doesn't need to rotate in the hands of the user, this option is not for you.

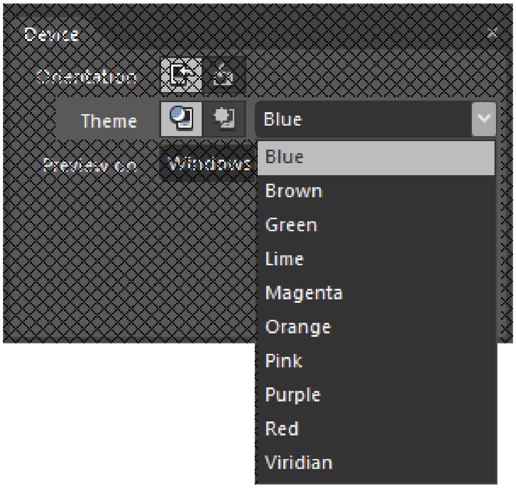


Theme Pink

Preview on Windows Phone 7 Emulator

Figure 4-2. Orientation buttons

Similarly, you can change the appearance (dark or light) and the accent color matching `PhoneAccentBrush`, which will allow you to keep the display in line with the "mood" of the user. The Device panel enables you to try various combinations of themes and accent colors, as you can see highlighted in Figure 4-3. However, in addition to enabling you to see whether your layout works with various accent colors, the Display panel also enables you to monitor how the various brushes that you have defined in your application are compatible with dark and light themes.



Theme Blue

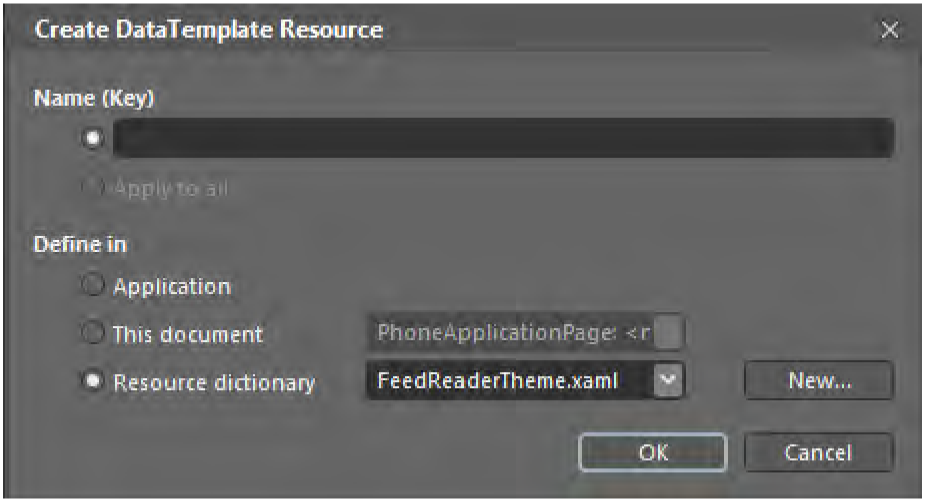
Figure 4-3. Theme selection

■ **Note** Just like the physical device, the emulator selects the dark theme by default.

You have reached nearly the central point of this book, but you will also consider applications from other chapters (also later) for customize it.

For this example, you will use the feed reader from Chapter 9 (Recipe 9-2). At first, it has simply a list box. You will edit the item template with Blend: right-click the list box and then choose Edit Additional Templates ➤ Edit Generated Items ➤ Edit A Copy.

A screen similar to Figure 4-4 displays and asks where you want to create the resource. We recommend that you always create a dictionary in which you can enter all the data template and container styles. We make this recommendation for several reasons. First, if you create a template and your application consists of many pages, you will want to reuse the template for data of the same type. Although it would be equally available profiles in the `app.xaml` file but is our best practice to leave this as clean as possible, because by using the Resources panel in Blend, you have available all the resources from various dictionaries merged into a single point. Then, if you're editing the template, you already know where to go to find it. We do not recommend using the template defined inside the control because it is more difficult to see the template while you are creating the application, without selecting the template again, and because this template will not be easily reusable.



Create DataTemplate Resource

Name (Key)

●

○ Apply to all

Define in

○ Application

○ This document PhoneApplicationPage: <r

● Resource dictionary FeedReaderTheme.xaml

Figure 4-4. Creating a data template

So create a new dictionary named `FeedReaderTheme.xaml` and create a new template named `NewsItemTemplate`. In this case, we opted for a simple template that has a stack panel with a text block to show the title of the news, and a hyperlink button to open the link to the news in a browser. The XAML is as follows:

```
...
<DataTemplate x:Key="NewsItemTemplate">
  <StackPanel>
    <TextBlock Text="{Binding Title}" Style="{StaticResourceNewsTitleTextBlockStyle}" />
    <HyperlinkButtonHorizontalAlignment="Left" Content="{Binding Link}"
             Click="HyperlinkButton_Click"/>
  </StackPanel>
</DataTemplate>
...
```

Refer to Chapter 10 to learn more about the concept of binding, which is explained together with preliminary information about implementing the Model-View-ViewModel (MVVM) pattern.

As you can see in the following code, you also retrieve the style of the text block that displays the title, and for this we have chosen a Tahoma (Bold) 12-point font:

```
...
<Style x:Key="NewsTitleTextBlockStyle" TargetType="TextBlock">
  <Setter Property="FontWeight" Value="Bold"/>
  <Setter Property="FontFamily" Value="Tahoma" />
  <Setter Property="FontSize" Value="16"/>
</Style>
...
```

After defining the style of the elements contained in the list, you will customize the itemContainer for the selection of an item that appears as a rectangle outline. Again, right-click the list box and then choose Edit Additional Template ➤ Edit Generated Item Container ➤ Edit A Copy. Call the style NewsListItemContainerStyle.

The template will appear very simple, but complete enough. In Blend's States panel, you can see the states that currently can take this control. What interests us is Selected status. If you select it, the interface is put in "recording" and the text is displayed with the color that you chose for the accent brush. (Now you get to play with the Device panel in Blend.)

In the States panel, select the element Base, to which you will add a rectangle without fill. Set the outline color to Accent Color, and then set the opacity to 0% so that in all cases the rectangle will be transparent. Then select Selected status, but this time for working more comfortable press F6 to change the layout of panels and enter in Storyboard Creation modality. Select the rectangle, and if you do not see the storyboard, click the Show Timeline button shown in Figure 4-5. Now you want the rectangle to appear with a fading effect with a delay of 5 seconds, so select the rectangle and move the playhead along the timeline up to 500 milliseconds, as shown in Figure 4-6. In the Properties panel, edit the property opacity to 100%.

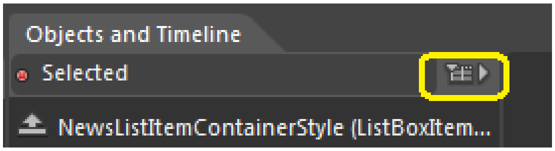


Figure 4-5. Show Timeline button

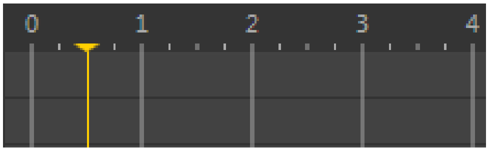


Figure 4-6. Timeline

In this way, you just created a storyboard, which will result in the following XAML:

```
...
<VisualState>
  <Storyboard>
    <ObjectAnimationUsingKeyFrames Storyboard.TargetProperty="Foreground"
          Storyboard.TargetName="ContentContainer">
      <DiscreteObjectKeyFrame KeyTime="0" Value="{StaticResource PhoneAccentBrush}"/>
    </ObjectAnimationUsingKeyFrames>
    <ObjectAnimationUsingKeyFrames Storyboard.TargetProperty="(UIElement.Visibility)"
            Storyboard.TargetName="rectangle">
      <DiscreteObjectKeyFrame KeyTime="0">
        <DiscreteObjectKeyFrame.Value>
          <Visibility>Visible</Visibility>
        </DiscreteObjectKeyFrame.Value>
      </DiscreteObjectKeyFrame>
    </ObjectAnimationUsingKeyFrames>
    <DoubleAnimationUsingKeyFrames Storyboard.TargetProperty="(UIElement.Opacity)"
          Storyboard.TargetName="rectangle">
      <EasingDoubleKeyFrame KeyTime="0" Value="0"/>
      <EasingDoubleKeyFrame KeyTime="0:0:0.5" Value="1"/>
    </DoubleAnimationUsingKeyFrames>
  </Storyboard>
</VisualState>
...
```

Obviously, it is much easier for a designer to create an animation with a few simple clicks than to write the XAML. Therefore, even though explained step by step is not difficult, but only requires more time (and in the real world, when you work, time is never enough).

The portion of XAML storyboards that most interests us is included in the item `DoubleAnimationUsingKeyFrames`—which, contrary to what it may seem, is an animation in which you define changes to properties that have values of type `Double`.

`Storyboard.TargetProperty` indicates to the storyboard what properties of the element specified in `Storyboard.TargetName` apply the changes keyframe by keyframe. In fact, you specify which are keyframes for us (at time 0 and 0.5), and declare that at time 0, the value of the property is 0, while at time 0.5, the value is 1 (100%). Then you're finished, because an animation declared in this way (with `EasingDoubleKeyFrame`) will increase with a linear function.

Usage

From Blend, select the target of your test in the Device panel. Press F5 or Ctrl+F5 and wait for the application to take the information from the Web. Select an element and watch the rectangle's opacity increase. Then select another and watch the unfocused element return to normal.

4-2. Changing the Skin of Your App

Problem

You want to customize your application with a different resource dictionary, depending on whether the light or dark theme is selected, and you want test it with fake data.

Solution

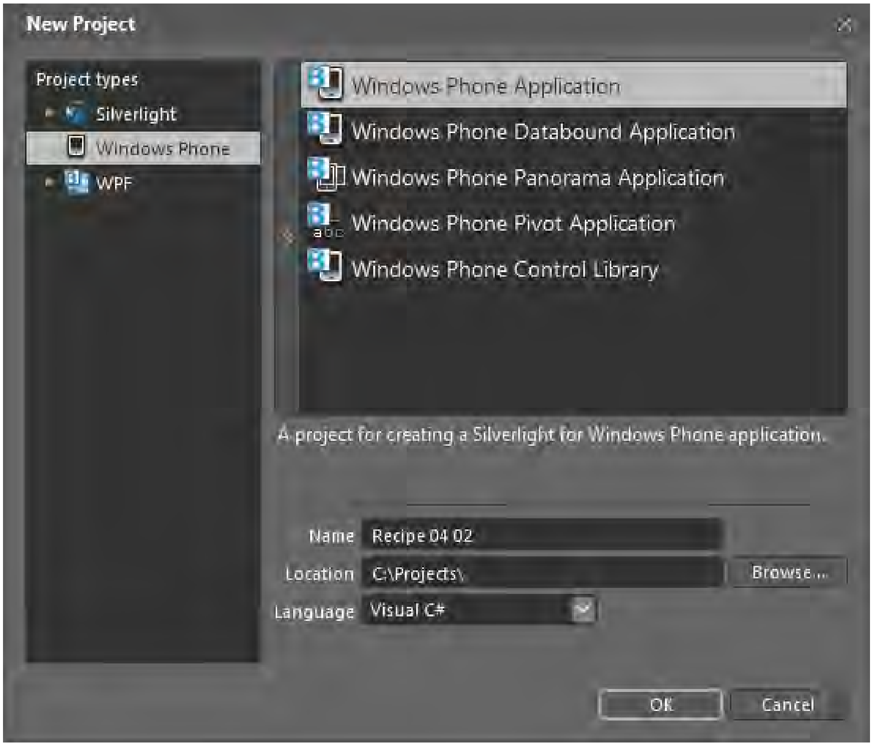
You must create different dictionaries with your brushes. Then you select `PhoneLightThemeVisibility` and apply the theme that you prefer, using sample data created inside Blend.

How It Works

This recipe is achievable in part only with Blend. In Visual Studio, you can edit only the `app.xaml.cs` code, and then from one of the two instruments you create a new project for Windows Phone (in Blend, as you can see in Figure 4-7).

Once you have created the project, add a folder named `Skins`, and add to this folder two dictionaries, `DarkTheme.xaml` and `LightTheme.xaml`. Next, edit the `app.XAML` file, which you will be automatically linked to the dictionary taking care of comment underlined two lines representing the themes to be applied (unfortunately, not at design time, but at runtime). If you also have settings that are shared by both themes, you could add a resource dictionary that contains the shared keys.

```
...
<ResourceDictionary.MergedDictionaries>
<!--<ResourceDictionary Source="Skins/DarkTheme.xaml" />-->
<!--<ResourceDictionary Source="Skins/LightTheme.xaml" />-->
</ResourceDictionary.MergedDictionaries>
...
```


New Project
Project types
Silverlight
Windows Phone
WPF
Windows Phone Application
Windows Phone Databound Application
Windows Phone Panorama Application
Windows Phone Pivot Application
Windows Phone Control Library
Browse...
OK
Cancel

A project for creating a Silverlight for Windows Phone application.

Name: Recipe 04 02
Location: C:\Projects\
Language: Visual C#

Figure 4-7. Creating a new project in Expression Blend

At this point, you use Blend's Data panel, which enables you to manage your application data sources and to generate sample data to test your pages. Another very nice feature offered by this panel is the creation of data representation from data. Follow along step by step:

Click the button to displays the menu in Figure 4-8. From this menu, select New Sample Data. A dialog box appears, where you can choose the data source's name, the point at which to define the scope, and the data source's visibility.

Call the data source `SampleDataSource`. If you are using a domain-oriented approach, consider creating the data source at the project level so that you can reuse it in another view. And because this is an application that is simply allowing to take into consideration these features offered by Blend, enable the sample data at runtime.

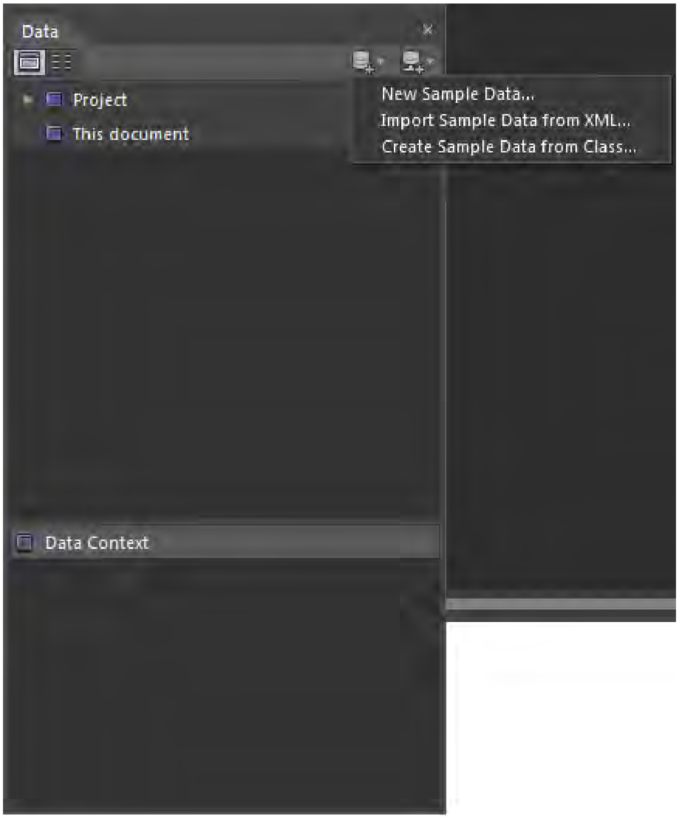

Data
Project
This document
New Sample Data...
Import Sample Data from XML...
Create Sample Data from Class...
Data Context

Figure 4-8. Data panel inside Blend

At this point, the base template has generated a data source called `SampleDataSource`, which (through the template hierarchy that you see in Figure 4-8) will have a complex type called `SampleDataSource`. Within the complex type, you can find a collection of objects composed of two properties called `Property1` and `Property2` (which will be the ones that are going to change).

To simulate an application domain, think of your application as an organizer that lets you keep track of your money. Rename the two properties automatically generated by the tool as `Reason` and `Money`, and add another by clicking the plus (+) symbol next to collection and naming it `Date`.

At this point, by clicking the Edit Sample Value button , you can edit the values that the properties must take. For `Date`, you define a type `String` ➤ `Date` (remember that Windows Phone doesn't have `StringFormat` in binding). For `Money`, you define a type `String` ➤ `Price`, and for `Reason`, you use `String` ➤ `loremipsum`. From this screen, you can specify the number of items that must be contained in your collection. To have a good amount of data, we have chosen 30.

Assuming that it was up to the developer to create the sample data source, it's now up to the designer to create a view template. (It is true that often these two job titles merge into one person, but it's always nice to talk of an ideal world). And assuming that if you are reading this chapter, you are the designer, in this case, we inform that this figure works a lot of inventiveness, and noncode tool.

In fact, you can just drag the collection contained in the data source on the page where you want it to display the list to create a list box with already an `ItemTemplate`. Unfortunately, the basic template is not as appealing as a designer might hope, but it still saves a bit of work.

```
...
<DataTemplate x:Key="ItemTemplate">
 <StackPanel>
  <TextBlock              Text="{Binding Date}"/>
  <TextBlock              Text="{Binding Money}"/>
  <TextBlock              Text="{Binding Reason}"/>
</StackPanel>
</DataTemplate>
...
```

Starting from this template, you want to get a table design, and then you will delete the `StackPanel` to get a `Grid` to define columns from 182/76/200 pixels (above the list box, you will create another `Grid` with the same columns to make the header of the grid).

Then the XAML for your template must be similar to this:

```
<DataTemplate x:Key="ItemTemplate">
        <Grid>
 <Grid.ColumnDefinitions>
                <ColumnDefinition Width="182" />
  <ColumnDefinition               Width="76" />
  <ColumnDefinition               Width="200" />
 </Grid.ColumnDefinitions>
        <TextBlock Text="{Binding Date}" />
        <TextBlock Text="{Binding Money}"  Grid.Column="1" />
        <TextBlock Text="{Binding Reason}"  Grid.Column="2" />
</Grid>
</DataTemplate>
```

■ **Note** For more information about data binding, look at Chapter 10.

At this point, the information is displayed in white on black, and vice versa, depending on the theme. Create your theme and try it to see if you like the result. The wisest choice is to uncomment the chosen theme and use the Device panel to change the theme of your phone. So first you define within the dark theme the following brushes:

```
...
<SolidColorBrush x:Key="DateBrush" Color="#FFFFFFFF" />
<SolidColorBrush x:Key="ReasonBrush" Color="#FBBEBE00" />
<SolidColorBrush x:Key="MoneyBrush" Color="#FFFF0000" />
...
```

In the light theme, the brushes are defined the same way but with different colors:

```
...
<SolidColorBrush x:Key="DateBrush" Color="#FF160FF9" />
<SolidColorBrush x:Key="ReasonBrush" Color="#FBE707AB" />
<SolidColorBrush x:Key="MoneyBrush" Color="#FFA90000" />
...
```

You now have two themes and you have tested them in various combinations for the phone. The last thing to do is apply them at runtime. Unlike everything you've done so far, this task must be done by hand with code at runtime, because only at this time can you know which theme has been chosen by the user.

Within the App.xaml.cs file, create a private method that has the scope to apply the theme and call it (with extreme imagination) ApplyTheme(). This method should be invoked to raise either of the events Launching or Activated for the simple reason that, in case your application has been simply reactivated following a tombstoning, you must be ready to acknowledge any change in theme settings made by the user in the meantime.

```
...
private void Application_Launching(object sender, LaunchingEventArgs e)
{
        ApplyTheme();
}

private void Application_Activated(object sender, ActivatedEventArgs e)
{
        ApplyTheme();
}

private void ApplyTheme()
{
  Visibility vis = (Visibility)Application.Current.Resources["PhoneLightThemeVisibility"];
  ResourceDictionary dict = new ResourceDictionary();
  dict.Source = new Uri((vis == System.Windows.Visibility.Visible)
      ? "/Skins/LightTheme.xaml"
      : "/Skins/DarkTheme.xaml", UriKind.Relative);

  Application.Current.Resources.MergedDictionaries.Clear();
  Application.Current.Resources.MergedDictionaries.Add(dict);
}
...
```

The method ApplyTheme() checks the value of the system resource PhoneLightThemeVisibility. If Visible loads the dictionary for the theme, the application uses the light theme, and otherwise uses dark. After this, cleans the MergedDictionaries collection of the application and adds the dictionary you have just loaded. This enables you to have different views, depending on the theme that the user has chosen.

Usage

You can run the project from Blend or Visual Studio by pressing F5. Look for the information displayed according to the color scheme you've chosen with respect to the mood of the user. Now go back to the start page, pressing the windows button. Enter the settings and change the theme to light or dark depending on what you had before. Go back into your application and view it in the theme with the mood chosen, but with the colors changed for better display.

4-3. Creating Some Cool Animation

Problem

You want to add animations to your application, to make the interaction with the user more interesting.

Solution

You will consider the idea of creating storyboard-based animations, and bind them to the various states of your controls.

How It Works

You will modify 7Drum, our pilot project, and change the three text blocks into three buttons. You will add a different effect to each button by creating a template for each and applying transformations to the elements that make up the template. The interface will then become animated, offering the user a more interactive experience.

The Code

Open the 7Drum project from Blend and open the main page. Let's start with the comment on the three text blocks:

```
<!--
<TextBlock x:Name="tbRecordGroove" Text="Take your groove" Style="{StaticResource
     PhoneTextExtraLargeStyle}" ManipulationStarted="tbRecordGroove_ManipulationStarted"
     HorizontalAlignment="Center" VerticalAlignment="Center" Padding="0 34" />

<TextBlock x:Name="tbTraining" Text="Training" Style="{StaticResource
     PhoneTextExtraLargeStyle}" ManipulationStarted="tbTraining_ManipulationStarted"
     HorizontalAlignment="Center" VerticalAlignment="Center" Padding="0 34" />

<TextBlock x:Name="tbMetronome" Text="Metronome" Style="{StaticResource
     PhoneTextExtraLargeStyle}" ManipulationStarted="tbMetronome_ManipulationStarted"
     HorizontalAlignment="Center" VerticalAlignment="Center" Padding="0 34" />
-->
```

Then add the three buttons:

```
<Button x:Name="RecordGrooveButton" Content="Take your groove" />
<Button x:Name="TrainingButton" Content="Training" />
<Button x:Name="MetronomeButton" Content="Metronome" />
```

For the first button, you want its size to decrease and then increase at regular intervals when the button is pressed.

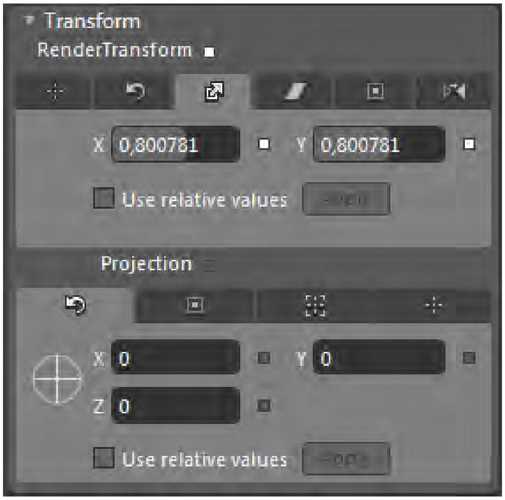
First you have to convert the base template button in a custom template. Right-click RecordGrooveButton and choose Edit Template ➤ Edit A Copy, naming it GrooveButtonTemplate. As always, we prefer the dictionary-based approach to organize our styles. Then in the screen of creation of the dictionary, you create a dictionary called SevenDrumButtonTemplates, because there you will put the template to use for the various buttons. You now have a template on which to work.

First you access the animation mode of the Blend interface by pressing F6 on your keyboard. For this first button, you do not need to add elements to the template for this type of animation, but you do have to select the state of all that you want to animate. So select in the States panel the state Pressed and then select the Border element called ButtonBackground, which contains the element ContentControl that acts as a container for the content you choose. Even before you have changed something, you expand the node of the tree view to display the children of ButtonBackground, note that has already set an animation, which develops all in the instant 0 in the timeline, when the button changes its color when touched.

Once you have selected ButtonBackground, move the yellow playhead along the timeline at instant 0.1 (the animation grows in a short time). In the Properties panel, select the Transform section from the list of sections and then tab Scales (as in Figure 4-9), bringing the values of X and Y to about 0.8

In this way, you have created the first part of the animation. Unfortunately, the animation is limited to execute only once, without then increase again the proportions as we have planned before. So select the animation of the RenderTransform property on the value of ScaleX and edit the XAML (this method is faster than having to select the various property and edit values in the Properties panel) to set the AutoReverse property to true, so that the animation will re-create the condition of the button enlargement, and set the RepeatBehavior to Forever so that there is a loop in the animation.

```
...
<DoubleAnimationUsingKeyFrames
Storyboard.TargetProperty="(UIElement.RenderTransform).(CompositeTransform.ScaleX)"
Storyboard.TargetName="ButtonBackground" AutoReverse="True" RepeatBehavior="Forever">
        <EasingDoubleKeyFrame KeyTime="0" Value="1"/>
        <EasingDoubleKeyFrame KeyTime="0:0:0.1" Value="0.8"/>
</DoubleAnimationUsingKeyFrames>

<DoubleAnimationUsingKeyFrames
Storyboard.TargetProperty="(UIElement.RenderTransform).(CompositeTransform.ScaleY)"
Storyboard.TargetName="ButtonBackground"  AutoReverse="True" RepeatBehavior="Forever">
        <EasingDoubleKeyFrame KeyTime="0" Value="1"/>
        <EasingDoubleKeyFrame KeyTime="0:0:0.1" Value="0.8"/>
</DoubleAnimationUsingKeyFrames>
...
```



X 0,800781 Y 0,800781

□ Use relative values

X 0 Y 0

Z 0

□ Use relative values

Figure 4-9. Transform section inside the Properties panel

Now your first animation of the button is ready, and you can move on to the next animation. In this case, you want the button area to become smaller and will be only a rectangle that widens and narrows to do animation.

As before, your first task is to edit a copy of the button's current template, placing it in the resource dictionary that you created earlier. Call the template `TrainingButtonTemplate`. Unlike before, this time you will go deeper into the study of why you need to modify the template by adding a `Rectangle` that will create the button animation that you desire. The template consists of a main `Grid` control.

```
...
<ControlTemplateTargetType="Button">
 <Grid        Background="Transparent">
...
```

Inside of is set the value of the attached property `VisualStateManager.VisualStateGroups`, which defines the various states that the control can assume. If you read it, you will find that it contains various `Storyboard` that we have defined. Immediately under the definition of this attached property, you will put a rectangle that will have as its margin the system resource `PhoneTouchTargetOverhang` and the `PhoneAccentBrush` as `Stroke` color to fit just the size of the border `ButtonBackground`, like a unique element.

```
...
<Rectangle Margin="{StaticResourcePhoneTouchTargetOverhang}"
Stroke="{StaticResourcePhoneAccentBrush}" />
<Border x:Name="ButtonBackground"
...
```

Now you have the controls that you need and you can proceed with the creation of the storyboard.

Select from the States panel the Pressed state and select ButtonBackground that you want to remain smaller for all the time of the pressure. Move the playhead along the timeline to 0.04 seconds (if you have difficulty doing so, you need to disable snapping to the timeline), as you did with the previous button size climbing up to 0.8, but in this case, you do not want your storyboard to be performed cyclically, so you will not define RepeatBehavior, and you don't want to run back, so you will not define the autoreverse (which by default is set to false).

So for this animation, you have this XAML:

```
<DoubleAnimationUsingKeyFrames
    Storyboard.TargetProperty="(UIElement.RenderTransform).(CompositeTransform.ScaleX)"
    Storyboard.TargetName="ButtonBackground">
  <EasingDoubleKeyFrame KeyTime="0" Value="1"/>
  <EasingDoubleKeyFrame KeyTime="0:0:0.04" Value="0.8"/>
</DoubleAnimationUsingKeyFrames>
<DoubleAnimationUsingKeyFrames
      Storyboard.TargetProperty="(UIElement.RenderTransform).(CompositeTransform.ScaleY)"
      Storyboard.TargetName="ButtonBackground">
  <EasingDoubleKeyFrame KeyTime="0" Value="1"/>
  <EasingDoubleKeyFrame KeyTime="0:0:0.04" Value="0.8"/>
</DoubleAnimationUsingKeyFrames>
```

Now you just have to animate the rectangle that you added earlier. Therefore, always remaining within the editing of the Pressed state, select the rectangle and move the playhead to the beginning of the timeline if it isn't there already. You create a keyframe, and then moving along the timeline at the level of 0.20 seconds, scale the rectangle to 0.8 for both the x- and y-axis. In this case, however, you define an infinite loop, and set Autoreverse to true so that the animation will expand and shrink the rectangle continuously, until the finger is on the button. Your XML should look like this:

```
<DoubleAnimationUsingKeyFrames AutoReverse="True" RepeatBehavior="Forever"
      Storyboard.TargetProperty="(UIElement.RenderTransform).(CompositeTransform.ScaleX)"
      Storyboard.TargetName="rectangle">
  <EasingDoubleKeyFrame KeyTime="0" Value="1"/>
  <EasingDoubleKeyFrame KeyTime="0:0:0.2" Value="0.8"/>
</DoubleAnimationUsingKeyFrames>
<DoubleAnimationUsingKeyFrames AutoReverse="True" RepeatBehavior="Forever"
     Storyboard.TargetProperty="(UIElement.RenderTransform).(CompositeTransform.ScaleY)"
     Storyboard.TargetName="rectangle">
  <EasingDoubleKeyFrame KeyTime="0" Value="1"/>
  <EasingDoubleKeyFrame KeyTime="0:0:0.2" Value="0.8"/>
</DoubleAnimationUsingKeyFrames>
```

It's time to animate the last button. This time, the animation will be a bit more 3D. As the user presses the button, it will flip along the y-axis.

As with the other buttons, you have to edit the template in the usual way, so right-click the button and edit the template as MetronomeButtonTemplate. You are using this naming convention because you are applying this style exclusively to the button itself. However, from the perspective of reusing these animations, you should indicate the name of the animation so that in your future projects, you can link in app.xaml the dictionary with templates and animations so you can use them anywhere.

Because you're editing the Metronome button, you want to give the button an oscillating movement in order to stay in the topic, and then select as usual the Pressed status and the ButtonBackground Border to edit the properties of the latter in time.

In the Properties panel under the transforsection, you have other kinds of transformations to apply to objects, including projection that is the arrangement of control along the x-, y- and z-axis.

At instant 0:00.1, you set the Y value of the `Projection` property to 18. Then in the instant 0: 00.3, you set it to –18. Finally, at instant 0:00.4, you reset it to 0. In this way, there is perpetual movement and adjustments over time. You also have to set `RepeatBehavior` to `Forever` for this animation to be ready.

The XAML resulting from these steps is as follows:

```
<DoubleAnimationUsingKeyFrames RepeatBehavior="Forever"
Storyboard.TargetProperty="(UIElement.Projection).(PlaneProjection.RotationY)"
Storyboard.TargetName="ButtonBackground">
        <EasingDoubleKeyFrame KeyTime="0" Value="0"/>
        <EasingDoubleKeyFrame KeyTime="0:0:0.1" Value="18"/>
        <EasingDoubleKeyFrame KeyTime="0:0:0.3" Value="-18"/>
        <EasingDoubleKeyFrame KeyTime="0:0:0.4" Value="0"/>
</DoubleAnimationUsingKeyFrames>
```

This animation presents a lot to consider, including the fact that it develops with regular intervals, just like a metronome. In this way, the animation draws the user's attention to what awaits via clicking that button. The animation itself grows in a short time, enabling the user to retrieve a visual benefit. (There is also to say that an animation too long on a control that should just manage the TAP does not make sense.)

Now you have to perform the developer's task and create the event handler to manage the `Click` event of all three buttons, so they do what they were doing before the text blocks.

E i tre eventhandler saranno tutti uguali

```
private void RecordGrooveButton_Click(object sender, System.Windows.RoutedEventArgs e)
{
        this.NavigationService.Navigate(new Uri("/VirtualDrum.xaml", UriKind.Relative));
}

private void TrainingButton_Click(object sender, RoutedEventArgs e)
{
        this.NavigationService.Navigate(new Uri("/Training.xaml", UriKind.Relative));
}

private void MetronomeButton_Click(object sender, RoutedEventArgs e)
{
        this.NavigationService.Navigate(new Uri("/Metronome.xaml", UriKind.Relative));
}
```

Usage

From Expression Blend, run the project by pressing F5 or Ctrl+F5. Click all three buttons to test that all the animations work, and relative event handler.

4-4. Customizing a Control

Problem

You would like to have a customized button that shows an image instead of the usual written text.

Solution

You have several solutions to this problem, each with its pros and cons. , and we will be listing them all brought then a definitive template that reflects what we want from this customization

How It Works

With XAML, you have the ability to create multiple controls together—so, for example, items in a list box can be a series of check boxes. You can also use XAML to set the contents of a button to be not text but an image. Finally, you can customize the behavior of a check box so that it has a different symbol than the standard, by editing the template to modify the path representing the usual check mark.

The Code

From Expression Blend, create a new project for Windows Phone and call it `PlayWithControlTemplate`. Do not create a pilot project for this recipe, because you could use this information in all your applications, and consequently bring your template around your products. (Suppose that you have created a suite of products, to which you have given your footprint graphic and you want these are always on the same line for each product to let the user easily settle with your other software.)

In this project, the first thing you do is add an `Images` folder and add an image named `TestImage.png` (Look at this link if you want some information about this image format: `www.libpng.org/pub/png/pngintro.html`). In this example, the image is the one shown in Figure 4-10, but you are free to choose another.

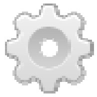


***Figure 4-10.** Our icon*

The first thing you want to get is an image that works just like a button. There are several ways to achieve this goal, but the easiest is to use an image instead of text as the content of the button. Here is an example:

```
<Button x:Name="ImageButton" Height="84" >
        <Image Source="Images/TestImage.png" />
</Button>
```

This code creates a button, shown in Figure 4-11, which is apparently already a button that is acceptable, but lacks some specialties, for example, has kept the edge to the content then we have to edit the template of the button to remove the Board and add our button some small effect to make it complete. Then, as always, right-click the button and edit the template, calling it ImageButtonTemplate.

First, you need to locate ButtonBackground, which currently is an element of type Border. You want to delete it or replace it with a common Grid, whose Background remains bound to the template. Then this Grid will add a rectangle that you will call OverlayRectangle and will fill with black so that its opacity is 100% not visible initially.

Figure 4-11. An image as content

The addition of this rectangle to afford when the button is disabled, showing an overlay on the image (or any other custom content).

Then the XAML that you need to use is similar to the following:

```
<Gridx:Name="ButtonBackground"Background="{TemplateBinding Background}"
   Margin="{StaticResource PhoneTouchTargetOverhang}">
        <ContentControl x:Name="ContentContainer" ContentTemplate="{TemplateBinding
           ContentTemplate}" Content="{TemplateBinding Content}"
           Foreground="{TemplateBinding Foreground}"
           HorizontalContentAlignment="{TemplateBinding HorizontalContentAlignment}"
           Padding="{TemplateBinding Padding}" VerticalContentAlignment="{TemplateBinding
           VerticalContentAlignment}"/>
        <Rectangle x:Name="OverlayRectangle" Fill="#B0000000" Visibility="Collapsed" />
</Grid>
```

Now you have to edit the statuses disabled and pressed. (This step would be avoidable if you don't remove the Border, but as you change it with the Grid, remember that if you do, it will result in an error in the storyboard, because unlike the Grid, does not have a border attribute as BorderBrush.) To complete this custom control, press F6 to toggle to storyboard mode and select the Pressed state, and then the grid, changing the background to {StaticResourcePhoneForegroundBrush}. Just as before, the button will change color from black to white (and vice versa), depending on the visual theme chosen by the user (which should always be taken into account). The XAML for this effect should be similar to this:

```
<VisualState x:Name="Pressed">
 <Storyboard>
  <ObjectAnimationUsingKeyFrames              Storyboard.TargetProperty="Background"
Storyboard.TargetName="ButtonBackground">
   <DiscreteObjectKeyFrame                     KeyTime="0" Value="{StaticResource
PhoneForegroundBrush}"/>
  </ObjectAnimationUsingKeyFrames>
 </Storyboard>
</VisualState>
```

You are changing the foreground color because you are thinking of abstracting this template compared to contents (contrary to what is chosen for the naming convention of the templates) so that if you apply this style to a button with text as its content, you would get the same result, a reversal of the background and foreground color. The aim is always the same, to have consistent behavior between the various elements that make up the user interface so that they are part of one big picture.

Well, you just have to manage the `Disabled` state of your templates, so that the rectangle forming the overlay to show "inert" our elements to change their visibility in visible, then once again select the element and change the visibility into property in order to obtain automatically the XAML like this:

```
<VisualState x:Name="Disabled">
 <Storyboard>
  <ObjectAnimationUsingKeyFrames
Storyboard.TargetProperty="(UIElement.Visibility)" Storyboard.TargetName="OverlayRectangle">
   <DiscreteObjectKeyFrame                      KeyTime="0">
    <DiscreteObjectKeyFrame.Value>
     <Visibility>Visible</Visibility>
    </DiscreteObjectKeyFrame.Value>
   </DiscreteObjectKeyFrame>
  </ObjectAnimationUsingKeyFrames>
 </Storyboard>
</VisualState>
```

Note: If you have previously changed the `Border` control in XAML to a `Grid` control and then haven't deleted the storyboard attached to it, you'll end up with a change of the foreground color in this case. However, does nothing more than what is already done by the rectangle, except that in this case it also applies to images, in either case applies only to text.

The template is ready, as you have customized the button template. Earlier, we said that you could create this template in several ways—and just for the sake of information, there is also a reverse way that could come in handy if you wanted to give a background image to your button. However, keeping a "normal" behavior compared to textual content.

This template will depart from using an item image for a button control. The process is virtually automatic thanks to Blend, and allows you to achieve satisfactory results with regard to the user experience. Our image for the button, shown in Figure 4-12, represents a prototype idea of a circular button.

Insert it into your own XAML as a normal image:

```
<Image Source="Images/Circle Button Red.png" />
```

So now you just have to right-click and choose the menu item Make Into Control. At this point, you will see a screen for selecting the controls that you can achieve starting from this image. In our case, we chose a button, but if you had a different image that represented, for example, a sheet of notebook paper, you might have considered using a list box.

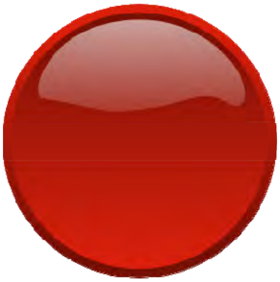


***Figure 4-12.** The base image for our button*

Name the template CircleButtonTemplate. If you try to, you will realize that the button is inert; it does not react to changes in state, to user pressure, or to being disabled. So you have to define the behavior under these conditions. Although this is unlike the type of template that you created earlier, it's not a big problem. All you have to do to start is add two ellipses to the template that will overlay the button's Pressed and Disabled states. You could also use a rectangle to achieve this goal, but just to let you see that you can achieve the same result in this manner, this example uses an ellipse.

The first ellipse, PressedEllipse, will overlay the image when the button is pressed. The second ellipse, DisabledEllipse, will, as its name suggests, overlay the image when the button is disabled.

Both ellipses must have their visibility set to Collapsed. Their opacity mask must be the image that you used to create the button. The fill color is white for the pressed state and gray for the disabled state. Both are not entirely opaque and have a good level of transparency.

```
<Ellipse x:Name="PressedEllipse" Visibility="Collapsed" Fill="#72DEDADA" >
        <Ellipse.OpacityMask>
                <ImageBrush Stretch="Uniform" ImageSource="Images/Circle Button Red.png"/>
 </Ellipse.OpacityMask>
</Ellipse>
<Ellipse x:Name="DisabledEllipse" Visibility="Collapsed" Fill="#B2787878" >
        <Ellipse.OpacityMask>
                <ImageBrush Stretch="Uniform" ImageSource="Images/Circle Button Red.png"/>
 </Ellipse.OpacityMask>
</Ellipse>
```

At this point, edit the Pressed state storyboard, and set the PressedEllipse visibility to Visible, and do the same for the Disabled state on DisabledEllipse in order to obtain an interactive button.

At the end of this edit, your XAML should be like this:

```
...
<VisualState x:Name="Pressed">
 <Storyboard>
  <ObjectAnimationUsingKeyFrames
Storyboard.TargetProperty="(UIElement.Visibility)" Storyboard.TargetName="PressedEllipse">
   <DiscreteObjectKeyFrame                     KeyTime="0">
    <DiscreteObjectKeyFrame.Value>
     <Visibility>Visible</Visibility>
    </DiscreteObjectKeyFrame.Value>
   </DiscreteObjectKeyFrame>
  </ObjectAnimationUsingKeyFrames>
 </Storyboard>
</VisualState>

<VisualState x:Name="Disabled">
 <Storyboard>
  <ObjectAnimationUsingKeyFrames
Storyboard.TargetProperty="(UIElement.Visibility)" Storyboard.TargetName="DisabledEllipse">
   <DiscreteObjectKeyFrame                      KeyTime="0">
    <DiscreteObjectKeyFrame.Value>
     <Visibility>Visible</Visibility>
    </DiscreteObjectKeyFrame.Value>
   </DiscreteObjectKeyFrame>
  </ObjectAnimationUsingKeyFrames>
 </Storyboard>
</VisualState>
...
```

Now you have a fully functional button. And now that you've learned how to customize the data template, button, and interezioni with these tools, understanding how to change the template of a check box will be much easier.

A check box template is composed of various elements: a content container, which allows you to specify the text to display (as you may have guessed, even in this case you could use an image); a path (a sequence of points connected by lines that make up a figure) that is made visible when the check box is selected; and a rectangle that is made visible in the case of an indeterminate state (as in the case of three state check box).

Suppose that for your application, you want your check box to be marked with an X instead of the usual check mark. You also want to display a question mark instead of a square for the indeterminate state. The first thing to do is get the path that reflects this forms. We recommend using Microsoft Expression Design for this purpose because creating a path by hand can be too difficult. To create an X, the code would be written as follows:

```
<Path x:Name="CheckMark" Fill="{StaticResource PhoneRadioCheckBoxCheckBrush}" Width="25"
Height="25" Canvas.Left="0" Canvas.Top="0" Stretch="Fill" StrokeLineJoin="Round"
Stroke="#FF000000" Data="F1 M 0.5,2.47917L 2.46875,0.5L 12.4687,10.4792L 22.4687,0.500002L
24.5,2.47917L 14.4687,12.4792L 24.5,22.4792L 22.4687,24.5L 12.4687,14.4792L 2.46875,24.5L
0.5,22.4792L 10.4687,12.4792L 0.5,2.47917 Z "/>
```

The path to get the question mark will more or less take this form:

```
<Path x:Name="IndeterminateMark" Fill="{StaticResourcePhoneRadioCheckBoxCheckBrush}"
Width="11.2721" Height="21.6238" Canvas.Left="0" Canvas.Top="0" Stretch="Fill" Data="F1 M
3.33606,15.3168C 3.24626,15.0697 3.16511,14.7475 3.09259,14.3501C 3.02006,13.9528
2.9838,13.5571 2.9838,13.1629C 2.9838,12.5529 3.1228,12.0015 3.40081,11.5087C 3.67881,11.016
4.02589,10.5546 4.44203,10.1244C 4.85817,9.69425 5.31144,9.28051 5.80183,8.8832C
6.29223,8.48589 6.7455,8.08388 7.16164,7.67719C 7.57778,7.27049 7.92486,6.84502
8.20286,6.40078C 8.48087,5.95655 8.61987,5.46538 8.61987,4.92729C 8.61987,4.47054
8.51885,4.06462 8.31683,3.70955C 8.1148,3.35447 7.83852,3.05726 7.48799,2.81794C
7.13747,2.57861 6.73254,2.39951 6.27323,2.28063C 5.81392,2.16175 5.32698,2.10231
4.81241,2.10231C 2.96135,2.10231 1.35722,2.80308 0,4.20462L 0,1.48288C 1.67493,0.494293
3.41203,0 5.21129,0C …
```

And does not seem appropriate to continue with all the points contained in it, but it is only to explain how important it is for a designer who intends to customize their own strong interface, using a tool such as Design to get XAML like this.

Usage

To use this recipe, use an alternative form to create a dictionary in which you insert all the effects, styles, and templates that were shown. Then apply them to `7Drum` or some other application. Note how important (and clever) it is as a designer to create your own dictionary of effects (while always trying to improve the graphics rendering) to keep in touch in the creation of an application. And if you're a developer, you can do the same thing, if you want to do without a designer your othe application.

CHAPTER 5

Gestures

With the introduction of the touch screen on phones, the way users interact with these devices has radically changed as compared to traditional mouse usage on personal computers. The same is true for the pen stylus input device, used for example, with BlackBerry phones; however, although the pen stylus emulates the mouse, it doesn't offer any new way to interact with the device.

The input interface revolution was born with the iPhone and iPod Touch devices, on which you can use your fingers to zoom in or zoom out on pictures, scroll text, and much more. Windows Phone 7 inherits iPhone input interface directives, enabling similar gestures to accomplish user interaction with the phone.

In this chapter, you will learn which gestures are provided by Windows Phone 7 and how to use them in your application. The recipes in this chapter describe how to do the following:

- 5-1. Manage gestures in a Silverlight Windows Phone 7 application
- 5-2. Add gestures management to `Click`-less Silverlight controls
- 5-3. Handle gestures in a graphical context such as a game menu
- 5-4. Manage gestures from the Silverlight for Windows Phone 7 toolkit

5-1. Managing Gestures in a Silverlight Windows Phone 7 Application

Problem

You need to understand what gestures are and how to use them in your Silverlight Windows Phone 7 application.

Solution

Various techniques are available for enabling you to know where a user touched the screen and how many fingers were used. You can use the `Touch` static class, which provides the `FrameReported` event rose when the screen is touched. Along with the `Touch` static class, you can use the `GetTouchPoints` method from the `TouchFrameEventArgs` argument provided by the `FrameReported` event handler. The

GetTouchPoints method returns a TouchPointCollection collection filled with TouchPoint objects representing touched screen points.

But using the TouchPointCollection to understand gestures is not so easy. You have to study the collection to understand how the user's fingers have moved on the screen and what that user's intentions could be. You should use—along with the Touch.FrameReported event handler—the TouchPanel class included in the XNA framework. The TouchPanel class, along with the GestureSample structure, really simplifies the recognition of gestures by your application (see Figure 5-1 for diagrams of these classes).

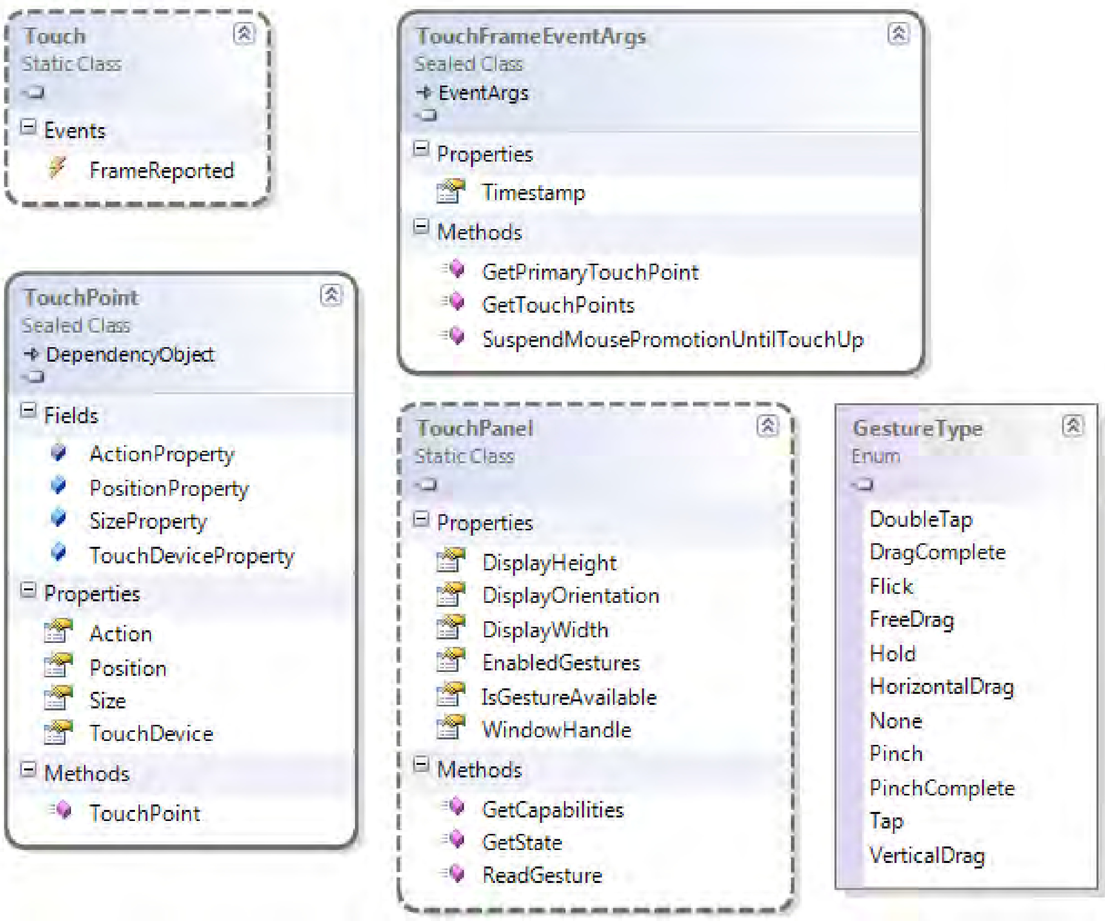


Figure 5-1. *Class diagram for gesture classes*

How It Works

Gestures are operations carried out with one or more fingers on the phone's touch screen. Windows Phone supports having at least four fingers on the screen. A finger can touch the screen and immediately rise up, or it can touch the screen and move in any direction while remaining pressed on the screen. Each operation that the user's fingers perform on the touch screen represents a gesture. In Table 5-1, you can see the list of supported gestures. The most used are Tap, Double Tap, Pinch and Flick.

Most Silverlight controls provide `Click` and `Double Click` event handlers when the user taps and double-taps on the control itself, but you might need other gestures in your application. For example, imagine a book reader application in which the user needs to scroll through pages quickly. Implementing a Tap gesture to scroll page by page would be frustrating for the user. Much better: the Flick gesture, which returns finger-moving speed with the `Delta` property provided by the `GestureSample` structure. You could use this `Vector2` value returned by the `Delta` property to enable the user to move faster across the book pages.

Table 5-1. All the gestures provided by the `GestureType` enumeration

Gesture	Description
Tap	The finger touches and immediately rises up from the touch screen.
Double Tap	The same as the Tap gesture, but touching and rising two times, one right after the other.
Horizontal Drag	The finger touches the screen, continues to press it, and moves horizontally.
Vertical Drag	The same as Horizontal Drag, but the movement is vertical.
Free Drag	The finger touches the screen, continues to press it, and moves freely.
Drag Complete	The finger starts a drag gesture and completes it by raising the finger.
Flick	The finger touches the screen and moves either up or down very fast. This is the gesture used to quickly remove the lock screen.
Pinch	Two fingers touch the screen, moving either apart or together. This is the gesture used to either zoom into or zoom out from an image.
Pinch Complete	Two fingers start the Pinch gesture and complete it by raising both fingers.
Hold	The finger touches the screen and continues to press it without moving.

To use gestures in your application, you first need to complete the following steps:

1. Add a reference to both the Microsoft.Xna.Framework.dll and Microsoft.Xna.Framework.Input.Touch.dll assemblies.
2. Define a FrameReported event handler.
3. Define all the gestures you want to trap in your application by specifying them in the EnabledGestures property from the TouchPanel class separated by the OR logical operator.
4. In the FrameReported event handler, check whether a gesture is available by using the IsGestureAvailable property from the TouchPanel class.
5. Define a GestureSample object that receives gestures from the ReadGesture method provided by the TouchPanel class.
6. Use the gesture accordingly in your application.

The Code

To demonstrate every gesture provided by the phone, we have created a simple application that writes the gesture type on the page title.

Start Visual Studio 2010 and create a new Silverlight Windows Phone 7 application called GesturesDemo. In the MainPage.xaml file, add a row definition to the content grid, specifying a new row with the Height property equal to Auto. Inside the content grid, add an image that fills the entire grid.

```
. . .
<!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <Grid.RowDefinitions>
                <RowDefinition Height="Auto" />
            </Grid.RowDefinitions>

            <Image x:Name="imgBackground" Grid.Row="0" Stretch="Fill"
                  Source="/images/background.png"/>
        </Grid>
. . .
```

■ **Note** We have added an image control just to give to the application a better look but the image control is not necessary to retrieve gestures. The Touch.FrameReported event is the only one that catches gestures because it is implemented into the PhoneApplicationFrame class.

The MainPage.xaml.cs file—more specifically, in the MainPage constructor—contains the necessary instructions for defining the gestures that you need to catch. In our case, we want to catch all the available gestures, so we specify them all, separating them by the OR logical operator in the

EnabledGestures property. Moreover, the FrameReported event is defined and managed by the Touch_FrameReported event handler.

```
. . .
// Constructor
        public MainPage()
        {
            InitializeComponent();
            Touch.FrameReported += new TouchFrameEventHandler(Touch_FrameReported);
            TouchPanel.EnabledGestures = GestureType.Tap
                                       | GestureType.DoubleTap
                                       | GestureType.Flick
                                       | GestureType.Pinch
                                       | GestureType.HorizontalDrag
                                       | GestureType.VerticalDrag
                                       | GestureType.PinchComplete
                                       | GestureType.DragComplete
                                       | GestureType.Hold
                                       | GestureType.FreeDrag;
        }
```

In the Touch_FrameReported event handler, the IsGestureAvailable property is checked to determine whether a gesture has been caught by the frame. If it has, the ReadGesture method is used to retrieve a GestureSample object. This object contains useful information (via the GestureType property) indicating which gesture has been performed by the user, and eventually extra information depending on the gesture type. For example, in our code when the Flick gesture occurs, we also print on the screen the Delta property.

The TouchFrameEventArgs parameter provided by the FrameReported event contains some cool information, such as a TimeSpan value set to the time—when the gesture has occurred. This gesture has been used in the 7Drum application to store drum component playing sequences and the times when they occur.

```
        void Touch_FrameReported(object sender, TouchFrameEventArgs e)
        {
            if (TouchPanel.IsGestureAvailable)
            {
                GestureSample gesture = TouchPanel.ReadGesture();

                PageTitle.Text = gesture.GestureType.ToString();

                if (gesture.GestureType == GestureType.Flick)
                    PageTitle.Text += " " + gesture.Delta.ToString();
            }
        }
```

Usage

In this recipe, you need a physical device to test the application. Indeed, the emulator is not able to intercept multi-touch gestures such as the Pinch.

Connect your unlocked device (see Recipe 1-6 for more information on how to unlock devices) and run the application from Visual Studio 2010, ensuring that the output target is set to Windows Phone 7 Device. The application will start, showing the output in Figure 5-2.

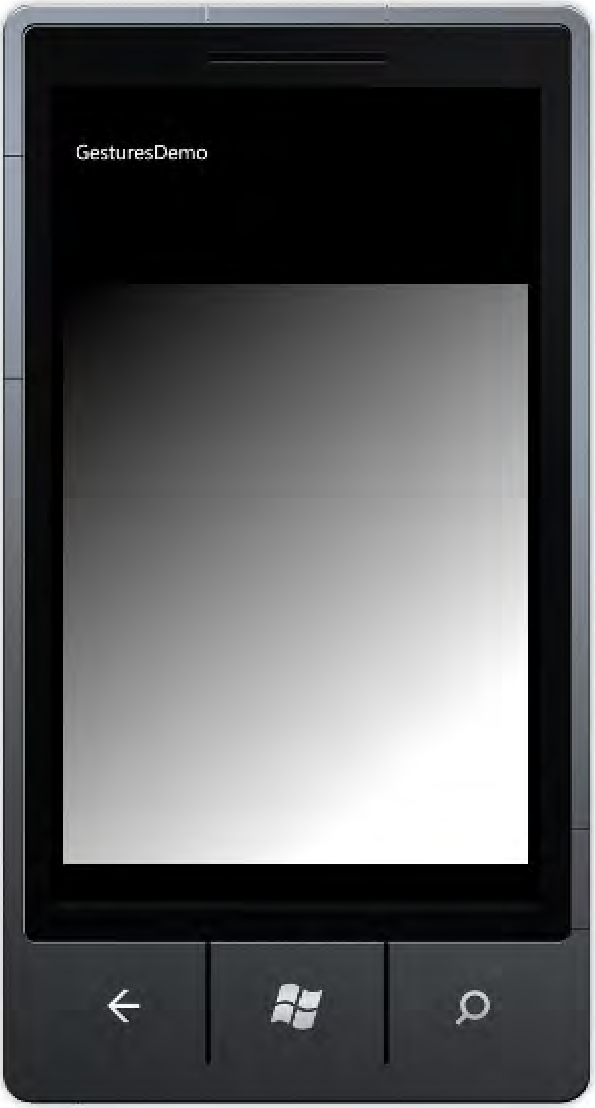


Figure 5-2. *The* `GesturesDemo` *application in action*

At this point, you can start playing with your phone. In Figure 5-3, we performed a very rapid Flick, as demonstrated by the page title showing the gesture type and the `Delta` property value.

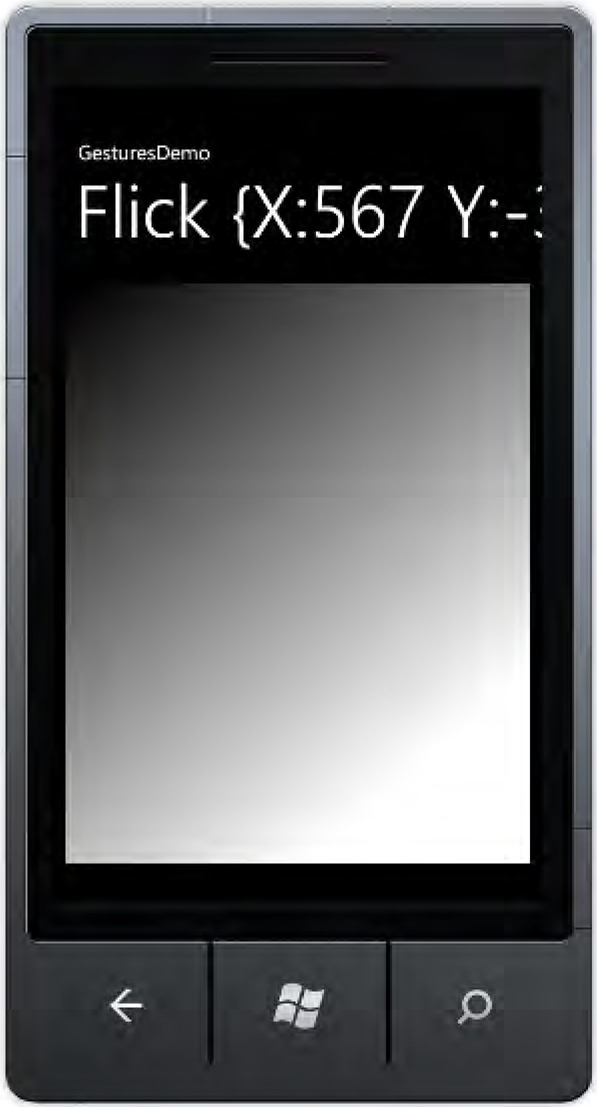


Figure 5-3. *The page title shows that a Flick gesture has occurred.*

5-2. Adding Gestures Management to Click-less Silverlight Controls

Problem

You need to add gestures to the controls that don't provide the Click event.

Solution

You need to use the Behavior class defined in the System.Windows.Interactivity.dll assembly.

How It Works

Almost all Silverlight controls in Windows Phone 7 have the Tap and Double Tap gestures associated to the Click and Double Click events. By the way, there are controls such as Grid (which inherits from the Panel control) that provide neither the Click nor Double Click events.

Examining the parent classes from which the Panel class derives, we arrive at the UIElement class that provides mouse events. Obviously, a Windows Phone doesn't have a mouse, but the events are fired the same when a finger touches the screen. You can manage MouseLeftButtonDown and MouseLeftButtonUp events to simulate the Tap or the Double Tap gestures on controls that derive from the UIElement class. In your code, you have to specify the response to mouse events for each control you need to manage. This is not the best approach to have when you need to add gestures to elements that don't provide them. It would be nice to have generic and reusable code that could be applied in XAML code to every control that needs it. This can be created by using the Behavior class.

The Behavior class (see its class diagram in Figure 5-4) provides the methods to create a behavior that is applicable to controls. Each control that derives from the class specified as generic type during the behavior definition will have that behavior. It provides the OnAttached method, where you can specify the event handlers that you want to trap. You can release those event handlers in the OnDetaching method provided by the Behavior class.

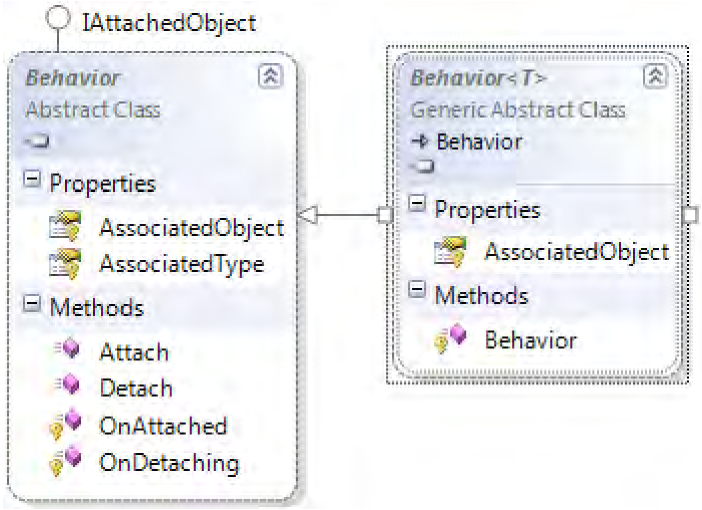


Figure 5-4. *The* Behavior *class diagram*

The Code

In the code for this recipe, you are going to add both the Tap and Hold gestures to the Grid control. Let's create a new Silverlight Windows Phone 7 application called AddGestureDemo from Visual Studio 2010.

The first operation you are going to perform is to add a new class to the project called AddTap. You can accomplish this step from Visual Studio 2010 by choosing Project ➤ Add Class. The skeleton of AddTap class is generated.

The next thing to do is to add a reference to the System.Windows.Interactivity.dll assembly. From the Solution Explorer, right-click the project name and select Add Reference from the context menu. From the Add Reference dialog box, select the .NET tab and search for System.Windows.Interactivity.

Now you can add the using directive in the AddTap class to point to the System.Windows.Interactivity namespace. In that way, you can derive the AddTap class from the Behavior<UIElement> class.

Next you override the OnAttached and OnDetaching methods. For the former, you are going to define event handlers for the MouseLeftButtonDown and MouseLeftButtonUp events. For the latter, you will detach them.

You will use the MouseLeftButtonDown event to store the ticks from the DateTime.Now property. Those ticks will be subtracted from the ticks picked in the MouseLeftButtonUp event and compared to the ticks equal to 1 second. In this way, you can tell when the user taps the screen (button down and up in less than 1 second) or when user holds a finger on the screen (button down and up in more than 1 second). So in the former case, the DoTap event will be raised, and in the latter case, the DoHold event will be fired.

■ **Note** We chose 1 second as the time limit to distinguish a Tap gesture from a Hold gesture, but you can change this value simply by changing the `TimeSpan.TicksPerSecond` value in the `if` condition within the `AssociatedObject_MouseLeftButtonUp` event handler.

```
. . .

using System.Windows.Interactivity;

namespace AddGestureDemo
{
    public class AddTap : Behavior<UIElement>
    {
        public event EventHandler Tap;
        public event EventHandler Hold;
        private bool _IsMousePressed;
        private TimeSpan _mouseLeftButtonDownTime;

        protected override void OnAttached()
        {
            this.AssociatedObject.MouseLeftButtonDown +=
                 new MouseButtonEventHandler(AssociatedObject_MouseLeftButtonDown);
            this.AssociatedObject.MouseLeftButtonUp +=
                new MouseButtonEventHandler(AssociatedObject_MouseLeftButtonUp);
            base.OnAttached();
        }

        protected override void OnDetaching()
        {
            this.AssociatedObject.MouseLeftButtonDown -=
                 AssociatedObject_MouseLeftButtonDown;
            this.AssociatedObject.MouseLeftButtonUp -= AssociatedObject_MouseLeftButtonUp;
            base.OnDetaching();
        }

        void AssociatedObject_MouseLeftButtonDown(object sender, MouseButtonEventArgs e)
        {
            _IsMousePressed = true;
            _mouseLeftButtonDownTime = TimeSpan.FromTicks(DateTime.Now.Ticks);
        }

        void AssociatedObject_MouseLeftButtonUp(object sender, MouseButtonEventArgs e)
        {
            TimeSpan _elapsedTime = TimeSpan.FromTicks(DateTime.Now.Ticks) -
                                       _mouseLeftButtonDownTime;
            if (_IsMousePressed && _elapsedTime.Ticks < TimeSpan.TicksPerSecond)
                DoTap();
            else
                DoHold();

            _IsMousePressed = false;
        }

        void DoTap()
        {
            if (Tap != null)
                Tap(AssociatedObject, EventArgs.Empty);
        }

        void DoHold()
        {
            if (Hold != null)
                Hold(AssociatedObject, EventArgs.Empty);
        }
    }
}
```

In the MainPage.xaml file, you can add some directives to use the AddTap class with the content grid. First, in the namespaces definition, you have to add two new namespaces: tap and i.

Between the ContentPanel's Grid tags, you can use our new behavior by adding the following instructions:

```
            <i:Interaction.Behaviors>
                <tap:AddTap Tap="AddTap_Tap" Hold="AddTap_Hold"/>
            </i:Interaction.Behaviors>
```

As you will see in the following code, the i namespace is added to the PhoneApplicationPage to point to the System.Windows.Interactivity assembly.

In that way, you declare that the new behavior is associated to the grid, and it will respond to the public Tap and Hold events defined in the AddTap class.

```
<phone:PhoneApplicationPage
    x:Class="AddGestureDemo.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    xmlns:tap="clr-namespace:AddGestureDemo"
    xmlns:i="clr-
namespace:System.Windows.Interactivity;assembly=System.Windows.Interactivity"
. . .
```

```
<!--ContentPanel - place additional content here-->
    <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0" Background="White">
        <i:Interaction.Behaviors>
            <tap:AddTap Tap="AddTap_Tap" Hold="AddTap_Hold"/>
        </i:Interaction.Behaviors>
    </Grid>
</Grid>
```

Finally, when the Tap and Hold events are raised, you simply show a MessageBox message indicating which gesture has been performed.

Usage

Press Ctrl+F5 from Visual Studio 2010, and be sure to select the Windows Phone 7 Emulator as the output target. The emulator will start, briefly showing the application, as you can see in Figure 5-5.

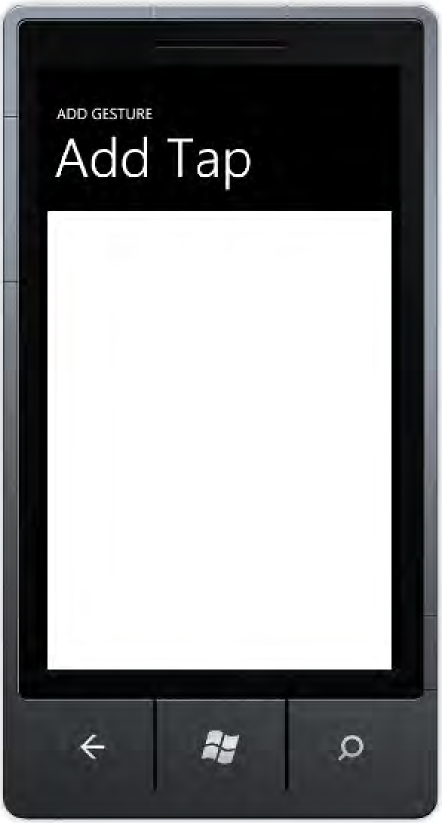


Figure 5-5. The AddGesture application shows a white background for the content grid.

Now press and then rapidly release the left mouse button over the white zone. A message box showing *You tapped the grid* is shown.

Now press and hold for more than 1 second the left mouse button over the white zone and then release it. A message box showing *Hold gesture in the grid* appears.

5-3. Handling Gestures in a Graphical Context Such as a Game Menu

Problem

You have an image with sensible touch zones—for example, a graphical game menu—and you need to manage gestures only when they occur in those zones.

Solution

You can create a mask image and use the `WriteableBitmap` class to retrieve the chosen pixel color. In your code, you associate a color to an operation.

How It Works

In this recipe, we are going further with the `7Drum` application developed throughout this book. In this case, you are going to examine the virtual drumming functionality. An image of a drum kit is shown on the screen, and the user can tap the drum components and hear the related sounds.

Because drum components have different sizes and shapes, memorizing their positions on the screen is not really the best thing to do. You can retrieve the position of the tap, but then you have to check which drum component has those coordinates. Because a drum component cannot have a linear shape, this is really a bad approach.

You can use the `WriteableBitmap` class, which provides the `Pixels` array used to retrieve a pixel to a provided x and y coordinate. You can create a mask image from the original image, load it in memory without showing it in your application, and use the `Pixels` array to retrieve the color of the chosen pixel. In your code, you have associated a color to an operation or a menu item, so you know what to do.

In our case, the drum-kit mask image contains different-colored zones related to drum components (see Figure 5-6). The drum-kit image shown to the user is definitively much better (see Figure 5-7).

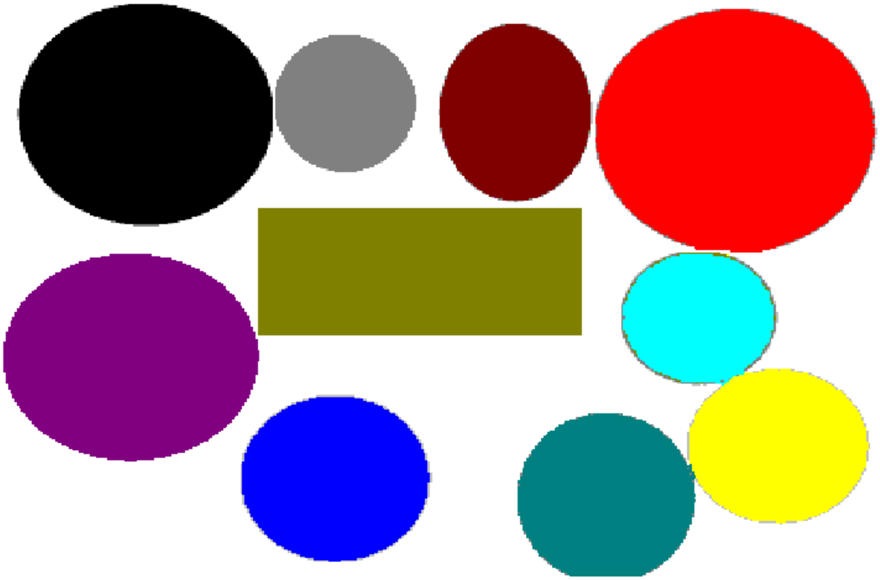


Figure 5-6. The drum kit mask image

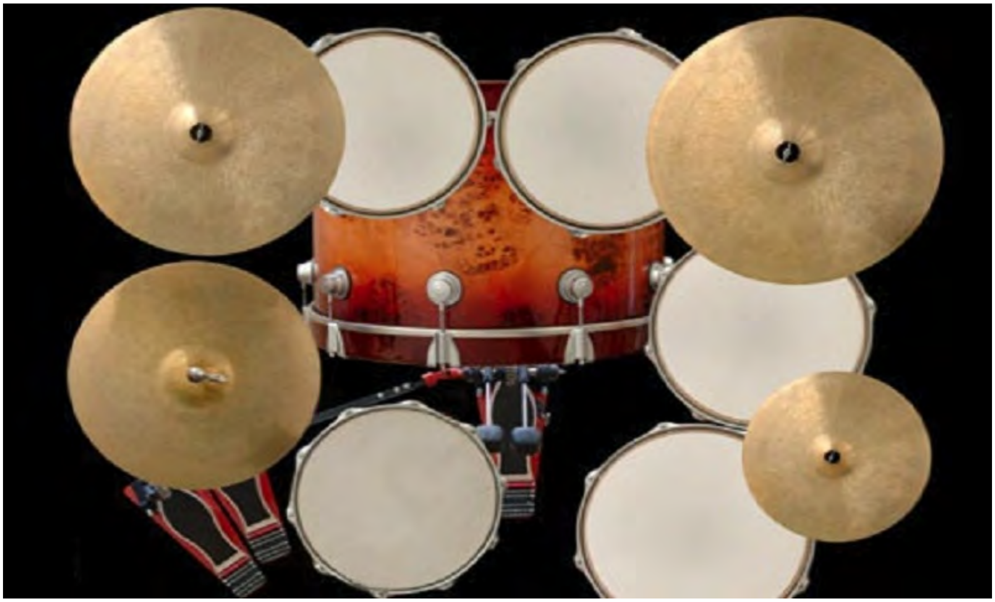


Figure 5-7. The drum kit shown to the user

When the user taps the snare, the code retrieves the pixel with blue color and plays the snare sound (see Recipe 7-3 to read more on playing sound).

■ **Note** To produce the mask image, we used the Paint.NET free drawing tool (you can download it from www.getpaint.net). You load the main image in the tool and add a new layer. You start to draw over the sensitive picture zones, giving each a different color. You remove the layer (the background, in this case) where you set the original image, remaining with the mask. Finally, you have to save the mask image in either a 16- or 256-color bitmap format so that oixels use solid colors.

The Code

To demonstrate this technique, we have added the virtual drumming functionality to the 7Drum application. Open the 7Drum project and add a Windows Phone Landscape Page called VirtualDrum.xaml. Create an images folder with the original image and the related mask image. Select the Content value from the Build Action property in the Property window. In this way, images will be added to the final XAP file as distinct files and not inserted as resources. This is done so that in the Image control, you can set the Source attribute to the image's relative path.

```
<phone:PhoneApplicationPage
    x:Class="_7Drum.VirtualDrum"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" d:DesignWidth="800" d:DesignHeight="480"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="Landscape" Orientation="Landscape"
    shell:SystemTray.IsVisible="False">

    <Image x:Name="imgDrum" Source="images/Drum_Kit_480x800.jpg" Width="800" Height="480" />

</phone:PhoneApplicationPage>
```

In the VirtualDrum.xaml.cs file, you use the constructor code to load the mask image and add the FrameReported event handler:

```
        // Constructor
        public VirtualDrum()
        {
            InitializeComponent();

            bmpMask = new BitmapImage(new Uri("images/mask_480x800.png", UriKind.Relative));
            bmpMask.CreateOptions = BitmapCreateOptions.None;

. . .

            Touch.FrameReported += new TouchFrameEventHandler(Touch_FrameReported);
        }
```

In the Touch_FrameReported event handler, the GetTouchPoints method is used to retrieve the collection of touched points within the TouchPointCollection object. Next, a foreach loop goes through the retrieved collection, checking only those points having Action set to the TouchAction.Down enumerable value. This is necessary because the TouchPointCollection contains points for every kind of operation such as drag, pinch, and so on.

The position of the tapped screen is passed to the PickTappedColor private method, which returns the Color object of the pixel. A LINQ query is used to retrieve the drum-kit component associated to the picked color, and the related sound is played.

```
        void Touch_FrameReported(object sender, TouchFrameEventArgs e)
        {
            TouchPointCollection tpc = e.GetTouchPoints(this);

            foreach (TouchPoint t in tpc)
            {
                if (t.Action == TouchAction.Down)
                {
                    System.Windows.Media.Color pickedColor = PickTappedColor(t.Position.X,
                                                                             t.Position.Y);

DrumKitComponent component = (from d in drum
                              where d.maskColor == pickedColor
                              select d).SingleOrDefault<DrumKitComponent>();

                    if (component != null)
                    {
                       // Play sound
                    }
                }
            }
        }
```

Let’s take a look at the PickTappedColor method in detail. An object from the WriteableBitmap class is created from the bitmap mask stored in memory. The WriteableBitmap contains the Pixels array but—surprise—it is not a two-dimensional one, so we cannot use x and y as array indexes. We need a simple math formula to transform x and y coordinates into one dimensional index. The formula is the y coordinate by the sum of the x coordinate with the bitmap width dimension.

After having retrieved the pixel, we can return the related Color by using the FromArgb static method provided by the Color class.

```
private System.Windows.Media.Color PickTappedColor(double X, double Y)
{
    wbmp = new WriteableBitmap(bmpMask);
    int pixel = (int)Y * (int)wbmp.PixelWidth + (int)X;
    int i = wbmp.Pixels[pixel];
    System.Windows.Media.Color color = System.Windows.Media.Color.FromArgb(255,
                                  (byte)((i >> 16) & 0xFF),
                                  (byte)((i >> 8) & 0xFF),
                                  (byte)(i & 0xFF));

    return color;
}
```

Usage

This may be one of the most fun ”Usage” sections of the entire book. We can make a lot of noise with a virtual drum! From Visual Studio 2010, press Ctrl+F5 and wait a few moments until the emulator starts (check that Windows Phone Emulator is the current output target).

From the main menu, choose Take Your Groove. The drum kit appears, as shown in Figure 5-8.

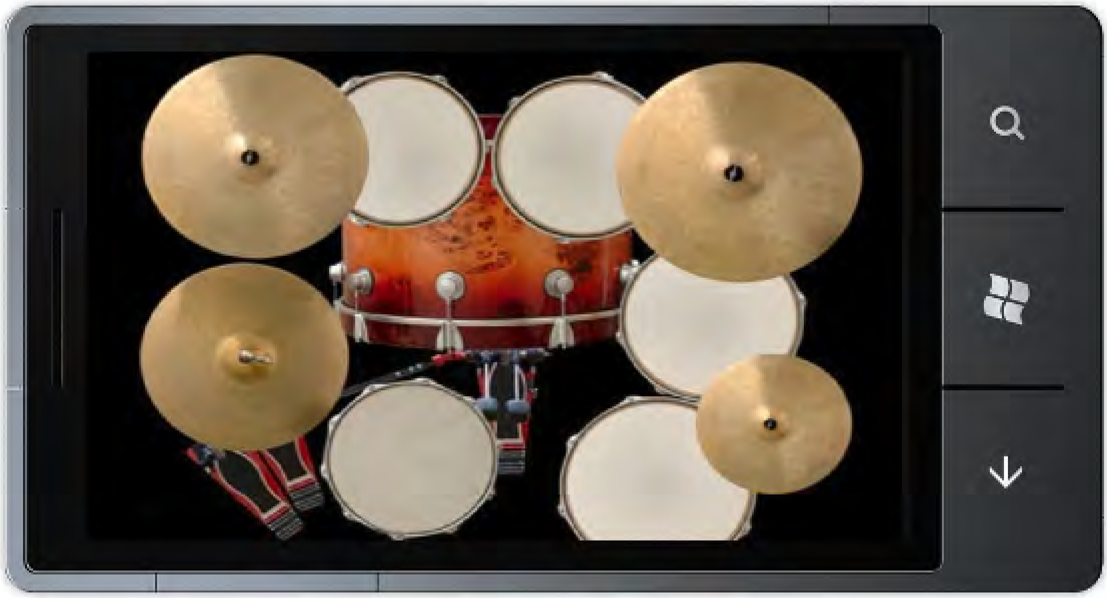


Figure 5-8. The virtual drum in action

Now you can tap on one or more drum components to hear the related sound.

5-4. Managing Gestures from the Silverlight for Windows Phone 7 Toolkit

Problem

You need to implement drag-and-drop in your Silverlight Windows Phone 7 application.

Solution

You have different options here, including using the gestures and techniques explained in the previous recipes. However, this time we suggest another solution to accomplish drag-and-drop or other gestures management: GestureListener, provided by the Silverlight for Windows Phone 7 toolkit.

How It Works

As you saw in Chapter 3, you can download the Silverlight for Windows Phone 7 toolkit from CodePlex at http://silverlight.codeplex.com. This toolkit provides the GestureService class, which exposes the GestureListener property. You can use this property to specify the gesture you want to manage in your application. Indeed, GestureListener provides a public event for each gesture supported by the phone, plus two more events indicating when the gesture begins and when the gesture is completed.

The Code

To demonstrate the drag-and-drop function in a Silverlight Windows Phone application, we have created the GesturesWithToolkit project. You are going to create an application in which a rectangle can be dragged around the screen. When the drag is completed, the code checks whether the rectangle has been dropped over another rectangle.

Create a new Visual Studio 2010 Silverlight Windows Phone application called GesturesWithToolkit. Add a reference to the Microsoft.Phone.Controls.Toolkit assembly. You should find it in the %Program%\ \Microsoft SDKs\Windows Phone\v7.0\Toolkit\Nov10\Bin directory.

In MainPage.xaml, you have to add a new namespace declaration to use the toolkit.

```
<phone:PhoneApplicationPage
    x:Class="GesturesWithToolkit.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    xmlns:toolkit="clr-
namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone.Controls.Toolkit"
. . .
```

Then you have to add the GestureService tag between the tags of the control used to manage the gestures. For example, we added those tags to the Rectangle control defined inside Canvas. The GestureListener tag enables us to define which gestures can be managed by our application specifying which is the related event handler. We have specified to retrieve DragStarted, DragDelta, and DragComplete events.

The two rectangles are placed into a Canvas control at fixed positions. The dragable rectangle has the ZIndex property greater than the other rectangle, so it will not disappear under the dragged rectangle when they overlap.

```
. . .
<!--ContentPanel - place additional content here-->
        <Canvas x:Name="ContentPanel" Margin="12,0,12,0">
            <Rectangle Fill="Red" x:Name="rSource" Width="100" Height="100" Grid.Row="0"
                       Canvas.Left="0" Canvas.Top="160" Canvas.ZIndex="1">
                <toolkit:GestureService.GestureListener>
                    <toolkit:GestureListener DragStarted="GestureListener_DragStarted"
                              DragDelta="GestureListener_DragDelta"
                              DragCompleted="GestureListener_DragCompleted" />
                </toolkit:GestureService.GestureListener>
            </Rectangle>
            <Rectangle Fill="Yellow" x:Name="rTarget" Height="100" Width="460"
                       Canvas.Left="0" Canvas.Top="660" Canvas.ZIndex="0" />
        </Canvas>
. . .
```

In the MainPage.xaml.cs file, we implemented the code to respond to the gesture events. In the GestureListener_DragStarted event handler, we simply inform the application that a drag operation has started. This is informs the other event handlers to accomplish their operation only when a drag is started. Despite the name, the CaptureMouse method is used to capture the tap on the control that uses it. So, the controls will receive tap and drag information whether or not the user's finger is in control's borders.

The GestureListener_DragDelta event handler is used to paint the rectangle to the newer coordinates. Those are calculated by adding the actual Left and Top rectangle positions in the Canvas to the VerticalChange and HorizontalChange values provided by the DragDeltaGestureEventArgs parameter.

```
        private void GestureListener_DragStarted(object sender,
                                                  DragStartedGestureEventArgs e)
        {
            Rectangle rect = sender as Rectangle;
            _isDrag = true;
            rect.CaptureMouse();
        }

        private void GestureListener_DragDelta(object sender, DragDeltaGestureEventArgs e)
        {
            if (_isDrag)
            {
                Rectangle rect = sender as Rectangle;
                rect.SetValue(Canvas.TopProperty,
                       (double)rect.GetValue(Canvas.TopProperty) + e.VerticalChange);
                rect.SetValue(Canvas.LeftProperty,
                       (double)rect.GetValue(Canvas.LeftProperty) + e.HorizontalChange);
            }
        }
```

Finally, in the GestureListener_DragCompleted event handler, we inform the application that the drag operation has ended. Moreover, we check whether the two rectangles have collided by calling the CollisionDetected method. If the rectangles have collided, we will show a MessageBox message informing the user that a collision between rectangles has been detected.

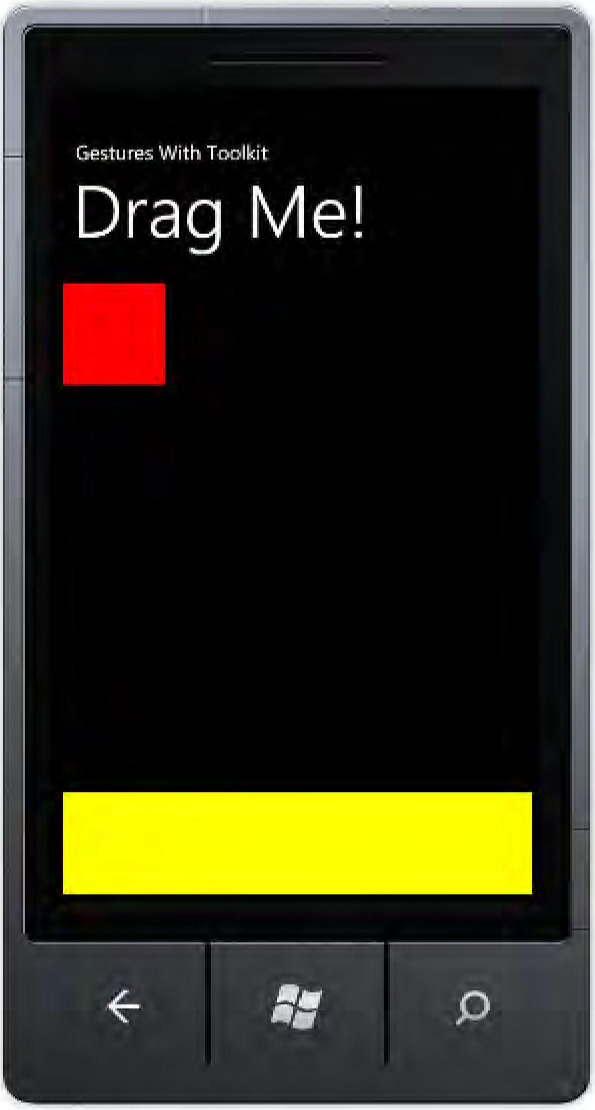
```
    private void GestureListener_DragCompleted(object sender,
                                               DragCompletedGestureEventArgs e)
    {
        Rectangle rect = sender as Rectangle;
        _isDrag = false;
        rect.ReleaseMouseCapture();

        if (CollisionDetected())
            MessageBox.Show("Collision detected!");
    }
```

The CollisionDetected method simply checks the vertical position of the rectangle adding to the position the rectangle's height. If this value is equal to or greater than the vertical position of the destination rectangle, then a collision is detected and the method returns a Boolean true value.

```
    private bool CollisionDetected()
    {
        double rSourcePos = rSource.Height +
                           (double)rSource.GetValue(Canvas.TopProperty);
        if (rSourcePos >= 660)
            return true;
        else
            return false;
    }
```

Usage

From Visual Studio 2010, press Ctrl+F5 and wait for the emulator to start. The application shown in Figure 5-9 displays.

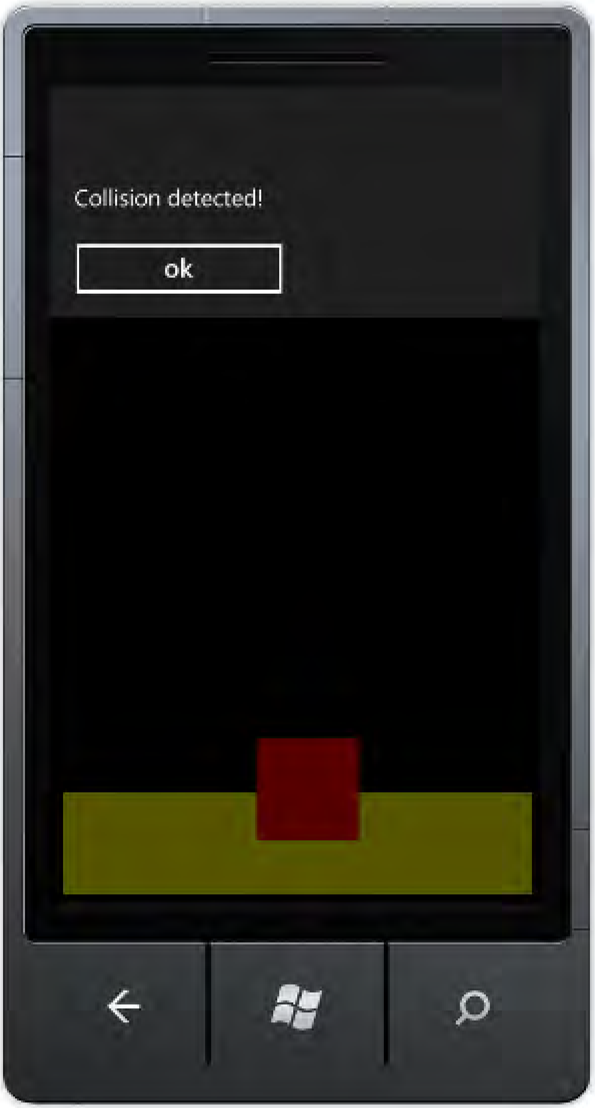


Gestures With Toolkit

Drag Me!

Figure 5-9. *The* `GestureWithToolkit` *application shows the red rectangle ready to be dragged over the yellow one.*

Now you can press and hold the left mouse button and start to move it around the screen emulator. When you drop the red rectangle over the yellow one, you will see a message appear onscreen, as shown in Figure 5-10.



Collision detected!

Figure 5-10. *The collision between the red and yellow rectangle has been detected.*

CHAPTER 6

Sensors

This chapter covers the use of sensors on Windows Phone 7. The base requirements for manufacturers are the accelerometer, compass, proximity sensor, light, and A-GPS. In this version of the SDK, from your code, you can have access only to the accelerometer and A-GPS. But don't worry—even with these two things, you can create high-impact applications for the user.

An accelerometer measures acceleration forces (for example, gravity or movement). The accelerometer API is built on top of the sensor framework (so when we will have access to the other sensors exposed by the API, we will use them all at the same way . The accelerometer data are exposed by the `AccelerometerReadingEventArgs` class, which exposes three properties for the x-, y-, and z-axis that assume values between –2 and 2 (the sign of value is used to interpret the direction of the vector of force).

The A-GPS is part of the Location Service, nwhich enables us to obtain the position of the phone on the planet. To find the position, the device can use GPS, Wi-Fi, and cellular radio, each of them with a different level (decreasing) of precision, balanced by the phone according to the state of battery and precision required by the application.

The recipes in this chapter describe how to do the following:

- 6-1. Resetting a form by shaking the phone
- 6-2. Create a seismograph
- 6-3. Indicate the user's position on a map
- 6-4. Display the time of sunrise and sunset
- 6-5. Indicate the user's position with coordinates
- 6-6. Use the radio

6-1. Resetting a form by shaking the phone!

For this first recipe, we chose to create a cool user interaction, in order to provide a better user experience (UX). When the device is shaken, we want all the text in the text boxes to be erased. As you know, people are fascinated by features that make a device's functionality more interesting. In this example, you will use a data form, but you could take this code and put it, for example, in a Sudoku game. In that case, creating a new schema when shaking the phone would be simple and requires only a change of the algorithm inside the method that resets the text boxes.

Problem

You need to detect the shaking of the device along the x axis.

Solution

You must use the Accelerometer class, subscribe to the event ReadingChanged, and manage the phone's movements.

How It Works

An accelerometer is an instrument capable of detecting and/or measuring acceleration. The accelerometer of Windows Phone 7 is accessible thanks to the Accelerometer class, which simply exposes methods to begin (Start) and end (Stop) the use of the accelerometer, and the event that will notify you that the values read from the device have changed. A fundamental thing to be taken into consideration is the scale of values that can be reported by the instrument along the x-, y-, and z-axis, which have a lower limit of –2 and an upper limit of 2.

The Code

It's useless to tell you one more time how to create a new project at this point in the book, and so we'll start directly with the code that interests us, then start creating a new Silverlight application for Windows Phone.

For the user interface (UI), you will have only a set of four text boxes that contain information for Name, Surname, Street, and City:

```
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0" Grid.RowSpan="6">
  <Grid.RowDefinitions>
    <RowDefinition Height="80"/>
    <RowDefinition Height="80" />
    <RowDefinition Height="80" />
    <RowDefinition Height="80" />
    <RowDefinition Height="80" />
    <RowDefinition Height="*" />
  </Grid.RowDefinitions>
  <TextBox Name="NameTextBox" Text="TextBlock" />
  <TextBox Name="SurnameTextBox" Text="TextBlock" Grid.Row="1" />
  <TextBox Name="StreetTextBox" Text="TextBlock" Grid.Row="2" />
  <TextBox Name="CityTextBox" Text="TextBlock" Grid.Row="3" />
  <TextBlock Text="Shake to reset" Grid.Row="4" VerticalAlignment="Center"
                                                    HorizontalAlignment="Center"/>
</Grid>
```

The first class that you must know about is Accelerometer, which allows you to access the functionality that you need. It's important to say how the movements are interpreted by the device. Assuming that you have your Windows Phone in your hand in portrait position, the movement along the x-axis is considered positive if you move the phone to the right (and negative if you move the phone to the left). Movement along the y-axis is relative to moving the phone up (in a positive direction) and down (in a negative direction). Movement along the z-axis occurs when you move the phone toward you (positive) and away from you (negative).

■ **Note** The `Accelerometer` class (which gives you access to accelerometer functionality) is contained in the namespace `Microsoft.Device.Sensors`. and to use it you must add a reference to the `Microsoft.Device.Sensors` assembly.

As you can see from the class diagram shown in Figure 6-1, there is an event to be subscribed to (`ReadingChanged`). This event is triggered every time the reference values of the accelerometer change (and based on the accelerometer's high degree of accuracy, those values will change often).

At the class level, you need to declare these members:

```
...
Accelerometer accelerometer = null;

//represents the time of the first significant movement
DateTimeOffset movementMoment = new DateTimeOffset();

double firstShakeStep = 0; //represents the value of the first significant movement
...
```

You will see soon why you need these two members.

Next you will write a private method named initAccelerometer that you will call just after `InitializeComponents` in the page constructor. This method will be responsible for initializing all you need for the accelerometer, such as the subscription to the `ReadingChanged` event.

```
...
private void initAccelerometer()
{
        accelerometer = new Accelerometer();
        accelerometer.ReadingChanged += new
EventHandler<AccelerometerReadingEventArgs>(Accelerometer_ReadingChanged);
        accelerometer.Start(); //this can be done in a button_click
}
...
```

The preceding code is self-explanatory, but note that with the last line you actually started the use of the accelerometer. But let's show in detail what you will do with this accelerometer, by using the event handler:

```
void Accelerometer_ReadingChanged(object sender, AccelerometerReadingEventArgs e)
{
        //put here the code to detect a shake
}
```

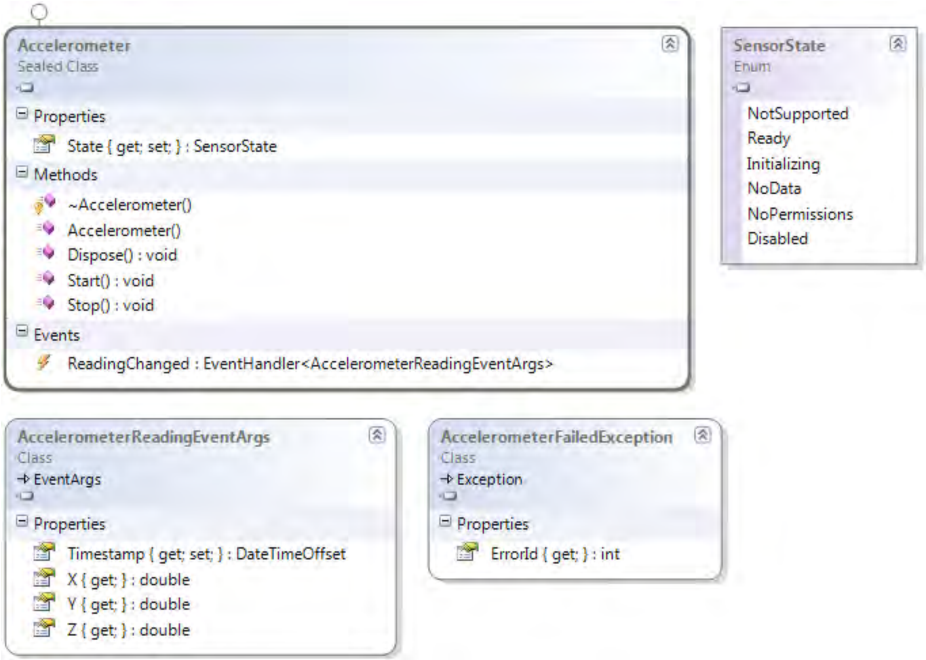


Figure 6-1. Diagram of classes used by the accelerometer

Assuming that by *shake* we mean a fast movement, large enough along the x-axis, the code that allows us to identify a movement of this type makes use of a precise timestamp, in order to access the actual position (relative to the starting point) of the phone at all times.

This code is as follows:

```
...
void Accelerometer_ReadingChanged(object sender, AccelerometerReadingEventArgs e)
{
  //if the movement takes less than 500 milliseconds
  if (e.Timestamp.Subtract(movementMoment).Duration().TotalMilliseconds <= 500)
  {
    if ((e.X <= -1 || e.X >= 1) && (firstShakeStep <= Math.Abs(e.X)))
      firstShakeStep = e.X;

    if (firstShakeStep != 0)
    {
      firstShakeStep = 0;
      Deployment.Current.Dispatcher.BeginInvoke(() => ResetTextBox());
     }
  }
  movementMoment = e.Timestamp;
}
...
```

All this code is based on a mathematical calculation to determine the magnitude of movement along the x-axis (you can test it moving the phone along the y- and z-axis). But why do you need to write `Deployment.Current.Dispatcher.BeginInvoke(() => ResetTextBox())`? It's simple:

- `() => ResetTextBox()` represents a delegate to the `ResetTextBox` method.
- `Deployment.Current.Dispatcher.BeginInvoke` is used to execute `Action` on the same thread of the UI. If you try to call a method that works on UI elements without this methodology, you will receive an "Invalid cross-thread access" error.

Finally, you must implement the `ResetTextBox` method:

```
...
private void ResetTextBox()
{
    this.NameTextBox.Text = "";
    this.SurnameTextBox.Text = "";
    this.StreetTextBox.Text = "";
    this.CityTextBox.Text = "";
}
...
```

There is something important to note about this code: With this code, you started to use the accelerometer, but you never stopped it. That means you will be using this sensor for the entire time that your application is working. This is a bad practice because the application will consume too much battery power. It is becoming increasingly important to offer the best user experience possible. If the user thinks that the application requires an excessive use of resources, that user might simply delete it.

Usage

In this recipe, you need a physical device to test the application. Indeed, you cannot use the emulator to test the accelerometer.

Connect your unlocked device (see Recipe 1-6 for more information on how to unlock devices) and run the application from Visual Studio 2010. Make sure that the target output is set to Windows Phone 7 Device. Write something in the text boxes, shake the phone, and then check that your form has been erased.

6-2. Creating a Seismograph

Problem

You want to create a seismograph, by merging into a single project the use of Microsoft XNA drawing capabilities with the sensitivity of the accelerometer (The accelerometer has a limited range, from –2 to +2 on the scale of values on the 3 axis but have a high precision of floating-point numbers beyond the point.)

Solution

You need to use the accelerometer capabilities in association with the XNA framework.

How It Works

The use of the accelerometer in our applications is a standard now. Users require greater interaction with devices. Think of these devices as trendy consoles on which users want more control and participation; they are no longer the old Commodore 64 joysticks. Shakes and finger gestures are just some of the interactions that users want, in order to feel at the heart of what they are doing. Therefore it is time to adapt our applications to keep in sync with the times and provide a richer user experience. Okay, it's time to get serious. In this example, you will learn how to access and use the accelerometer in your games, to provide user interaction. By following the concepts used in these recipes, you can make high-interaction games, for a better experience for your gamers. So that we don't lose too much time in explaining what games you can create and how, you can use your own ideas. So enough with the talk. Let's start to write code.

The Code

This section does not explain the basics for working with XNA, because doing so would require another entire book. Instead, it explains what you need to do in order to read the oscillations of the phone and to turn those oscillations into a line on the screen. Obviously, that read data can be applied to every other aspect of any other application that you want to write.

So let's go! As a first step, add a new SpriteFont in the project of the contents (automatically created by project template), which with his default content must be good enough)

```
<XnaContent xmlns:Graphics="Microsoft.Xna.Framework.Content.Pipeline.Graphics">
  <Asset Type="Graphics:FontDescription">

    <!--
    Modify this string to change the font that will be imported.
    -->
    <FontName>Segoe UI Mono</FontName>

    <!--
    Size is a float value, measured in points. Modify this value to change
    the size of the font.
    -->
    <Size>14</Size>

    <!--
    Spacing is a float value, measured in pixels. Modify this value to change
    the amount of spacing in between characters.
    -->
    <Spacing>0</Spacing>

    <!--
    UseKerning controls the layout of the font. If this value is true, kerning
    Information will be used when placing characters.
    -->
    <UseKerning>true</UseKerning>

    <!--
    Style controls the style of the font. Valid entries are "Regular", "Bold", "Italic",
    and "Bold, Italic", and are case sensitive.
    -->
    <Style>Regular</Style>

<!--
CharacterRegions control what letters are available in the font. Every character from Start
to End will be built and made available for drawing. The default range is from 32, (ASCII
space), to 126, ('~'), covering the basic Latin character set. The characters are ordered
according to the Unicode standard.
-->
    <CharacterRegions>
      <CharacterRegion>
        <Start>&#32;</Start>
        <End>&#126;</End>
      </CharacterRegion>
    </CharacterRegions>
  </Asset>
</XnaContent>
```

After creating this font, the other content you need is a 1×1 pixel image that will be the texture of your line. At this point, there is nothing in the design of Contents, so go to the heart of the action, to the code in the .cs file of our game.

First of all, remember to resolve Microsoft.Devices.Sensors, and then add (always at the class level) a member of type Accelerometer that will be the data provider. This time you have an available method that is called Initialize, which is the ideal place to do all your initializations:

```
...
accelerometer = new Accelerometer();
accelerometer.ReadingChanged += new
EventHandler<AccelerometerReadingEventArgs>(accelerometer_ReadingChanged);
accelerometer.Start();
...
```

In the event handler, the first thing you do is calculate the magnitude of oscillation, increasing by 100 the scale because, as you remember, the accelerometer is extremely sensitive but assumes values from –2 to +2 for each axis, that compared to the screen resolution are little thing:

```
...
void accelerometer_ReadingChanged(object sender, AccelerometerReadingEventArgs e)
{
  double magnitude = Math.Sqrt(Math.Pow(e.X, 2) + Math.Pow(e.Y, 2) + Math.Pow(e.Z, 2))* 100;
}
...
```

But what you do with this magnitude after it is calculated? Well, it's clear! It will be the value of reference for your swing. But before using it to draw, you need to take a few preliminary steps. First, at the class level, define some members as follows:

```
...
        VertexBuffer vertexBuffer = null;
        Texture2D pointTexture = null;
        List<VertexPositionColor> vertices = null;
        SpriteFont font = null;

        double actualX;
        double actualY;
        double actualZ;
        float maxMagnitude = 0;
        float yPosition = 240;
...
```

The most important members that we need to talk are:

- yPosition that represents the offset relative to the y-axis of the graph. (Otherwise, you would have a chart that stays too high on the screen.)
- vertexBuffer is your “summits” buffer, where you will load the vertices to be drawn.
- vertices is the vertex list that you'll draw. (Keep in mind that you could use an array for greater consistency with the methods used, but we are more comfortable working with a list and then converting the array when necessary.)
- pointTexture and font are part of the topics that are not covered in this chapter in detail. You need to know only that the class will be used to load the texture (created earlier in Contents project) and to load the preceding fonts.

The other fields, we would dare call them *diagnostic*, and you need them to see the onscreen information about the status of the accelerometer as you go forward in the execution.
Next, with all these elements set to null, something in the initialization method must be changed, as follows:

```
...
vertexBuffer = new VertexBuffer(graphics.GraphicsDevice,
                                typeof(VertexPositionColor),
                                1000,
                                BufferUsage.None);
vertices = new List<VertexPositionColor>();
...
```

There are still loads of fonts and textures. The best place for them is the LoadContent method:

```
...
pointTexture = this.Content.Load<Texture2D>("point");
font = this.Content.Load<SpriteFont>("SismoFont");
...
```

And the code of the event handler becomes somewhat more full-bodied:

```
...
void accelerometer_ReadingChanged(object sender, AccelerometerReadingEventArgs e)
{
 double magnitude = Math.Sqrt(Math.Pow(e.X, 2) + Math.Pow(e.Y, 2) + Math.Pow(e.Z, 2)) * 100;
 if (magnitude > maxMagnitude)
   maxMagnitude = (float)magnitude;

 VertexPositionColor vertex = new VertexPositionColor(new Vector3(0, yPosition +
       (float)magnitude,                                                  1), Color.White);
vertices.Add(vertex);

actualX = e.X;
actualY = e.Y;
actualZ = e.Z;

List<VertexPositionColor> newVertices = new List<VertexPositionColor>();
for (int i = 0; i < vertices.Count; i++)
{
   VertexPositionColor ver = vertices[i];
   ver.Position.X += 1;
   newVertices.Add(ver);
}
vertices = newVertices;

if (vertices.Count > 799)
   vertices.RemoveAt(0);
}
...
```

Step by step, what you do is as follows:

1. Calculate as before the magnitude of the vibration.
2. Check if it is greater than the event occurred, and if, you keep it in the variable.
3. Create a new vertex with x = 0, and y = magnitude + (your offset).
4. Set the fields with the values of the disclosures made by the accelerometer.
5. Create a list of the same type of summits, where items pouring of the original list, increasing with every elements of the value on the x-axis and by allocating (and replaces) the original list .
6. With the last, you ensure that you will never have more vertices needed to show the information onscreen (in this case, we are not at all interested in having a history of what happened).

So far you have calculated the position of the various summits, and this means that now the vertices are ready to be drawn. As you know, XNA is based on two methods (`Update` and `Draw`) that are invoked cyclically, about 30 times per second. In the `Update` method, you will prepare the data in the buffer to be draw, while `Draw` will concretely do work of show vertexes on video:

```
protected override void Update(GameTime gameTime)
{
  // Allows the game to exit
  if (GamePad.GetState(PlayerIndex.One).Buttons.Back == ButtonState.Pressed)
    this.Exit();

  //force reading accelerometer data
  //accelerometer_ReadingChanged(null, null);
  if (vertices.Count > 0 && vertices.Count < 800)
    vertexBuffer.SetData<VertexPositionColor>(vertices.ToArray()); ;
  base.Update(gameTime);
}
```

This is not complicated to understand, you are setting data in `vertexBuffer` taking them from the `vertices` collection. While things get complicated (but short) in the `Draw` method:

```
protected override void Draw(GameTime gameTime)
{
  GraphicsDevice.Clear(Color.Black);
  spriteBatch.Begin();
  if (vertices.Count > 1)
  {
    for (int i = 0; i < vertices.Count - 1; i++)
    {
      VertexPositionColor v1 = vertices[i];
      VertexPositionColor v2 = vertices[i + 1];
      drawLine(
        new Vector2(v1.Position.X, v2.Position.X),
        new Vector2(v1.Position.Y, v2.Position.Y), v1.Color);

     }
     spriteBatch.DrawString(font, string.Format("Count: {0}",vertices.Count),
                            new Vector2(20, 20), Color.Red);

     spriteBatch.DrawString(font, string.Format("X:{0}", actualX), new Vector2(20, 40),
                            Color.PeachPuff);

     spriteBatch.DrawString(font, string.Format("Y:{0}", actualY), new Vector2(20, 60),
                            Color.PeachPuff);

     spriteBatch.DrawString(font, string.Format("Z:{0}", actualZ), new Vector2(20, 80),
                            Color.PeachPuff);

     spriteBatch.DrawString(font, string.Format("MaxMagnitude:{0}", maxMagnitude),
                            new Vector2(20, 100), Color.PeachPuff);
      }

      spriteBatch.End();
      base.Draw(gameTime);
}
```

Again, step by step, here is what you do in this method:

1. Clean the old screen.
2. Draw the operations.
3. If you have more than one vertex, scroll the array of vertices, passing every vertice as a parameter to the `drawLine` method, the coordinates of the current point and of the point immediately after. (That's the reason why you do this if you have more than one vertex.)
4. Show on video, thanks to the `DrawString` method, displaying the information that you have found for diagnostic purposes.
5. Close the batch data preparation and paint everything.

```
As you can see we call a method named drawLine, that the code is below
void drawLine(Vector2 v1, Vector2 v2, Color color)
{
        float lenght = Vector2.Distance(v1, v2);
              spriteBatch.Draw(pointTexture,
                         new Rectangle((int)v1.X,
                         (int)v2.X, 1, 1), color);
}
```

The `drawLine` method does nothing more than create many small rectangles (1×1 pixels) at a position identified by the vectors that constitute your line.

Usage

From Visual Studio 2010, press Ctrl+F5 and wait for the application to be deployed and starts on your device . Put the phone on your table.Begin to simulate an earthquake by hitting the table (be careful: don’t hit too hard. you might get hurt).

6-3. Indicating the User’s Position?

Problem

You want an application (or game) that gives information about the area where your user is located. (For a game, you could choose to let the user play in the city where the user is located, against other players around there.)

Solution

To solve this problem, you’ll use a control that uses Bing Maps tailored for WP7. , but much more important of how you will show data, is how you will get them, thanks to the `GeoCoordinateWatcher` class contained in the namespace `System.Device.Location`.

How It Works

The GeoCoordinateWatcher class provides location data based on coordinates of latitude and longitude. Like other sensors, the cycle is defined by the Start method (which enables you to access to the Position property and enable the PositionChanged event) and Stop (which prevents GeoCoordinateWatcher from providing events and data on the position).

The Code

As you can see in Figure 6-2, the constructor has an overload that enables you to specify the degree of accuracy that you want in determining the user's location (the property DesiredAccuracy is read-only). If you set the accuracy to High, you will have a more precise location of the user, but this requires more resources that will easily discharge the battery. Therefore, use this setting only if needed, because you don't want to risk the user rejecting your application because it is too resource-intensive.

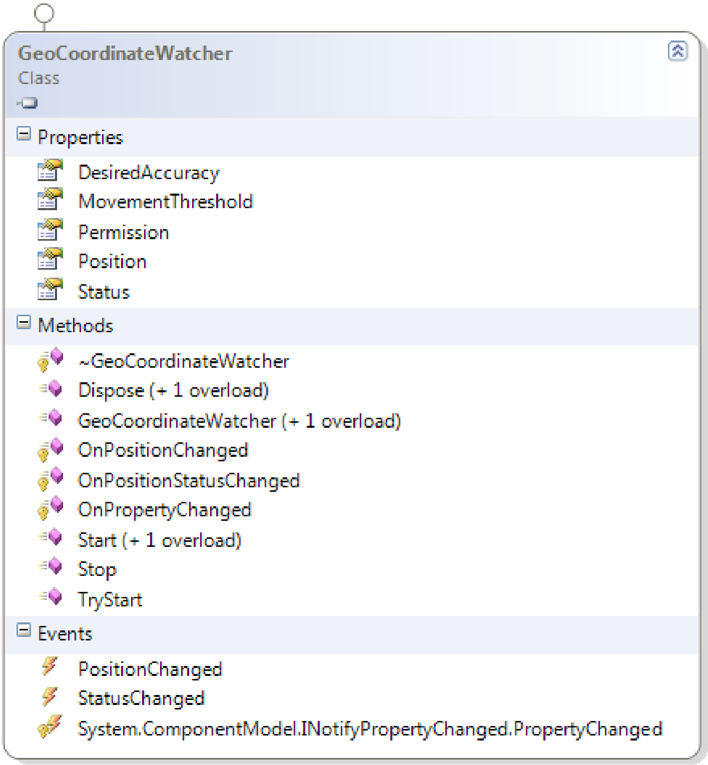


Figure 6-2. Class diagram of ***GeoCoordinateWatcher***

There are two important events that you must take into consideration:

- PositionChanged
- StatusChanged

...

Then we start to see the private method that initialize the GeoCoordinateWatcher and subscribes the two events with our handlers

```
private void InitWatcher()
{
  geoWatcher = new GeoCoordinateWatcher(GeoPositionAccuracy.High);
  geoWatcher.PositionChanged += new
       EventHandler<GeoPositionChangedEventArgs<GeoCoordinate>>(geoWatcher_PositionChanged);

  geoWatcher.StatusChanged += new
       EventHandler<GeoPositionStatusChangedEventArgs>(geoWatcher_StatusChanged);
}
...
```

The respective handler is as follows:

```
...
void geoWatcher_StatusChanged(object sender, GeoPositionStatusChangedEventArgs e)
{
   //Handle here the change of status
}

void geoWatcher_PositionChanged(object sender, GeoPositionChangedEventArgs<GeoCoordinate> e)
{
   //Handle here the change of position
}
...
```

Let us explain the purpose of these thow event-handlers:

- geoWatcher_StatusChanged takes care of notifying that the status of GeoCoordinateWatcher has changed.
- geoWatcher_PositionChanged is the most important. The event handler is called when the PositionChanged event occurs, and communicates via GeoCoordinate the new location.

The GeoCoordinate class has several interesting fields that provide important information as you can see in figure 6-3, such as altitude, latitude, and longitude (identifying the position) that will be set to NAN until the Watcher status will not become ready. Another interesting property is the speed (which would be useful if you wanted to create a navigation system).

All you need to do to resolve your problem quickly is to write this code:

```
...
void geoWatcher_PositionChanged(object sender, GeoPositionChangedEventArgs<GeoCoordinate> e)
{
   //BingMap is the Map control provided for the scope
   //14d is the level of zoom, this is good enough to have
   bingMap.SetView(e.Position.Location,14d);
}
```

It's really too simple, we know. Microsoft loves to allow developers to create applications as quickly as possible and has therefore integrated into its operating system some base components to help developers focus on creating other aspects of their applications. Of course we think it's important that you know that the use of Bing Maps implies that you are registered on Bing Maps service portal.

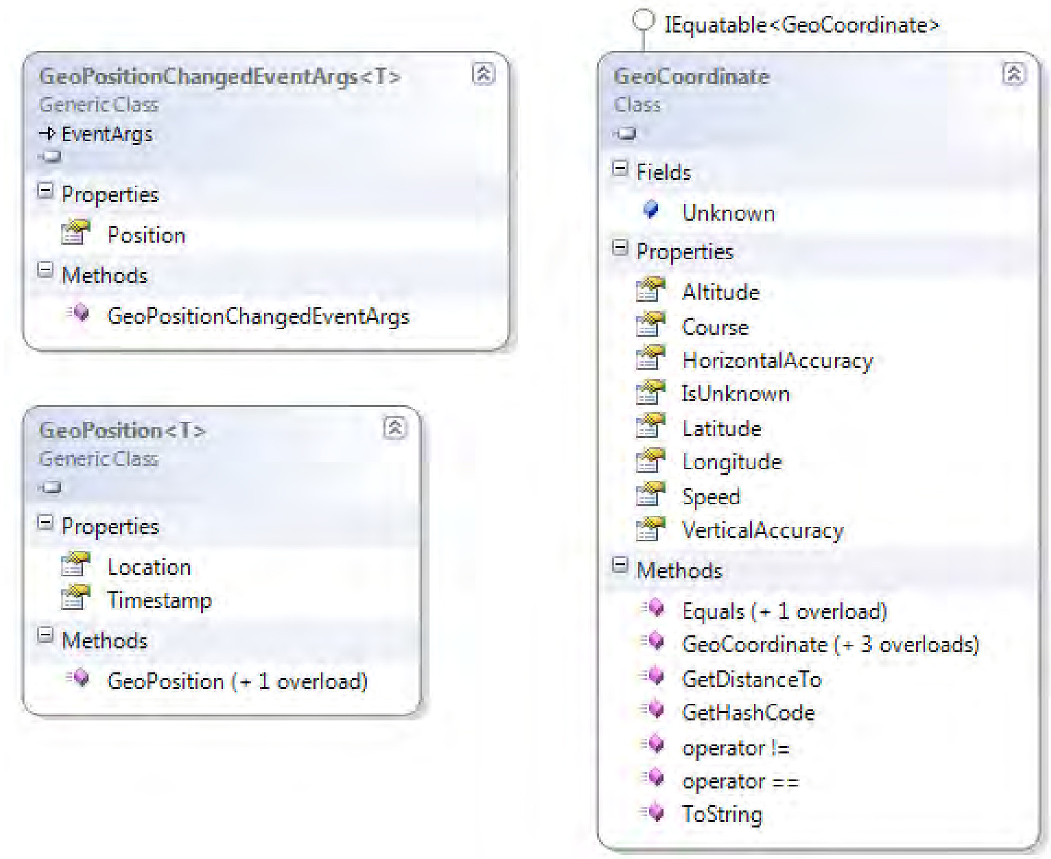


Figure 6-3. *Classes used to handle* ***GeoCoordinate***

What if you don't want to use Bing Maps to show the user's position on a map? You can use Microsoft Research Maps (available at `http://msrmaps.com/default.aspx`). In this chapter, you will not see how to interact with this service (look for that information in Chapter 9). Instead, your focus will be directed to the data, both at how to get it from Location Services, and at how to use it to find the user's exact spot.

After you add a reference to the service available from `http://msrmaps.com/TerraService2.asmx` (we will explain the configuration later), you can begin to look at the code.

The structure of the UI will look like this:

```
<Grid x:Name="LayoutRoot" Background="Transparent">
    <Grid.RowDefinitions>
        <RowDefinition Height="Auto"/>
        <RowDefinition Height="*"/>
    </Grid.RowDefinitions>

    <!--TitlePanel contains the name of the application and page title-->
    <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
        <StackPanel Orientation="Horizontal">
            <TextBlock Text="Location Service"
                       Style="{StaticResource PhoneTextNormalStyle}"/>
            <TextBlock x:Name="LocationStatusTextBox" Text="..."
                       Style="{StaticResource PhoneTextNormalStyle}"/>
        </StackPanel>
    </StackPanel>

    <!--ContentPanel - place additional content here-->
    <Grid x:Name="ContentPanel" Grid.Row="1" >

    </Grid>
</Grid>
```

There's something obviously strange in this interface at first glance. The `Grid ContentPanel` is empty, but only because inside the code you will create a kind of mosaic. In the code-behind, you will need a series of `using` statements:

```
...
using System.Device.Location;
using System.Windows.Media.Imaging;
using System.IO;
...
```

You will also need a private method that enables you to initialize the various services. In addition, you will need a proxy (and this will be the name of the object that we will use to interact with service but we will not see here the use of web services) for `TerraService` and a `GeoCoordinateWatcher`:

```
TerraService proxy = null;
GeoCoordinateWatcher geoWatcher = null;

// Constructor
public MainPage()
{
  InitializeComponent();
  InizializeServices();
  Loaded += new RoutedEventHandler(MainPage_Loaded);
}

private void InizializeServices()
{
  proxy = new TerraService();
  geoWatcher = new GeoCoordinateWatcher();
}
```

In the event that fires when the page has finished loading, you will write the code to subscribe to events that are raised at the completion of an asynchronous request. This is because the service always works asynchronously, so you don't stop the UI too long while you wait for a response, and then your code will be notified that a request has been answered. This mode of operation is not new to anyone who has already worked with Silverlight on the web side. Once again, this makes us appreciate how easy it is for developers to recycle their skills between technologies based on the .NET technologies stack.

```
void MainPage_Loaded(object sender, RoutedEventArgs e)
{
...
//Subscribe here webservice events
...
geoWatcher.PositionChanged += new
EventHandler<GeoPositionChangedEventArgs<GeoCoordinate>>(geoWatcher_PositionChanged);

geoWatcher.StatusChanged += new
EventHandler<GeoPositionStatusChangedEventArgs>(geoWatcher_StatusChanged);
//Start the geoWatcher
       geoWatcher.Start();
}
```

When the StatusChanged event of GeoCoordinateWatcher fires, you will change the text of the text box destined for this use, so you can have onscreen feedback that the location service is effectively launched and operational:

```
void geoWatcher_StatusChanged(object sender, GeoPositionStatusChangedEventArgs e)
{
this.LocationStatusTextBox.Text = e.Status.ToString();
}
```

The workflow of your application is as follows:

- firing the event geoWatcher_PositionChanged will make a request by calling the method GetAreaFromPt in the proxy,
- whether successful or unsuccessful, will fire proxy_GetAreaFromPtCompleted event,
- which in the case of a correct answer will call the GetTile method of the proxy, with the consequent trigger of the event proxy _ GetTileCompleted.

Then we start from the first step, implementing geoWatcher_PositionChanged

```
void geoWatcher_PositionChanged(object sender,
                                GeoPositionChangedEventArgs<GeoCoordinate> e)
{
        if (!e.Position.Location.IsUnknown)
        {
                proxy.GetAreaFromPt (
                    //the ActualPosition
                    new TerraService.LonLatPt()
                    {
                        Lat = e.Position.Location.Latitude,
                        Lon = e.Position.Location.Longitude
                    },
                    //the type of map
                    1,
                    //the scale of image received
                    TerraService.Scale.Scale2km,
                    (int)ContentPanel.ActualWidth,
                    (int)ContentPanel.ActualHeight);
        }
}
```

The purpose of this recipe was to show you how the Location Service, based on a universal standard for localization, enables you to access (without too much trouble) information about the device's position in the world.

Usage

From Visual Studio 2010, press Ctrl+F5. Wait for the application to start on the phone and then wait that the position is available then look that the position on the map changes relating your actual position.

6-4. Displaying Sunset and Sunrise

Problem

Your aim is to obtain an application that is able to tell the user what time the sun will rise and set today in the user's location.

Solution

There are several ways to find out the time of sunrise and sunset (for example, through web services, libraries, and complex calculations). This recipe shows how to access and use a certain property in order to explore the potential of Location Services. There are several ways to calculate the times from latitude and longitude values, and we will let you choose which best suits your needs.

How It Works

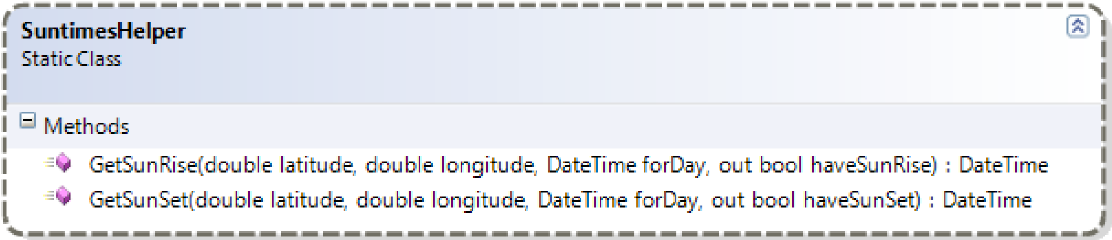
You will use information about the user's position, obtained from the device, to calculate the time of sunrise and sunset, simulating with a helper class the behavior of a service to calculate them

The Code

To start writing code for this recipe we need two members field:

```
GeoCoordinateWatcher geo = new GeoCoordinateWatcher();
SuntimesHelper ssc = new SuntimesHelper();
```

`SuntimesHelper` is a class written by us, whose code is based on algorithms that are easily available on the Internet. This class exposes two methods, called `GetSunRise` and `GetSunSet`, as you can see in Figure 6-4.



SuntimesHelper
Static Class

Methods
GetSunRise(double latitude, double longitude, DateTime forDay, out bool haveSunRise) : DateTime
GetSunSet(double latitude, double longitude, DateTime forDay, out bool haveSunSet) : DateTime

Figure 6-4. Class diagram of `SuntimesHelper`

```
void geo_PositionChanged(object sender, GeoPositionChangedEventArgs<GeoCoordinate> e)
{
            if (!e.Position.Location.IsUnknown)
            {
                bool isSunrise = false;
                bool isSunset = false;

                DateTime sunrise = SuntimesHelper.GetSunRise(e.Position.Location.Latitude,
e.Position.Location.Longitude, DateTime.Now, out isSunrise);
DateTime sunset = SuntimesHelper.GetSunSet(e.Position.Location.Latitude,
e.Position.Location.Longitude, DateTime.Now, out isSunset);
geo.Stop()
           }
}
```

It is important when working with the position to point out that the applications used for localizing consume battery power. Although we may sound repetitive, it is important to provide the best possible user interaction in our applications. Therefore, remember to stop the use of `GeoCoordinateWatcher` when you don't need it anymore.

Usage

From Visual Studio 2010, deploy the application to a physical device and watch it calculating sunrise and sunset from your position.

6-5. Indicating the User's Position via Coordinates

Problem

At application startup, you want to localize by position of the phone to see where in the world is and what is the relative address.

Solution

The solution to this problem is very simple if you use classes available in Windows Phone 7. However, the official solution is unusable at this time, because `CivicAddressResolver` was scheduled to be included in Silverlight for Windows Phone, and using `CivicAddressResolver` you can disclose to obtain a `CivicAddress` by using the geo-coordinates. This method has not yet been implemented.

However, in this section, we will show you what to do, so when the method is implemented, you will be ready to integrate features that can use it. Meanwhile, we will show you an alternative implementation of this service.

How It Works

As in the previous recipe, retrieving the user's position on the map based on geo-coordinates will be simple. You will use certain classes in the namespace associated with the civic `System.Device.Location` to retrieve coordinates that we are providing.

The Code

As you can see in Figure 6-5, the `CivicAddressResolver` class implements the `ICivicAddressResolver` interface. Therefore, even if the service is not implemented yet, you might think the realization of our resolver, rather than wait for subsequent implementations, just as you will do shortly. But let's proceed step by step.

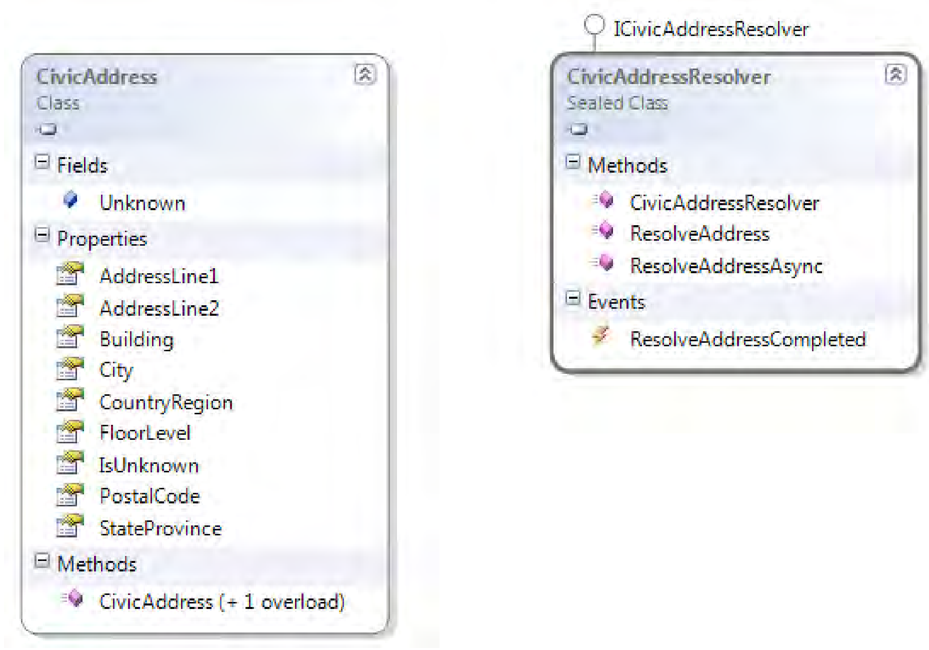


***Figure 6-5.** Class diagram for `CivicAddressResolver` and its respective data class*

First, declare at the class level these two members:

```
GeoCoordinateWatcher geoWatcher = null;
ICivicAddressResolver civicResolver = null;
```

Next, create two private void methods dedicated to initialize the preceding members:

- `InitWatcher()`
- `InitResolver()`

The names that we choosen is self-explaining, says us all that you will do in their implementation, that you can see below

```
private void InitResolver()
{
  //for now we will use the default implementation
  civicResolver = new CivicAddressResolver();
  civicResolver.ResolveAddressCompleted += new
     EventHandler<ResolveAddressCompletedEventArgs>(civicResolver_ResolveAddressCompleted);
}
```

```
private void InitWatcher()
{
  geoWatcher = new GeoCoordinateWatcher(GeoPositionAccuracy.High);
  geoWatcher.PositionChanged += new
     EventHandler<GeoPositionChangedEventArgs<GeoCoordinate>>(geoWatcher_PositionChanged);
  geoWatcher.StatusChanged += new
     EventHandler<GeoPositionStatusChangedEventArgs>(geoWatcher_StatusChanged);
        geoWatcher.Start();
}
```

The use of `InitWatcher` is clear, because you have seen it in previous recipes. `InitResolver` indicates that the class `CivicAddressResolver` will make a call to some external service, and will raise the `OnResolveAddressCompleted` event when it has finished finding the information you need.

```
void geoWatcher_PositionChanged(object sender,
                               GeoPositionChangedEventArgs<GeoCoordinate> e)
{
   var civic = civicResolver.ResolveAddress(e.Position.Location);
}

void civicResolver_ResolveAddressCompleted(object sender,
                                           ResolveAddressCompletedEventArgs e)
{
  //do something with resolved address
  //here you can see the properties that you can access
  //e.Address.AddressLine1
  //e.Address.AddressLine2
  //e.Address.Building
  //e.Address.City
  //e.Address.CountryRegion
  //e.Address.FloorLevel
  //e.Address.PostalCode
  //e.Address.StateProvince
}
```

This is all you need to do to use `CivicAddressResolver`. It's simple to use this class, but is also useless because behind of this class there is no implementation. Therefore, we have given you a way to implement a service similar to what Microsoft has planned, but "homemade."

You will need to use a Bing Maps service from `http://msdn.microsoft.com/en-us/library/cc966738.aspx` and then add a service reference to the Geocode Service (if you don't know how to do that, look at Chapter 9).

First, add a new class to your project and call it `CustomCivicResolver`:

```
public class CustomAddressResolver : ICivicAddressResolver
{
  public CivicAddress ResolveAddress(GeoCoordinate coordinate)
  {
    //…
  }
  public void ResolveAddressAsync(GeoCoordinate coordinate)
  {
    //…
  }

  public event EventHandler<ResolveAddressCompletedEventArgs> ResolveAddressCompleted;
  {
   ...
  }
```

You will implement only ResolveAddressAsync, simply because you are using Silverlight for Windows phone and so are not interested in the synchronous pattern.

You declare at the global class level the proxy for the service:

```
         GeocodeService.GeocodeServiceClient proxy = null;
```

And you must write the constructor of the class, where you will instantiate the proxy and subscribe to the event OnReverseGeocodeCompleted:

```
public CustomAddressResolver()
{
  proxy = new GeocodeService.GeocodeServiceClient("BasicHttpBinding_IGeocodeService");
  proxy.ReverseGeocodeCompleted += new
                     EventHandler<GeocodeService.ReverseGeocodeCompletedEventArgs>(
                                                       proxy_ReverseGeocodeCompleted);
}
```

Then it's time to prepare your request to the service (and prepare your service to respond to the request that will come from the outside):

```
public void ResolveAddressAsync(GeoCoordinate coordinate)
{
  proxy.ReverseGeocodeAsync(
  new GeocodeService.ReverseGeocodeRequest()
    {
      Location = new Microsoft.Phone.Controls.Maps.Platform.Location()
      {
        Latitude = coordinate.Latitude,
        Longitude = coordinate.Longitude,
        Altitude = coordinate.Altitude
      },
      Credentials = new Microsoft.Phone.Controls.Maps.Credentials()
      {
         ApplicationId = "Put you app key here"
      });
  }
```

The only row of this code that must be commented is the creation of a credential for the service. You must get an API key for your application from http://msdn.microsoft.com/en-us/library/cc966738.aspx. Without this key, you will never have a response from the service. So remember to do this before you carry on.

```
void proxy_ReverseGeocodeCompleted(object sender,
                                   GeocodeService.ReverseGeocodeCompletedEventArgs e)
{
  ResolveAddressCompleted(
    sender,
    new ResolveAddressCompletedEventArgs(
      new CivicAddress()
      {
        AddressLine1 = e.Result.Results[0].Address.AddressLine,
        AddressLine2 = e.Result.Results[0].Address.FormattedAddress,
        Building = "",
        City = e.Result.Results[0].Address.Locality,
        CountryRegion = e.Result.Results[0].Address.CountryRegion,
        FloorLevel = "0",
        PostalCode = e.Result.Results[0].Address.PostalCode,
        StateProvince = e.Result.Results[0].Address.PostalTown
      },
      e.Error,
      e.Cancelled,
      e.UserState));
}
```

When the `ReverseGeocodeCompleted` fires, you also fire the event `ResolveAddressCompleted`, member of the `ICivicAddressResolver` interface, that will be triggered by who uses this class.

As you can see, you can't add some information in `CivicAddress`, such as `Building` and `FloorLevel`, but if you aren't writing an application to track the position of a courier, we think you can do well without this information (and it is still better than not having the ability to retrieve information).

Usage

From Visual Studio 2010, start the application. Wait for your position to become available and then look for retrieved addresses while you move around the globe. Remember, in order to use Position in your application, you must activate it in the settings or you will never have correct information to work from.

6-6. Using the Radio

Problem

You want to create a complete FMRadio application that is different from the standard radio included in the Windows Phone Music hub.

Solution

You must use the `FMRadio` class included in Windows Phone 7 to access radio functionalities. In just a few steps, you can have a complete radio that you can tune into various stations.

How It Works

The Microsoft.Devices.Radio namespace contains the class FMRadio, which implements the singleton pattern. In this way, there is only one point of access to the radio API . To tune the radio, you must change the frequency property of FMRadio.Instance, and if you want to implement a seek functionality, you must check for Signal Strength (also known as a Received Signal Strength Indicator or RSSI).

The Code

Create a project for Windows Phone by using Visual Studio and call it Enhanced Radio. After the template is created, add a folder named Images to the solution. As you can imagine, in this folder you will add some pictures to create the user interface. In this case, you have the four pictures shown in Figure 6-6. After this preliminary operation, you will need to add a reference to the Windows Phone Toolkit assembly, to use the ToggleSwitch control.

Figure 6-6. Our images

At the top of your application, inside TitlePanel you need two columns. In the first column will be a toggle button that starts and stops the radio (of course, if the radio is already started, the toggle must be selected). In the second column is a slider that represents the signal strength indicator.

To create this user interface, you will use the following XAML:

```
<Grid x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
  <Grid.ColumnDefinitions>
    <ColumnDefinition Width="250" />
    <ColumnDefinition Width="*" />
  /Grid.ColumnDefinitions>
  <Slider Grid.Column="1" x:Name="SignalSlider" Foreground="{StaticResource
                                                   PhoneAccentBrush}" Maximum="1" />

  <toolkit:ToggleSwitch x:Name="RadioSwitch" Header="Radio status"
                                                                 Margin="1,1,0,-1"/>
</Grid>
```

After creating the header, you will add a TextBlock to show the frequency and four buttons to add seek an single-step frequency change:

```
<StackPanel x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
  <TextBlock Text="**.*" Style="{StaticResource FrequencyTextBlockStyle}"
                                              Name="FrequencyTextBlock" />
  <StackPanel x:Name=”ButtonsStackPanel” Orientation="Horizontal"
                                     HorizontalAlignment="Center">
    <Button HorizontalAlignment="Right" Height="86" Width="106" Name="FastBackwardButton"
                                                      Click="FastBackwardButton_Click">
      <Image Source="Images/FastBackward.png" />
    </Button>
    <Button HorizontalAlignment="Right" Height="86" Width="106" Name="BackwardButton"
                                                   Click="BackwardButton_Click">
      <Image Source="Images/Backward.png" />
    </Button>
    <Button HorizontalAlignment="Right" Height="86" Width="106" Name="ForwardButton"
                                                     Click="ForwardButton_Click">
      <Image Source="Images/Forward.png" />
    </Button>
    <Button HorizontalAlignment="Right" Height="86" Width="106" Name="FastForwardButton"
                                                     Click="FastForwardButton_Click">
      <Image Source="Images/FastForward.png" />
    </Button>
  </StackPanel>
</StackPanel>
```

As you can see, you are creating image buttons by using the process you learned in Chapter 4. . The only thing to explain in this XAML is the use of the style for the FrequencyTextBlock (another thing that you can see in Chapter 4). That is composed by the following XAML

```
<Style x:Key="FrequencyTextBlockStyle" TargetType="TextBlock">
  <Setter Property="FontSize" Value="56"/>
  <Setter Property="FontFamily" Value="Meiryo UI"/>
  <Setter Property="VerticalAlignment" Value="Center"/>
  <Setter Property="HorizontalAlignment" Value="Center"/>
</Style>
```

Now, after you have created the interface, you can concentrate on the code-behind, the place where you interact with the FMRadio API.

First, declare at the class level six constants that will be the top limit and bottom limit of frequency ranges available in Europe, the United States, and Japan:

```
    private const double minFrequencyEurope = 87.6;
    private const double maxFrequencyEurope = 107.7;

    private const double minFrequencyUnitedStates = 87.8;
    private const double maxFrequencyUnitedStates = 108;

    private const double minFrequencyJapan = 76;
    private const double maxFrequencyJapan = 90;
```

After this, you need the instance of the radio:

```
    FMRadio radio = FMRadio.Instance;
```

Because the radio could need up to 3 seconds to start, it is not convenient to launch it in the constructor. Other than that, we prefer to start the application as soon as possible, again to give control to the user.

```
        public MainPage()
        {
            InitializeComponent();
            this.Loaded += new RoutedEventHandler(MainPage_Loaded);
        }
```

And inside the `MainPage_Loaded` event handler, you will start your application:

```
        void MainPage_Loaded(object sender, RoutedEventArgs e)
        {
            RadioSwitch.Checked += new
EventHandler<RoutedEventArgs>(RadioSwitch_CheckChanged);
            RadioSwitch.Unchecked += new
EventHandler<RoutedEventArgs>(RadioSwitch_CheckChanged);
        }
```

At this point, you need something that will update the interface and at same time checks what is the current state of radio instance, then declare at class level a `Timer` from `System.Threading` namespace to do action at given time, and we initialize it inside `Loaded` event handler

```
        private Timer signalCheckTimer;
...
        signalCheckTimer = new Timer((o) =>
            {
                Deployment.Current.Dispatcher.BeginInvoke(() =>
                {
                    this.SignalSlider.Value = radio.SignalStrength;
                    this.FrequencyTextBlock.Text = radio.Frequency.ToString();
                    this.RadioSwitch.IsChecked = radio.PowerMode == RadioPowerMode.On;
                });
            }, null, 100, 100);
```

Now that you have updated the interface, looking for any changes to the state of the radio, you can begin creating the event handler for the controls. The first is the `ToggleSwitch`, which when touched by the user, turns the radio on and off.

```
        void RadioSwitch_CheckChanged(object sender, RoutedEventArgs e)
        {
            try
            {
                bool powerCheck = RadioSwitch.IsChecked.HasValue
                        ? RadioSwitch.IsChecked.Value
                        : false;
                radio.PowerMode = powerCheck
                    ? RadioPowerMode.On
                    : RadioPowerMode.Off;
            }
            catch (RadioDisabledException ex)
            {
                ManageRadioDisabledException(ex);
            }
        }
```

As you can see, you have introduced a method to manage what to do when the radio is not available. In this case, you show a message box. However, it is useful to do this, calling a method, because you will manage the exception that can come from all methods in only one point of your code

Given that you can change the actual frequency of the radio in several places, with different buttons, and you have to verify the correctness of any modification, we prefer to use a method to do it for everyone. And this is called `ManageFrequencyChange`:

```
private void ManageFrequencyChange(double delta)
        {
            try
            {
                double frequency = radio.Frequency;
                do
                {
                    frequency += delta;
                    switch (radio.CurrentRegion)
                    {
                        case RadioRegion.Europe:
                            if (frequency < minFrequencyEurope)
                                frequency = maxFrequencyEurope;
                            if (frequency > maxFrequencyEurope)
                                frequency = minFrequencyEurope;
                            break;
                        case RadioRegion.Japan:
                            if (frequency < minFrequencyJapan)
                                frequency = maxFrequencyJapan;
                            if (frequency > maxFrequencyJapan)
                                frequency = minFrequencyJapan;
                            break;
                        case RadioRegion.UnitedStates:
                            if (frequency < minFrequencyUnitedStates)
                                frequency = maxFrequencyUnitedStates;
                            if (frequency > maxFrequencyUnitedStates)
                                frequency = minFrequencyUnitedStates;

                            break;
                        default:
                          //Throw new ArgumentException();
                            break;
                    }

                } while (!IsFrequencyCorrect(frequency));
                radio.Frequency = Math.Round(frequency, 1);

            }
```

As you can see here, you have introduced a new method, which checks whether a frequency is correct for the radio region available.

```
private bool IsFrequencyCorrect(double frequency)
        {
            string separator =
CultureInfo.CurrentCulture.NumberFormat.NumberDecimalSeparator;
            bool isCorrect = false;
            string frequencyAsString = Math.Round(frequency, 1).ToString();
            switch (radio.CurrentRegion)
            {
                case RadioRegion.Europe:
                 isCorrect = frequencyAsString.EndsWith(string.Format("{0}1", separator)) ||
                 frequencyAsString.EndsWith(string.Format("{0}3", separator)) ||
                 frequencyAsString.EndsWith(string.Format("{0}5", separator)) ||
                 frequencyAsString.EndsWith(string.Format("{0}6", separator)) ||
                 frequencyAsString.EndsWith(string.Format("{0}8", separator)) ||
                 frequencyAsString.EndsWith(string.Format("{0}0", separator));
                    break;
                case RadioRegion.Japan:
                    //check here the correctness of frequency for this position
                    break;
                case RadioRegion.UnitedStates:
                    //check here the correctness of frequency for this position
                    break;
                default:
                    throw new ArgumentOutOfRangeException();
            }
            return isCorrect;
        }
```

The last thing to do at this point it to manage the buttons' click, and the seek for a strong frequency:

```
private void ForwardButton_Click(object sender, RoutedEventArgs e)
        {
            ManageFrequencyChange(0.1);
        }

        private void BackwardButton_Click(object sender, RoutedEventArgs e)
        {
            ManageFrequencyChange(-0.1);
        }

        private void FastBackwardButton_Click(object sender, RoutedEventArgs e)
        {
            try
            {
                do
                {
                    ManageFrequencyChange(-0.1);
                } while (radio.SignalStrength * 100 < 65);
            }
            catch (RadioDisabledException ex)
            {
                ManageRadioDisabledException(ex);
            }
        }

        private void FastForwardButton_Click(object sender, RoutedEventArgs e)
        {
            try
            {
                do
                {
                    ManageFrequencyChange(0.1);
                } while (radio.SignalStrength * 100 < 65);
            }
            catch (RadioDisabledException ex)
            {
                ManageRadioDisabledException(ex);
            }
        }
```

The seek functionality has now been implemented thanks to the `do…while` loop, which is stopped when the signal reaches at least 70 percent.

Usage

From Visual Studio, start the application by pressing F5. Start using the radio, changing the frequency, seeking a strong signal, and then trying to see how will change the signal strength if you move all around.

CHAPTER 7

Media Management

In this chapter, you will find recipes dedicated to media management. Indeed, audio and video are two of the best resources provided by your phone, and as a developer, there are so many cool tricks and tips you should know in order to produce both ear-catching and eye-catching applications.

- The recipes in this chapter describe how to do the following:7-1. Take a photo from your phone camera and upload it to the Flickr site
- 7-2. Pick a photo from your media library and upload it to the Flickr site
- 7-3 Use Windows Media Player to shuffle songs in your media library
- 7-4. Use the microphone in the Funny Repeater application
- 7-5. Use the `MediaElement` control to play both music and video
- 7-6. Add integration with the Music-Videos hub

7-1. Taking a Photo from Your Phone Camera

Problem

You need to take a photo from your application without pressing the hardware Camera button provided by the phone.

Solution

You have to use the `CameraCaptureTask` chooser, which provides the `Show` method used to programmatically show the same camera application that is executed by the hardware Camera phone button.

How It Works

As you learned in Chapter 3, choosers are used to run external native Windows Phone 7 applications or tasks. The main difference as compared to launchers is that choosers return data to your program. On the contrary, a chooser such as CameraCaptureTask opens the photo camera on the device and returns the photo taken from the camera to your application.

The CameraCaptureTask class provides the Show method, which is responsible for running the external application that enables you to take a picture from the camera and to set some options such as flash on/off, and zoom.

After the picture is taken, CameraCaptureTask raises the Completed event that your application can hook in order to have information on the photo. Indeed, the PhotoResult event argument provided by this event contains very important information about the photo such as the temporary path where it has been stored—the OriginalFileName property—and the stream containing the data of the phone—the ChosenPhoto property.

The Code

To demonstrate the use of the photo camera, we have created an application that enables us to take a picture and upload it to an account on the Flickr site. You have already seen part of this application in action in Chapter 3, Recipe 3-1, about animating a splash screen.

Open Visual Studio 2010 and load the FlickrPhotoAlbum application. In the MainPage.xaml.cs file, we defined a CameraCaptureTask object at the class level and we initialized it in the class constructor. The Completed event is managed by the camera_Completed event handler:

```
    public partial class MainPage : PhoneApplicationPage
    {
        CameraCaptureTask camera = null;
        Popup popup = null;

        // Constructor
        public MainPage()
        {
            InitializeComponent();

            camera = new CameraCaptureTask();
            camera.Completed += new EventHandler<PhotoResult>(camera_Completed);
. . .
```

The camera_Completed event handler contains the code that stores the image in a memory stream to be reused during the Flickr upload, and the code to show a preview by using the Image control defined in the MainPage.xaml file. Before performing any operation, the TaskResult property is checked to see whether the task has given a positive result returning OK. Next, the ChosenPhoto property containing the stream of picture data is copied to a byte array and, successively, to the memory stream. Finally, the OriginalFileName property is used by the BitmapImage class constructor to create a new image and set the Image control's Source property to it.

```
void camera_Completed(object sender, PhotoResult e)
{
    App app = Application.Current as App;

    if (e.TaskResult == TaskResult.OK)
    {
        byte[] data;
        using (var br = new BinaryReader(e.ChosenPhoto)) data =
               br.ReadBytes((int)e.ChosenPhoto.Length);
        app.settings.Image = new MemoryStream(data);

        imgPhoto.Source = new BitmapImage(new Uri(e.OriginalFileName));
        btnUpload.IsEnabled = true;
    }
}
```

■ **Note** In the preceding code, you can see the `App` class having the `settings` property. This property points to an object from the `Settings` class that we added to contain useful information to be shared with all the pages within the application.

In the `MainPage.xaml.cs` code file, there is a button to take the photo that is enabled after you have successfully logged on to the Flickr site and given authorization to the phone application. In the `Click` event of this button, we call the `Show` method provided by the `CameraCaptureTask` class so that the Camera application is shown:

```
private void btnTakePicture_Click(object sender, RoutedEventArgs e)
{
    camera.Show();
}
```

That's all about camera usage from the code; let's focus our attention on Flickr functionalities. We have used the Flickr.NET library that you can download from the `http://flickrnet.codeplex.com` site. This library contains a lot of assemblies targeting almost all .NET systems, including Windows Phone 7.

To use this library in your code, you need to register your application on the Flickr site and receive an application API key and a security key. Then in your code you have to use both keys in the Flickr class's constructor, as shown in the following code.

■ **Note** Because API and security keys are private, you will not find ours in the code. You have to register your application on Flickr and use yours in the Flickr class's constructor.

```
    public partial class App : Application
    {
        /// <summary>
        /// Provides easy access to the root frame of the Phone Application.
        /// </summary>
        /// <returns>The root frame of the Phone Application.</returns>
        public PhoneApplicationFrame RootFrame { get; private set; }

        private FlickrNet.Flickr _flickr;
        public FlickrNet.Flickr FlickrService { get { return _flickr;  } }

. . .

_flickr = new FlickrNet.Flickr("apiKey", "secureKey");
```

Because your application will be used by different users who want to upload photos on their accounts, the first thing you need to do in your code is to authenticate the user. This is accomplished adding a WebBrowser control to the MainPage.xaml page, to point to an URL calculated by the AuthCalcUrl method. This method accepts Frob as an input parameter; Frob is a sort of application identifier that we have to use in different API calls such as AuthCalcUrl ones. Frob is returned by a call to the AuthGetFrobAsync method. This is an async method that accepts a callback function as a parameter. We used a lambda expression in our code to create an inline callback function. Moreover, we used the BeginInvoke static method from the Dispatcher class so that the application is not stuck waiting for the Flickr API response and the user can continue to use it. The r parameter represents the result; we check whether there are errors by using the HasError property, and if there are no errors, we store the result in the Frob property from the Settings class. Finally, we call the AuthCalcUrl method to retrieve the calculated URL that we pass to the Navigate method provided by the WebBrowser control.

```
        private void ConnectToFlickr()
        {
            App a = Application.Current as App;

            Flickr flickr = a.FlickrService;

            flickr.AuthGetFrobAsync(r =>
            {
                Dispatcher.BeginInvoke(() =>
                {
                    if (r.HasError)
                    {
                        MessageBox.Show(r.Error.Message);
                    }
                    else
                    {
                        a.settings.Frob = r.Result;
                        string url = flickr.AuthCalcUrl(a.settings.Frob, AuthLevel.Write);
                        Uri uri = new Uri(url);
                        wbBrowser.Navigate(uri);
                    }
                });
            });
        }
```

The next step is retrieving the authentication token after the user is authenticated at the Flickr site. The AuthGetTokenAsync method accepts the Frob identifier and, like AuthGetFrobAsync, accepts a callback function that is called by this async method after the authorization process is finished. Even in this method we used a lambda expression as an inline callback function. If no errors occur, some buttons are enabled and the authorization token key is stored in the application settings.

```
    private void btnAuthenticate_Click(object sender, RoutedEventArgs e)
    {
        App app = Application.Current as App;

        app.FlickrService.AuthGetTokenAsync(app.settings.Frob, r =>
        {
            Dispatcher.BeginInvoke(() =>
            {
                if (r.HasError)
                {
                    MessageBox.Show(r.Error.Message);
                }
                else
                {
                    app.settings.Token = r.Result;
                    btnTakePicture.IsEnabled = true;
                    wbBrowser.Visibility = System.Windows.Visibility.Collapsed;
                    imgPhoto.Visibility = System.Windows.Visibility.Visible;
                }
            });
        });
    }
```

Finally, the photo uploading is accomplished by the UploadPictureAsync method. Among the many parameters it accepts, the ones worth noting are the first parameter (a Stream object containing the image data) and the third parameter (which is the name of the image that will be associated with the photo).

```
private void Button_Click(object sender, RoutedEventArgs e)
{

    if (txtName.Text == string.Empty)
    {
        MessageBox.Show("Please, specify the photo name");
        return;
    }

    App app = Application.Current as App;

    app.FlickrService.UploadPictureAsync(app.settings.Image,
                                    txtName.Text,
                                    txtName.Text,
                                    txtDescription.Text,
                                    txtTag.Text,
                                    true,
                                    true,
                                    true,
                                    ContentType.Photo,
                                    SafetyLevel.None,
                                    HiddenFromSearch.None, r =>
                                    {
                                        Dispatcher.BeginInvoke(() =>
                                        {
                                            if (r.HasError)
                                            {
                                                MessageBox.Show("Ooops,
                                                    error during upload...");
                                            }
                                            else
                                            {
                                                MessageBox.Show("Upload
                                                    done successfully...");
                                            }
                                        });
                                    });
}
```

Usage

With Visual Studio 2010 opened, set the target output to Windows Phone 7 Emulator and press Ctrl+F5. The emulator starts, briefly showing the animated splash screen. Meanwhile, the application is requiring the `Frob` identifier and uses it to calculate the URL. When this process is accomplished, the main page is shown with the `WebBrowser` control filled with the Flickr page (see Figure 7-1).

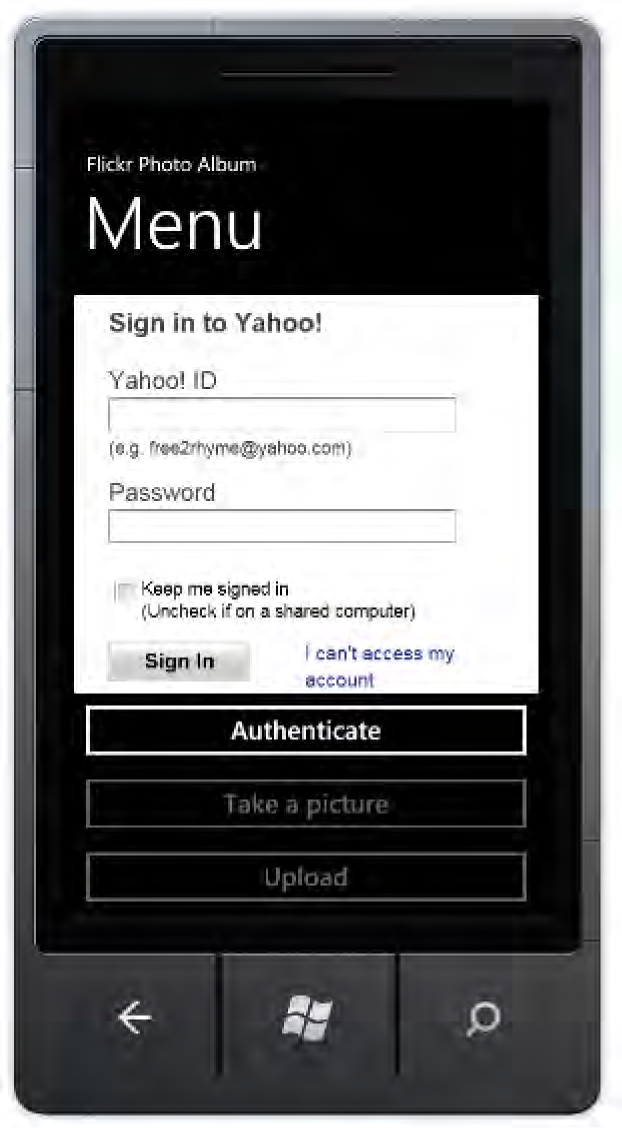


Figure 7-1. The `FlickrPhotoAlbum` *application in action*

After inserting your Flickr credentials and accepting that the `FlickrPhotoAlbum` application can access your account, you can press the Authenticate button. If the process doesn't return errors, the Take A Picture button will be enabled. Press this button and you will see the emulator simulating the Windows Phone Camera application (see Figure 7-2). The emulator will show a moving square, simulating a moving target. By pressing the top-right icon, you can take a photo shot.

■ **Note** If you are using the Windows Phone 7 device with Zune running and connected, you will not be able to accomplish this step, because Zune software locks the camera. You have to shut Zune down and use the WPConnect tool that you can find in the `%Program Files%\Microsoft SDKs\Windows Phone\v7.0\Tools\WPConnect` path. This tool is available only after having installed the Windows Phone Developer Tools January 2011 Update.

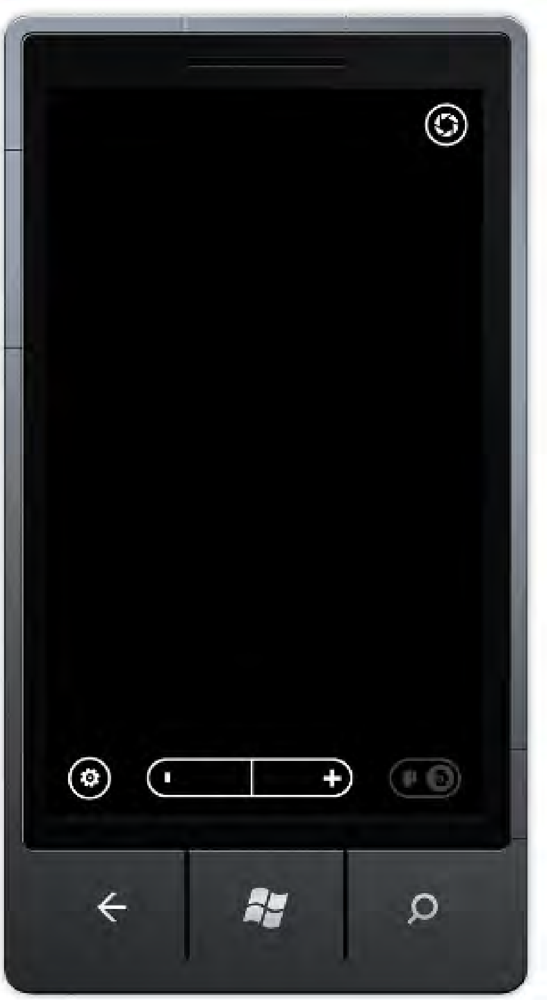
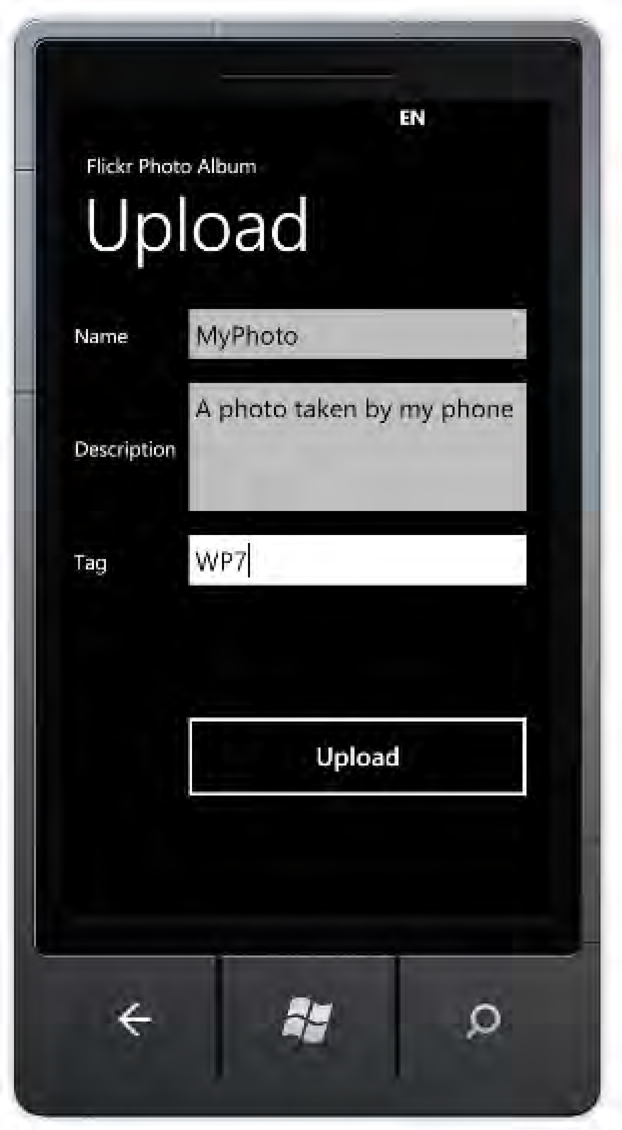


Figure 7-2. The camera emulated by the Windows Phone 7 Emulator

After taking the picture and accepting it, you can see that the Upload button is enabled. By pressing the Upload button, the Upload page is shown. Here you have to fill some text boxes with the picture's name, description, and tag (see Figure 7-3). Press the Upload button (maybe you can't see it because it is too small!) to start the upload process.


EN

Flickr Photo Album

Upload

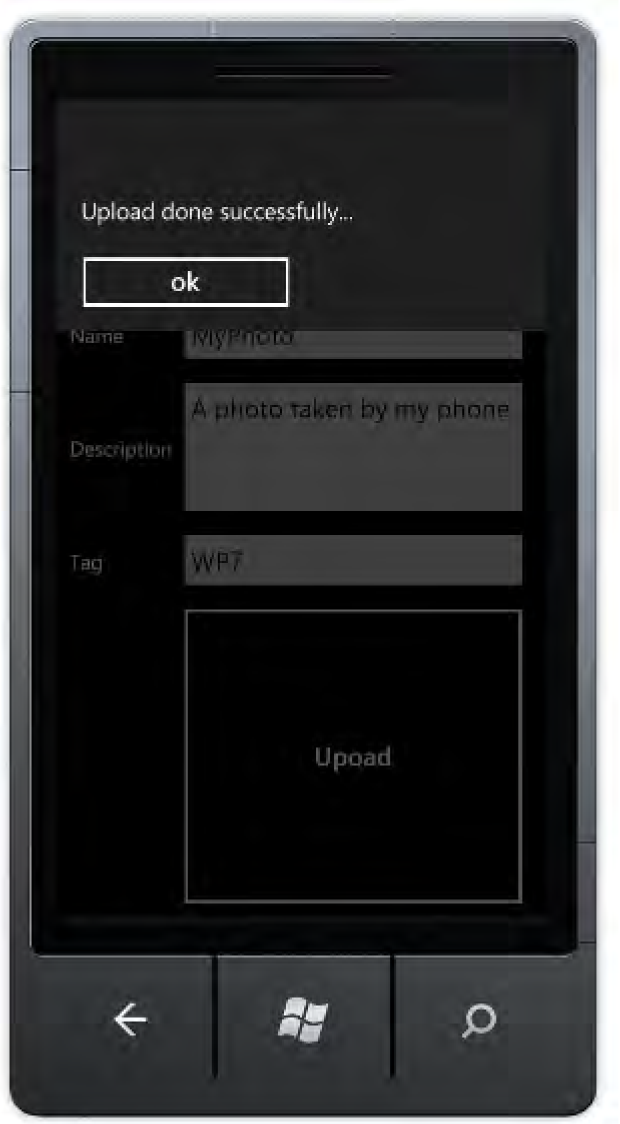
Name: MyPhoto

Description: A photo taken by my phone

Tag: WP7

Figure 7-3. *The Upload page contains text boxes used to specify the photo's name, description, and tag.*

Depending on your Internet connection speed and its traffic, after a few seconds you will be informed by a dialog box that the upload has been accomplished (see Figure 7-4).



Upload done successfully...

Name MyPhoto

Description A photo taken by my phone

Tag WP7

Figure 7-4. The upload is done.

7-2. Picking a Photo from Your Media Library

Problem

You need to pick a photo from your media library and upload it to the Flickr site.

Solution

You have to use the PhotoChooserTask chooser.

How It Works

The PhotoChooserTask chooser class provides the Show method, which shows the picture library and lets you to pick a photo from it. When the photo has been chosen, the Completed event is raised. This event provides a PhotoResult object as a parameter; by using its properties, you can retrieve the stream data composing the photo by using the ChosenPhoto property, obtain the path and filename of the image by using the OriginalFileName property, and the get the result of the photo-picking operation by using the TaskResult property.

The Code

To demonstrate this recipe, we have enhanced the application written in Recipe 7-1, the FlickrPhotoAlbum. We added the Load button to the MainPage.xaml code, specifying that we want to manage its Click event.

```
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
    <Grid>
        <Grid.RowDefinitions>
            <RowDefinition Height="*" />
            <RowDefinition Height="Auto" />
            <RowDefinition Height="Auto" />
            <RowDefinition Height="Auto" />
            <RowDefinition Height="Auto" />
        </Grid.RowDefinitions>
        <phone:WebBrowser x:Name="wbBrowser" Grid.Row="0"
         Navigated="wbBrowser_Navigated"/>
        <Image x:Name="imgPhoto" Grid.Row="0" Stretch="UniformToFill"
         Visibility="Collapsed" />
        <Button x:Name="btnAuthenticate" Grid.Row="1" Content="Autenthicate"
         Click="btnAuthenticate_Click" IsEnabled="False" />
        <Button x:Name="btnTakePicture" Grid.Row="2" Content="Take a picture"
         Click="btnTakePicture_Click" IsEnabled="False" />
        <Button x:Name="btnLoad" Grid.Row="3" Content="Load" Click="btnLoad_Click"
         IsEnabled="False" />
```

```
                <Button x:Name="btnUpload" Grid.Row="4" Content="Upload"
                 Click="btnUpload_Click" IsEnabled="False" />
            </Grid>
        </Grid>
```

In the MainPage.xaml.cs code file, a PhotoChooserTask object is defined at the class level and created in the MainPage constructor. Finally, the chooser_Completed event handler is defined in order to respond to the Completed event.

```
    public partial class MainPage : PhoneApplicationPage
    {
        CameraCaptureTask camera = null;
        Popup popup = null;
        PhotoChooserTask chooser = null;

        // Constructor
        public MainPage()
        {
            InitializeComponent();

            camera = new CameraCaptureTask();
            camera.Completed += new EventHandler<PhotoResult>(camera_Completed);

            popup = new Popup();
            popup.Child = new MySplashScreen();
            popup.IsOpen = true;

            chooser = new PhotoChooserTask();
            chooser.Completed += new EventHandler<PhotoResult>(chooser_Completed);
        }
. . .
```

In the chooser_Completed event handler, we call the private DoCompletedTask method. Because the code from Recipe 7-1 in the camera_Completed event handler is the same as that needed to load a photo from the media library, we have created DoCompletedTask, which accepts the PhotoResult argument, puts the image in a memory stream object, and shows a preview image.

```
        private void DoCompletedTask(PhotoResult e)
        {
            App app = Application.Current as App;

            if (e.TaskResult == TaskResult.OK)
            {
                byte[] data;
                using (var br =
            new BinaryReader(e.ChosenPhoto)) data = br.ReadBytes((int)e.ChosenPhoto.Length);
                app.settings.Image = new MemoryStream(data);

                imgPhoto.Source = new BitmapImage(new Uri(e.OriginalFileName));
                btnUpload.IsEnabled = true;
            }
        }
```

Finally, in the `btnLoad_Click` event handler, we call the `Show` method provided by the `PhotoChooserTask` class:

```
        private void btnLoad_Click(object sender, RoutedEventArgs e)
        {
            chooser.Show();
        }
```

Usage

The application usage is similar to Recipe 7-1. After having authenticated to the Flickr site and authorized our application to access the user's library, the Load button will be enabled.

Press the Load button, and the application will show the picture's library on your phone. In the emulator, you can access the library with some photos inside, as shown in Figure 7-5.

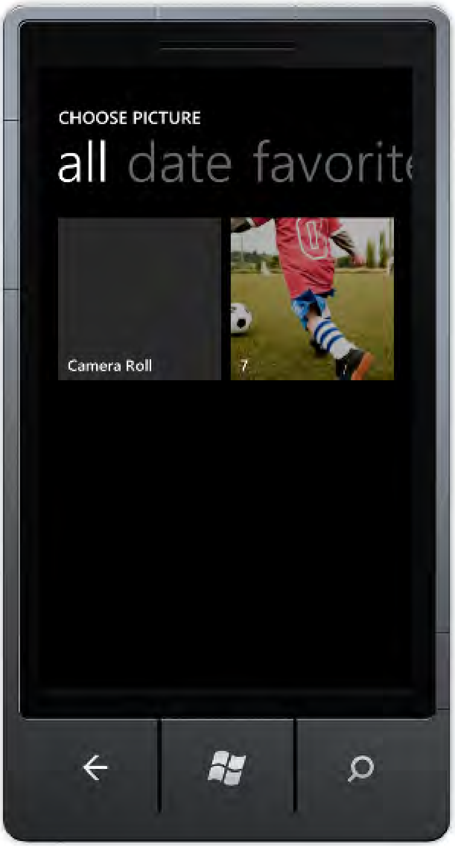


Figure 7-5. The picture library on the emulator

Now, select a picture of your choice, and you will see it in the FlickrPhotoAlbum application as a preview. The Upload button becomes enabled. Press the Upload button as you did in Recipe 7-1, and the picture loads into the Flickr site, as shown in Figure 7-6.

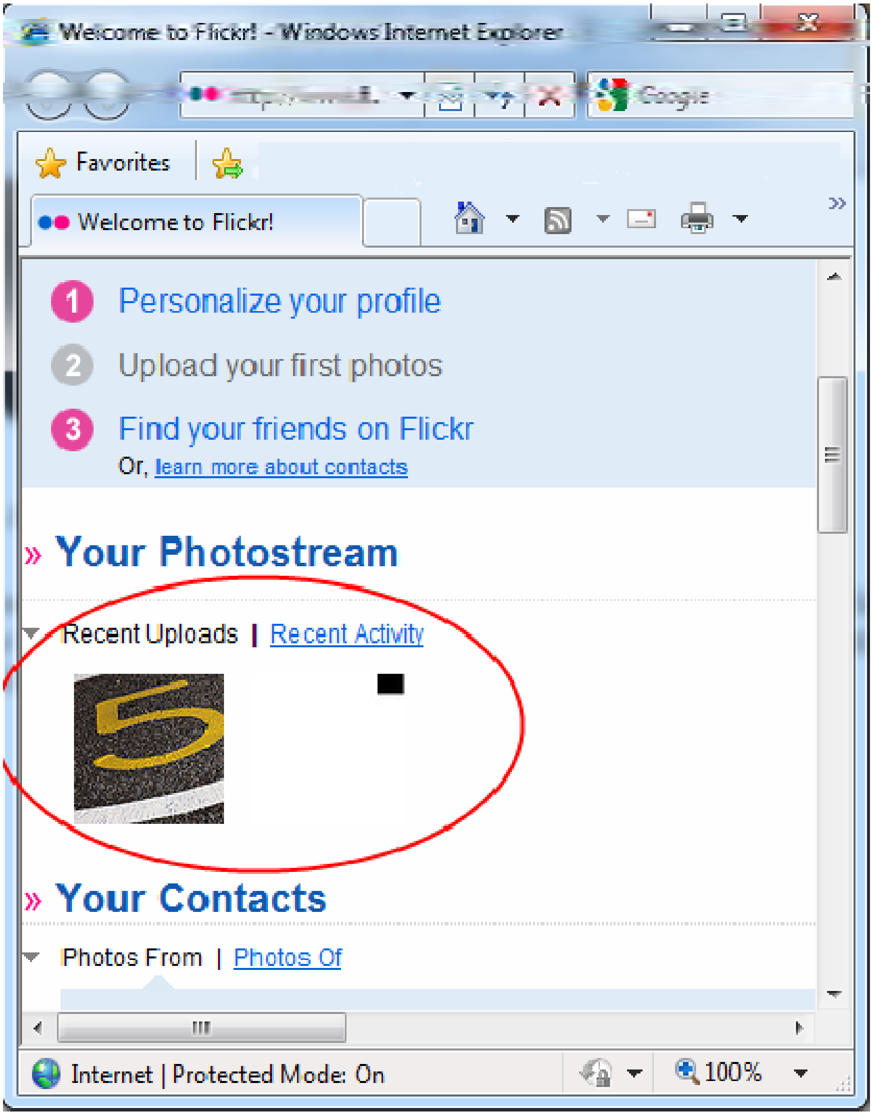

Welcome to Flickr! - Windows Internet Explorer
Google
Favorites
Welcome to Flickr!
1 Personalize your profile
2 Upload your first photos
3 Find your friends on Flickr
Or, learn more about contacts
» Your Photostream
Recent Uploads | Recent Activity
» Your Contacts
Photos From | Photos Of
Internet | Protected Mode: On
100%

Figure 7-6. The photo has been uploaded to the Flickr site.

7-3. Using Media Player to Shuffle Songs in Your Media Library

Problem

You need to retrieve songs from the media library of your Windows Phone 7 device and play them in shuffle mode.

Solution

You have to use the `MediaLibrary` class provided by the XNA Framework and use its property collections such as `Songs` and `Albums`. Moreover, you can play a song by using the `Play` static method defined in the `MediaPlayer` class.

How It Works

The XNA Framework provides the `MediaLibrary` class, in the `Microsoft.XNA.Framework.dll` assembly, which enables us to retrieve information from the media library of your phone. The `MediaLibrary` class provides a lot of useful media collections such as Songs, Pictures, and Albums. After you have a `MediaLibrary` object instance, you automatically have those collections filled with related information.

In this recipe, you are going to reproduce a song, so you are interested to the Songs collection. By using the `Songs` property from the `MediaLibrary` class, you can obtain a `Song` object pointing to a specified collection index.

The `Song` class contains everything concerning a song in the media library. Indeed, you can find the `Album` property to retrieve information on the album containing the song. The `Artist` property retrieves information on the song's author. The `Duration` property indicates the song's duration. The `Genre` property contains information on the song genre. The `Name` property is the song name. The `TrackNumber` property represents the song number within the album. Finally, the `PlayCount` and `Rating` properties return the number of times the song has been played and the song's rating (if you have rated it), respectively. Figure 7-7 shows the pertinent class diagrams.

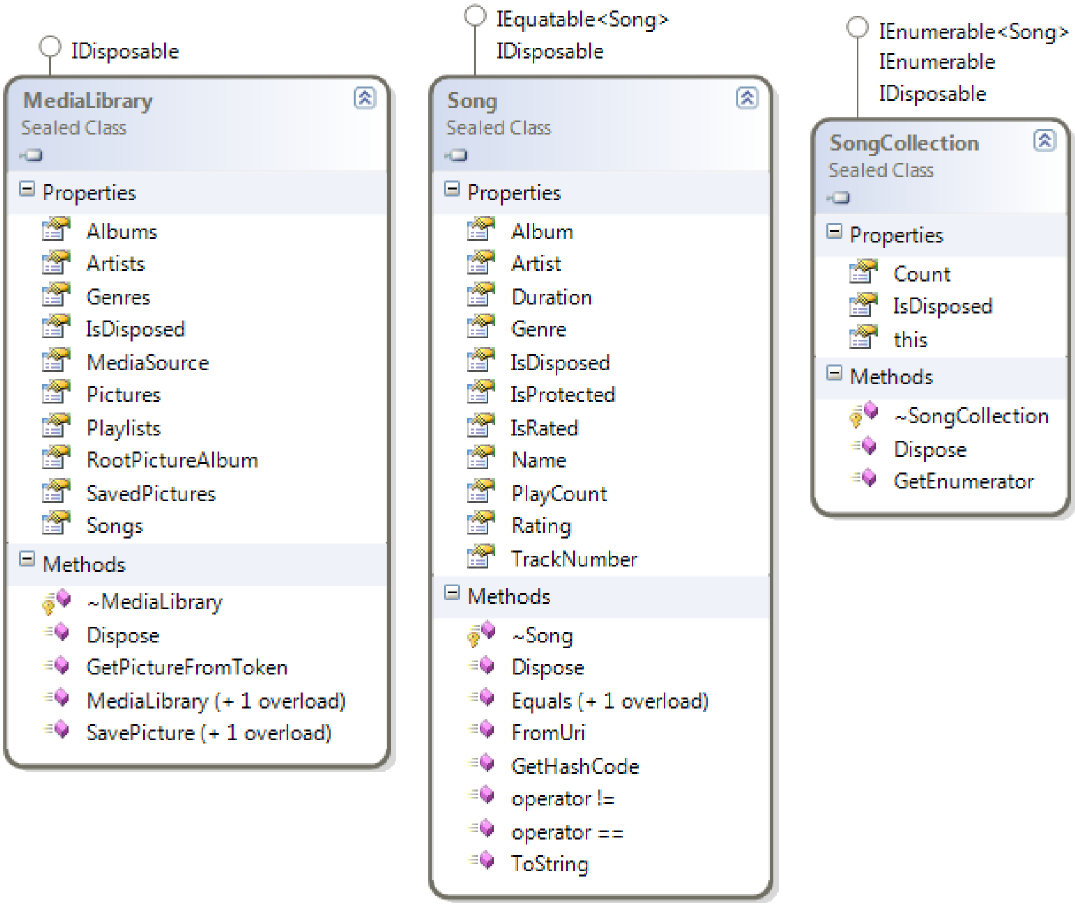


Figure 7-7. The ***MediaLibrary****,* ***Song****, and* ***SongCollection*** *class diagram*

The Code

To demonstrate this recipe, we have created the **ShuffleMe** application by using the Silverlight Windows Phone 7 template from Visual Studio 2010.

Because the Silverlight application for Windows Phone 7 doesn't have support for accessing the media library, the first thing we did was to reference the **Microsoft.Xna.Framework.dll** assembly. Indeed, the XNA Framework has everything necessary to query the media library for pictures and songs.

After shuffling the songs and retrieving a random one, you are going to play the selected song by using the **Play** method provided by the **MediaPlayer** class. But because we have a Silverlight application calling the **Play** method, you need to do an extra step: you need to call the **Update** static method from the **FrameworkDispatcher** class. This call should be done periodically, so the Microsoft official documentation suggests the creation of a class implementing the **IApplicationService** interface. This interface has two method definitions, to start and to stop the service. In the related methods, you are going to start and stop a DispatcherTimer timer object. This timer has an interval set to 30 times per second in which it raises the Tick event. By defining the Tick event handler, you can call the Update static method periodically.

```
public class XNADispatcherService : IApplicationService
{
    private DispatcherTimer frameworkDispatcherTimer;

    public void StartService(ApplicationServiceContext context)
    {
        this.frameworkDispatcherTimer.Start();
    }

    public void StopService()
    {
        this.frameworkDispatcherTimer.Stop();
    }

    public XNADispatcherService()
    {
        this.frameworkDispatcherTimer = new DispatcherTimer();
        this.frameworkDispatcherTimer.Interval = TimeSpan.FromTicks(333333);
        this.frameworkDispatcherTimer.Tick += frameworkDispatcherTimer_Tick;
        FrameworkDispatcher.Update();
    }

    void frameworkDispatcherTimer_Tick(object sender, EventArgs e) {
         FrameworkDispatcher.Update(); }
}
```

In the App.xaml file, you can add the namespace that contains the XnaDispatcherService class and include a tag so that the application itself will start and stop the timer, automatically:

```
<Application
    x:Class="ShuffleMe.App"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:local="clr-namespace:ShuffleMe">

    <!--Application Resources-->
    <Application.Resources>
    </Application.Resources>
    <Application.ApplicationLifetimeObjects>
        <!--Required object that handles lifetime events for the application-->
        <shell:PhoneApplicationService
            Launching="Application_Launching" Closing="Application_Closing"
            Activated="Application_Activated" Deactivated="Application_Deactivated"/>
        <local:XNADispatcherService />
    </Application.ApplicationLifetimeObjects>

</Application>
```

The `ShuffleMe` application has some requirements, which can be summarized as follows:

- It must continue to play and shuffle songs even when the screen is locked.
- When one song is over, a new one must be played, and it shouldn't be the same.
- When the application is tombstoned, it must save the song's properties such as its title and album cover.
- When the application is reactivated from a tombstone, it must not stop the current played song and must again display the song's properties.
- When the hardware Back button is pressed, the application must stop playing the song.

Let's examine the code and the solutions found to address those points.

As you saw in Chapter 2, you can set the `ApplicationIdleDetectionMode` property to `IdleDetectionMode.Disabled` so that your application doesn't stop working when the screen is locked:

```
// The shuffle routine has to work even when the screen is locked
PhoneApplicationService.Current.ApplicationIdleDetectionMode = IdleDetectionMode.Disabled;
```

Sadly, the `MediaLibrary` doesn't provide either a property or a method to retrieve when the song is over. Our solution has been to create a `DispatcherTimer` object set to 1 second more than the song duration. Indeed, when the song is over (plus 1 second), the timer raises the `Tick` event that is hooked by the related event handler, and the private `PlaySong` method is called:

```
    public partial class MainPage : PhoneApplicationPage
    {
. . .
        DispatcherTimer timer = null;

        // Constructor
        public MainPage()
        {
. . .

            timer = new DispatcherTimer();
            timer.Tick += new EventHandler(timer_Tick);
            // The shuffle routine has to work even when the screen is locked
            PhoneApplicationService.Current.ApplicationIdleDetectionMode =
                                                        IdleDetectionMode.Disabled;
        }

        void timer_Tick(object sender, EventArgs e)
        {
            PlaySong();
        }
. . .
```

When the application is tombstoned—for example, by the user pressing the hardware Start button—the application must store important data such the album cover and the song's author and title. Sadly, the Song class is not serializable, and the same is true for the BitmapImage class for the album cover. You need to create the AppSettings serializable class with specific information such as the Title property to store the application's title and the AlbumImage bytes array to store the image album. The latter is the way we found to serialize an image. In the IsTombstoned property, you set when the application is tombstoned. Finally, in the SongNumber property, you store the song's number generated by the shuffle routine.

```
    public class AppSettings
    {
        public bool IsTombstoned { get; set; }
        public string Title { get; set; }
        public byte[] AlbumImage { get; set; }
        public int SongNumber { get; set; }
    }
```

■ **Note** You could store only the SongNumber value during the tombstoning and use it to retrieve the song when the application is reactivated. However, in this way you can learn different techniques to manage images' serialization.

An object from the AppSettings class is stored in the App application class, and you can retrieve it by using the related settings property:

```
    public partial class App : Application
    {
        /// <summary>
        /// Provides easy access to the root frame of the Phone Application.
        /// </summary>
        /// <returns>The root frame of the Phone Application.</returns>
        public PhoneApplicationFrame RootFrame { get; private set; }

        public AppSettings settings { get; set; }
. . .
```

Moreover, in the App class, you define the event handlers to manage the tombstoning:

```
// Code to execute when the application is launching (e.g., from Start)
// This code will not execute when the application is reactivated
private void Application_Launching(object sender, LaunchingEventArgs e)
{
    settings = new AppSettings();

    settings.IsTombstoned = false;
}

// Code to execute when the application is activated (brought to foreground)
// This code will not execute when the application is first launched
private void Application_Activated(object sender, ActivatedEventArgs e)
{
    if (PhoneApplicationService.Current.State.ContainsKey("settings"))
    {
        settings = PhoneApplicationService.Current.State["settings"] as AppSettings;
        settings.IsTombstoned = true;

    }
}

// Code to execute when the application is deactivated (sent to background)
// This code will not execute when the application is closing
private void Application_Deactivated(object sender, DeactivatedEventArgs e)
{
    PhoneApplicationService.Current.State["settings"] = settings;
}
```

The other properties provided by the AppSettings class are set in the PlaySong method. The first operation in this method calls the DoShuffle method, which returns a Song object. This object is compared to a previous Song object stored as _lastSong variable. If the objects are equal, the PlaySong method is called again until a new Song object is retrieved. If the user has only one song in her library, the song is repeated each time until the application is closed.

■ **Note** You could use the SongNumber property to check whether the DoShuffle method picked the same song, but we used a Song object to demonstrate that this class supports object comparison.

The PlaySong method contains a couple of interesting code snippets. The HasArt property is checked to see whether the song has an associated album cover. If it does, the GetAlbumArt method is used to retrieve the stream data of the image. One way to use the Stream object with the Image control—and specifically its Source property—is to create a WriteableBitmap object with the static DecodeJpeg method from the PictureDecoder class defined in the Microsoft.Phone namespace. If the song does not have an associated album cover, a No Cover image is retrieved from the image folder within the ShuffleMe project.

The AlbumImage bytes array defined in the settings is filled with the GetAlbumArt data thanks to the BinaryReader class and its ReadBytes method.

Finally, the Duration property from the Song class is used to set the Interval property of the timer, and then the timer is started.

```
        private void PlaySong()
        {
            Song s = DoShuffle();
            if ((s != null && s != _lastSong)||(library.Songs.Count == 1))
            {
                App app = Application.Current as App;

                _lastSong = s;

                tbAuthor.Text = s.Artist.Name + ": " + s.Name;
                app.settings.Title = tbAuthor.Text;

                if (s.Album.HasArt)
                {
                    WriteableBitmap wbimg =
                               PictureDecoder.DecodeJpeg(s.Album.GetAlbumArt());
                    imgCover.Source = wbimg;
                    using (var br = new BinaryReader(s.Album.GetAlbumArt()))
                           app.settings.AlbumImage =
                                    br.ReadBytes((int)s.Album.GetAlbumArt().Length);
                }
                else
                {
                    app.settings.AlbumImage = null;
                    imgCover.Source = new BitmapImage(new Uri("/images/nocover.png",
                                                      UriKind.Relative));
                }

                MediaPlayer.Play(s);
                timer.Interval = s.Duration + TimeSpan.FromSeconds(1);
                timer.Start();
            }
            else
                PlaySong();
        }
```

When the application either starts or is tombstoned, the Loaded event for the MainPage page is raised and the private PlaySong method is called. But before calling this method, you check whether the application has been tombstoned or has been launched for the first time. Only in the latter case do you call the PlaySong method, because you want to avoid having a new song played when the application is reactivated by tombstoning. Indeed, in the tombstoning case, you simply rewrite the title and reset the album cover.

In the PhoneApplicationPage_Loaded event handler, there is an interesting thing that is worth noting. After tombstoning occurs, the timer is not working anymore, and so you need to set its interval again. But this time you can't use the song duration because some time has passed. So the PlayPosition property from the MediaPlayer class is used to retrieve a TimeSpan object representing the song reproduction time. By subtracting this value from the song's duration, you obtain the new Interval value of the timer.

```
private void PhoneApplicationPage_Loaded(object sender, RoutedEventArgs e)
{
    App app = Application.Current as App;

    if (!app.settings.IsTombstoned)
        PlaySong();
    else
    {
        tbAuthor.Text = app.settings.Title;
        if (app.settings.AlbumImage != null)
        {
            MemoryStream ms = new MemoryStream(app.settings.AlbumImage);
            WriteableBitmap wbimg = PictureDecoder.DecodeJpeg(ms);
            imgCover.Source = wbimg;
        }
        else
            imgCover.Source = new BitmapImage(new Uri("/images/nocover.png",
                                               UriKind.Relative));

        TimeSpan remainTime = library.Songs[app.settings.SongNumber].Duration -
                              MediaPlayer.PlayPosition;
        timer.Interval = remainTime + TimeSpan.FromSeconds(1);
        timer.Start();
    }
}
```

In the DoShuffle method code, you use the Random class to generate a number ranging from zero to the value of the Count property of the Songs collection, which returns the number of songs in the media library. Finally, this number is saved in the SongNumber property of the settings object, and the song at songIndex is returned from the Songs collection.

```
private Song DoShuffle()
{
    App app = Application.Current as App;

    int count = library.Songs.Count;

    Random rand = new Random();
    int songIndex = rand.Next(0, count);

    app.settings.SongNumber = songIndex;
    return library.Songs[songIndex];
}
```

The last requirement we have imposed on ourselves is that the application must end when the hardware Back button is pressed. In the `PhoneApplicationPage` class, you define the `OnBackKeyPress` method, which you can override so as to add your code before the back functionality is accomplished.

In this case, you stop the song that is playing and you stop the timer.

```
protected override void OnBackKeyPress(System.ComponentModel.CancelEventArgs e)
{
    MediaPlayer.Stop();
    timer.Stop();

    base.OnBackKeyPress(e);
}
```

■ **Note** Actually, at writing time, the `MediaLibrary` has an initialization bug that can be resolved with a workaround. In the `MainPage` class constructor, you can add the `MediaPlayer.Queue.ToString();` call so that you force the library initialization.

Usage

From Visual Studio 2010, select the output target as Windows Phone 7 Emulator and press Ctrl+F5. The emulator starts, briefly showing the application, as in Figure 7-8. The song you play could be different from the one shown in Figure 7-8, because of the shuffle mode. The emulator provides three songs with no covers, so if you want to see the application with album covers as well, you should run it on a physical device.

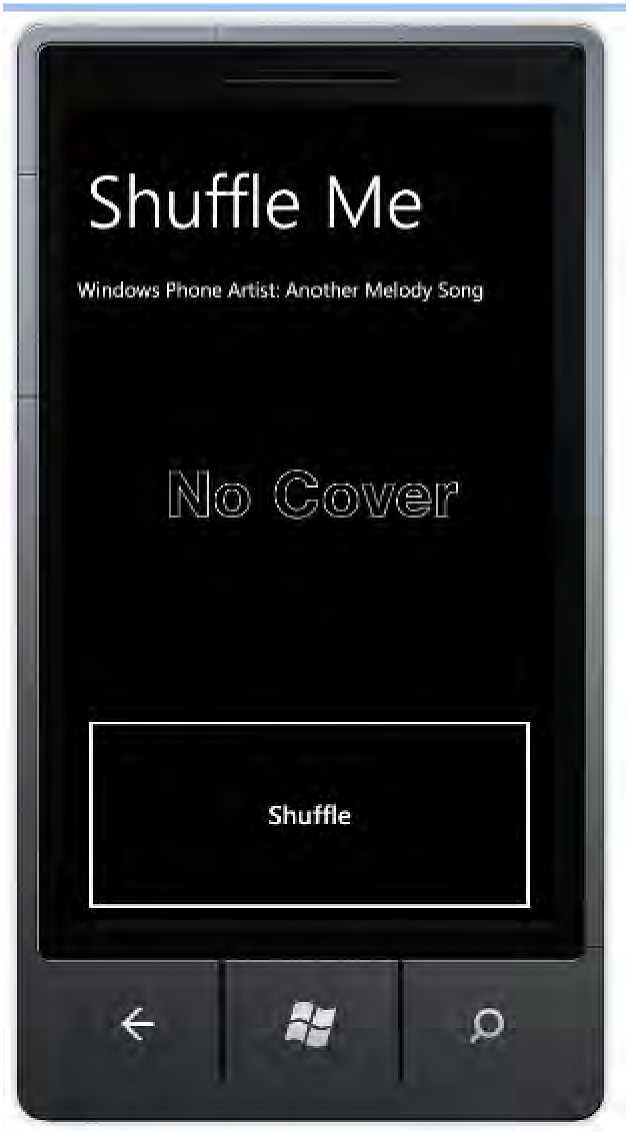


Figure 7-8. The ***ShuffleMe*** *application running in the emulator*

Press the hardware Back button to terminate the application and its song. Or press the hardware Start button and then the hardware Back button to simulate the application tombstoning. You should hear the song continuing playing without any interruption and see the title, as before the tombstoning.

Now you can wait until the song ends in order to see that another (and different) song is played.

7-4. Using the Microphone in the Funny Repeater Application

Problem

You need to use the Windows Phone 7 microphone to register your voice and reproduce it in a funny way.

Solution

You can use the `Microphone` class from the `Microsoft.Xna.Framework.dll` assembly and the `Play` method provided by the `SoundEffect` class.

How It Works

In the `Microsoft.Xna.Framework.Audio` namespace, the `Microphone` class is defined; this class provides access to the device's microphone. The `Microphone` class (see Figure 7-9 for the class diagram) has the `BufferReady` event that is raised at regular intervals depending on the `BufferDuration` setting. Within the `BufferReady` event handler, you can call the `GetData` method provided by the `Microphone` class in order to retrieve a portion of the registered audio buffer. This buffer has a fixed size that you can calculate by calling the `GetSampleSizeInBytes` method from the `Microphone` class.

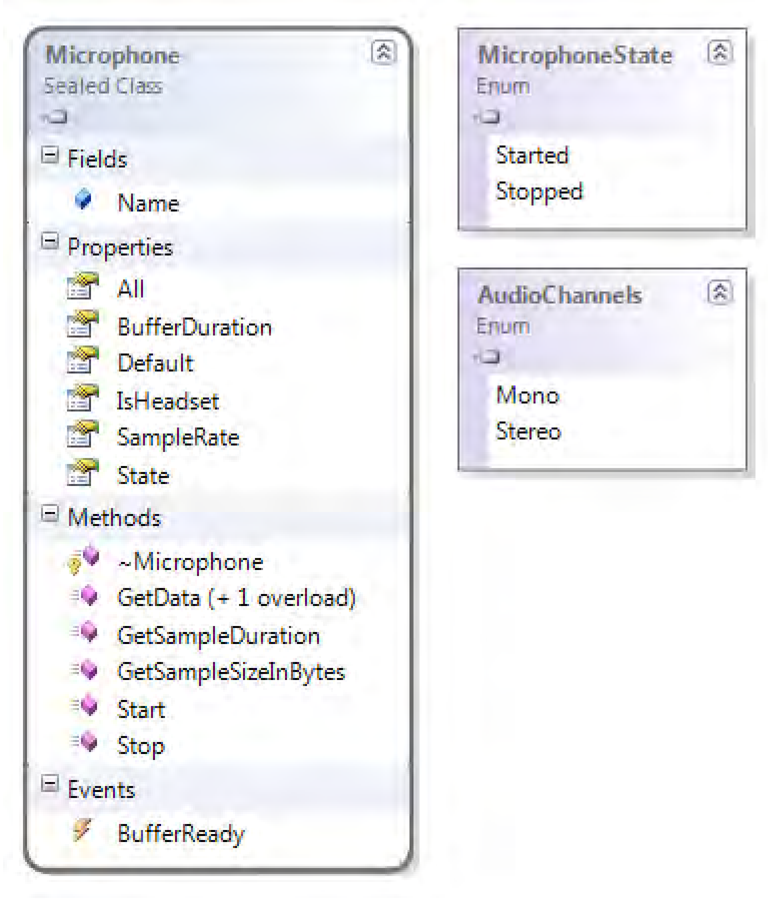


Figure 7-9. *The `Microphone` class diagram*

The microphone is started by using the `Start` method from the `Microphone` class and is stopped by the `Stop` method. The `Microphone` class is sealed, so you cannot create an instance from it; you have to call the static `Default` property from the `Microphone` class, which returns an instance of the `Microphone` object representing the default microphone.

To play the recorded audio, you have to use the `Play` method provided by the `SoundEffect` class. Before using this method, you need to create an object from the `SoundEffect` class by using one of the two provided constructors. The first constructor accepts the audio buffer as a bytes array, the audio sample rate, and the number of audio channels to use during the audio playing. The second constructor accepts—in addition to those three parameters— an offset value indicating from where the audio play has to start, the count representing the amount of data to play, and loops parameters to reproduce a looping sound.

The `SoundEffect` class provides a mix of static and instance methods. Among the static methods worth noting is the `FromStream` method, which retrieves a `SoundEffect` object from a stream. Among the instance methods worth noting is the `CreateInstance` method, which returns a `SoundEffectInstance` object. Before calling the Play method, you can use the CreateInstance method to return a SoundEffectInstance object and set its own 3D audio space parameters. Moreover, you can use the SoundEffectInstance object to set audio pitch, volume, and pan.

The Code

To demonstrate using the microphone and reproducing sound, we have created the FunnyRepeater Silverlight for Windows Phone 7 application.

As you already learned in Recipe 7-3, the Silverlight application doesn't have support for audio recording, so you have to reference the Microsoft.Xna.Framework.dll assembly. Moreover, because the Play method needs repeated updates to the framework dispatcher, you add the XnaDispatcherService, which implements the IApplicationService interface (as seen in Recipe 7-3).

In the MainPage.xaml file, you add just a single button that starts and stops the audio recording from the microphone. You use the PageTitle TextBlock control to display the recording status.

```
<!--ContentPanel - place additional content here-->
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
    <Button x:Name="btnRecord" Click="btnRecord_Click" Content="Record" />
</Grid>
```

In the MainPage.xaml.cs code file, you start defining at the class level a Microphone object and some buffer data. In the MainPage constructor, you add the hook to the BufferReady event.

```
public partial class MainPage : PhoneApplicationPage
{
    Microphone mic = Microphone.Default;
    byte[] data = null;
    MemoryStream audio = null;

    // Constructor
    public MainPage()
    {
        InitializeComponent();
        mic.BufferReady += new EventHandler<EventArgs>(mic_BufferReady);
    }
```

When the BufferReady event is raised, you store the provided audio buffer into a MemoryStream object. This is necessary because this event is raised at regular intervals and provides slices of audio registration. Thanks to the MemoryStream object, you can store the entire audio recording.

```
void mic_BufferReady(object sender, EventArgs e)
{
    mic.GetData(data);
    audio.Write(data, 0, data.Length);
}
```

Behind the button click event handler stays the core of this application. First of all, to know when the button has either to start or to stop the audio recording, you check the State property provided by the Microphone class. When State is equal to the MicrophoneState.Stopped value, it means the microphone is not working and you can start it. When you want to start the audio recording, you set the

BufferDuration property to 100 milliseconds—so that the BufferReady event is raised every 100 milliseconds. Then you prepare the bytes array buffer to receive audio data. This array will have a capacity equal to the value returned by the GetSampleSizeInBytes method provided by the Microphone class. The GetSampleSizeInBytes method accepts a TimeSpan object set equal to the BufferDuration property value. A fresh new MemoryStream object is created—so that each time a recording is started, you don't have the new recording appended to the old one—and the Microphone is started with the Start method. Finally, the PageTitle and the button's Content are set according to the new state.

If the button is used to stop the recording, you use the Stop method from the Microphone class to stop the microphone recording. Then the page title and button's content are set according to their new states, and the registration is played by calling the PlayRecordedAudio method. Finally, when the audio playing is over, PageTitle is set back to the original value.

```
private void btnRecord_Click(object sender, RoutedEventArgs e)
{
    if (mic.State == MicrophoneState.Stopped)
    {
        mic.BufferDuration = TimeSpan.FromMilliseconds(100);
        data = new byte[mic.GetSampleSizeInBytes(mic.BufferDuration)];
        audio = new MemoryStream();
        mic.Start();
        this.PageTitle.Text = "recording...";
        btnRecord.Content = "Stop";
    }
    else
    {
        mic.Stop();
        this.PageTitle.Text = "playing";
        btnRecord.Content = "Record";
        btnRecord.IsEnabled = false;
        PlayRecordedAudio();
        this.PageTitle.Text = "ready";
    }
}
```

In the private PlayRecordedAudio method, you create an object from the SoundEffect class providing the MemoryStream buffer. This buffer is converted to an array with the ToArray method. Finally, you provide the SampleRate microphone audio sample rate, and the mono audio channel. You play the recorded audio by using the Play method that accepts three parameters: the volume, the pitch, and the pan. All those parameters are float numbers but have different ranges. The volume parameter goes from 0.0 f (float) (no sounds) to 1.0 f (the volume is equal to the MasterVolume set in the phone). The pitch parameter is responsible for the funny effect. It reproduces the sound one octave higher than the original. The last parameter is the pan value, which represents the audio balancing heard from the left and right ears.

```
private void PlayRecordedAudio()
{
    SoundEffect se = new SoundEffect(audio.ToArray(), mic.SampleRate,
                                     AudioChannels.Mono);
    se.Play(1.0f, 1.0f, 0.0f);
    btnRecord.IsEnabled = true;
}
```

Usage

You can use this application both in the emulator and the physical device. If you choose the former, the PC's microphone will be used.

From Visual Studio 2010, press Ctrl+F5 so that the application is started. If you choose the emulator, the application will look like Figure 7-10.

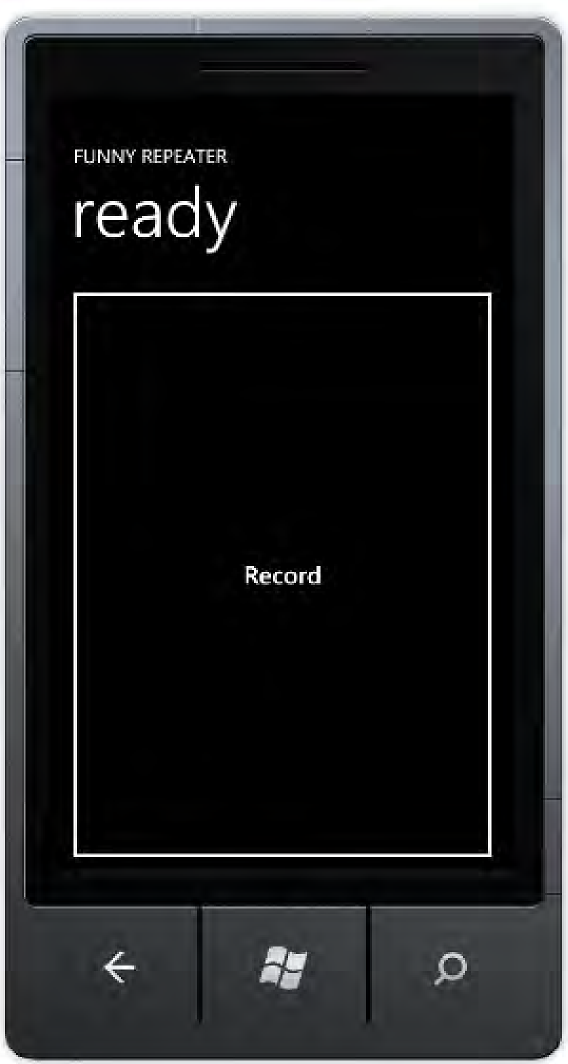


Figure 7-10. The Funny Repeater application running in the emulator

Now you can press the Record button and start to say what you would like to say. Press the Stop button, and hopefully you will hear your voice repeating your speech, but in a funny way.

7-5. Using the MediaElement Control to Play Both Music and Video

Problem

You need to play music, such as MP3 and WMA files, and videos by using the same Silverlight control.

Solution

You can use the `MediaElement` control within the `System.Windows.Controls` namespace.

How It Works

Within the Silverlight for Windows Phone 7 controls library is the `MediaElement` control, which enables us to reproduce music and video available from remote sites and local resources. Obviously, in the latter case, the final distribution XAP package will be greater than the XAP package provided by the remote solution.

This path can be specified in the `Source` property that accepts the URI path of the file, or by using the `SetSource` method if the media file is stored locally in isolated storage.

■ **Note** In the following MSDN article, you can read about all media formats compatible with the `MediaElement` control: `http://msdn.microsoft.com/en-us/library/ff462087(VS.92).aspx`.

Other than the classic methods to start, stop, and pause the media playing, `MediaElement` provides some very interesting events. The `CurrentStateChanged` event is raised when the state of the media playing is changed. This event is used when you need to manage buttons to play, stop, and pause the media. For example, in this recipe, the event is used to change the Play icon of the `ApplicationBarIcon` to a Pause icon when the `CurrentState` property of `MediaElement` is equal to the `MediaElementState.Playing` value.

The `BufferingProgressChanged` event is raised during the buffering of the media file. Usually when the file is on a remote site, this event is used to inform the user that a buffering process is in progress. You can use the event to show the buffering percentage. The buffering progress can be retrieved from the `BufferingProgress` property, which returns a `double` value (from 0.0 to 1.0) that you can multiply by 100 to obtain the progress percentage.

The `MediaOpened` event is raised when the media is ready to be played (which means the header of the file has been read and the `MediaElement` properties are set). `MediaEnded` is raised when the media playing ends.

The AutoPlay property enables you to automatically start playing the media when its value is set to true. However, the Marketplace certification requirements (Section 6.5) indicate that you can't interrupt music that is already playing, so it is better to start with this value set to false and then check whether music is already playing on your device. This can be accomplished by calling the GameHasControl method provided by the MediaPlayer class.

The NaturalDuration, NaturalWidth, and NaturalHeight properties represent the media duration, width, and height (if the media is a video), respectively.

Finally, the Position property represents the media-playing position that you can read and set with a TimeSpan value. In this recipe, we used this property to update a Slider control position so to have visual feedback about the progression of the media playing.

The Code

To demonstrate the MediaElement usage, we have created a Silverlight for Windows Phone 7 application that uses a MediaElement, a slider, to represent the progression of the media playing, and a TextBlock control to write the buffering percentage.

In the MainPage.xaml file, you add those three controls within the Content grid. Moreover, you define two ApplicationBarIconButton controls that enable us to play, pause, and stop the media playing (the Play button becomes the Pause button after being pressed).

```
        <!--ContentPanel - place additional content here-->
        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <Grid>
                <Grid.RowDefinitions>
                    <RowDefinition Height="Auto" />
                    <RowDefinition Height="*" />
                    <RowDefinition Height="Auto" />
                </Grid.RowDefinitions>
                <TextBlock x:Name="tbBuffering" Grid.Row="0" />
                <MediaElement AutoPlay="False" x:Name="meVideo"
Source="http://mschannel9.vo.msecnd.net/o9/mix/09/wmv/key01.wmv" Grid.Row="1"/>
                <Slider x:Name="sPosition" Grid.Row="2"/>
            </Grid>
        </Grid>

    <phone:PhoneApplicationPage.ApplicationBar>
        <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
            <shell:ApplicationBarIconButton IconUri="/Images/appbar.transport.play.rest.png"
            Text="Play" x:Name="btnPlay" Click="btnPlay_Click"/>
            <shell:ApplicationBarIconButton IconUri="/Images/appbar.stop.rest.png"
            Text="Stop" Click="btnStop_Click"/>
        </shell:ApplicationBar>
    </phone:PhoneApplicationPage.ApplicationBar>
```

In the MainPage.xaml.cs code file, you start defining two class-level variables representing the media file duration and a DispatcherTimer timer to update the slider control position. In the MainPage constructor, you add event handlers and other initialization code. As you already learned in Recipe 3-2, even if you define a name for an application's icon button, you need to assign its own control's reference by picking the related index from the Buttons collection of the ApplicationBar class.

```
    public partial class MainPage : PhoneApplicationPage
    {
        private TimeSpan duration;
        private DispatcherTimer timer;

        // Constructor
        public MainPage()
        {
            InitializeComponent();
            meVideo.BufferingProgressChanged +=
                    new RoutedEventHandler(meVideo_BufferingProgressChanged);
            meVideo.CurrentStateChanged +=
                    new RoutedEventHandler(meVideo_CurrentStateChanged);
            meVideo.MediaOpened += new RoutedEventHandler(meVideo_MediaOpened);
            meVideo.MediaEnded += new RoutedEventHandler(meVideo_MediaEnded);
            btnPlay = ApplicationBar.Buttons[0] as ApplicationBarIconButton;
            timer = new DispatcherTimer();
            timer.Tick += new EventHandler(timer_Tick);
            timer.Interval = TimeSpan.FromMilliseconds(500);
            sPosition.Value = 0;
        }
. . .
```

The DispatcherTimer object is used to update the progress value of the slider control. Every half second, the Tick event is raised and the slider value property is set with the new Position value provided by the MediaElement class.

```
        void timer_Tick(object sender, EventArgs e)
        {
            if (meVideo.CurrentState == MediaElementState.Playing)
            {
                double currentPostition = meVideo.Position.TotalMilliseconds;
                double progressPosition = (currentPostition * 100) /
                                          duration.TotalMilliseconds;
                sPosition.Value = progressPosition;
            }
        }
```

The duration variable is set in the MediaOpened event handler, where you are sure that the media header has been read and media properties are set.

```
        void meVideo_MediaOpened(object sender, RoutedEventArgs e)
        {
            duration = meVideo.NaturalDuration.TimeSpan;
        }
```

In the BufferingProgressChanged event handler, you are going to update the text block Text property with the media buffering percentage that is retrieved by the BufferingProgress property of MediaElement and formatted with the Format method.

```
void meVideo_BufferingProgressChanged(object sender, RoutedEventArgs e)
{
    tbBuffering.Text = string.Format("Buffering...{0:P}",
                                     meVideo.BufferingProgress);
}
```

The CurrentStateChanged event is managed by the related event handler in order to change the Play icon button into the Pause icon button when CurrentState is equal to Playing.

```
void meVideo_CurrentStateChanged(object sender, RoutedEventArgs e)
{
    if (meVideo.CurrentState == MediaElementState.Playing)
        btnPlay.IconUri = new Uri("/Images/appbar.transport.pause.rest.png",
                                  UriKind.Relative);
    else
        btnPlay.IconUri = new Uri("/Images/appbar.transport.play.rest.png",
                                  UriKind.Relative);
}
```

In the Play and Stop event handlers, in response to the Play and Stop button clicks on the application bar, you call the Play, Pause, and Stop methods provided by the MediaElement class.

```
private void btnPlay_Click(object sender, EventArgs e)
{
    if (meVideo.CurrentState == MediaElementState.Playing)
    {
        meVideo.Pause();
        timer.Stop();
    }
    else
    {
        timer.Start();
        meVideo.Play();
    }
}

private void btnStop_Click(object sender, EventArgs e)
{
    meVideo.Stop();
}
```

Finally, you add some code to reset the media control when the media playing is over:

```
void meVideo_MediaEnded(object sender, RoutedEventArgs e)
{
    meVideo.Position = TimeSpan.Zero;
    sPosition.Value = 0;
    btnPlay.IconUri = new Uri("/Images/appbar.transport.play.rest.png",
                              UriKind.Relative);
}
```

Usage

From Visual Studio 2010, select the Windows Phone 7 Emulator as the target output and press Ctrl+F5 to start the application shown in Figure 7-11.

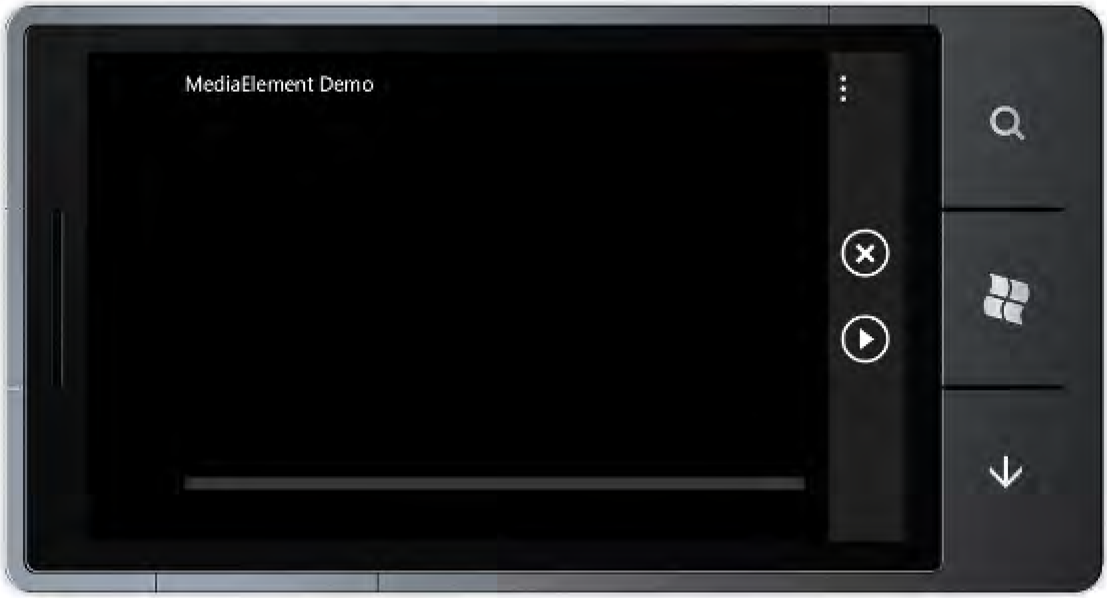


Figure 7-11. The `MediaElement` *demo application running in the emulator*

Now you can press the Play button on the application bar and see the buffering information on the screen. When the buffering is complete, the movie will start and the Play button will change into the Pause button.

7-6. Adding Integration with the Music-Videos Hub

Problem

You need to integrate your application with the Music-Videos hub in your Windows Phone 7 device.

Solution

You have to use methods and properties provided by `MediaHistory` and `MediaHistoryItem` classes.

How It Works

The Music-Videos hub is an aggregator application available from the Windows Phone 7 operating system. It groups all the applications installed on the phone that reproduce media files such as music and videos. The Music-Videos hub is composed of four sections:

Zune: Contains links to music, video, podcasts, radio, and the Marketplace

History: Contains recently played media and content from third-party providers

New: Contains recent media either uploaded to the phone or downloaded from the Marketplace

Marquee: Contains the list of applications that manage media

So the last section is very interesting. How can your application be included in the Marquee section of the Music-Videos hub? The MSDN official documentation says that the use of `MediaHistory` and `MediaHistoryItem` classes in your application will be detected during the certification process. If the application is accepted, the `WMAppManifest.xml` file is modified and the `HubType` attribute is added to the `App` tag. In this case, the application name will appear in the Marquee section, and the user can execute it from there.

■ **Tip** You can manually add the `HubType="1"` attribute to the `App` tag in the `WMAppManifest.xml` file within your project in order to test the integration between your application and the Music-Videos hub.

■ **Note** In the official App Hub forum, there is a thread about the certification process and the `HubType` attribute. It seems the official documentation is wrong, and you have to manually insert the `HubType` attribute to have the integration with the hub. See the following page: `http://forums.create.msdn.com/forums/p/71794/444930.aspx`.

The application must be developed to correctly respond to the Music-Videos hub interactions. These interactions can be summarized as follows:

- When a media file is played, it appears as Now Playing in the History section, next the Zune section. It appears as a 358×358 pixel image that you must provide in your solution. This image should represent your application, and you must provide a title for the media file being played.
- When another media file starts playing, the old one has to be inserted into the History section.

- When an item is picked from the History section, your application will be executed and a QueryString will be provided with the information you stored in the PlayerContext collection. Your application has to manage this query string information and play the related media.
- When your application is executed from the Marquee section and a media file is already playing, the application has to continue playing that media.

Everything noted in the preceding list is available from the MediaHistoryItem and MediaHistory classes.

The MediaHistory class contains the Instance property, which returns the current instance of that class. Indeed, MediaHistory cannot be instantiated because it is a sealed class. After retrieving the instance of the MediaHistory class, you can use its methods to add items into the History section of the Music-Videos hub.

The WriteRecentPlay method writes a MediaHistoryItem item into the History section. The WriteAcquiredItem method writes the provided MediaHistoryItem into the New section.

Finally, the NowPlaying property is used to set the item that is presently playing in the Music-Videos hub. When the user selects the Now Playing icon in the hub, the application will be executed again (please note that we haven't said it is tombstoned). However, this time the QueryString collection property will contain the key/value pair you added via the PlayerContext property provided by the MediaHistoryItem class. You can retrieve its value in the OnNavigatedTo event handler so as to play the media again.

So you have encountered the first property from the MediaHistoryItem class. There are other very useful properties, such as ImageStream (whicht has to contain the image of 358×358 pixels, as stated in preceding bullet list).

■ **Caution** The image cannot be greater than 16 kilobytes. Otherwise, the following exception will occur: "System.ArgumentException: image stream size bigger than maximum allowed 16384."

The Title property enables you to set the string that will be displayed over the NowPlaying icon. Usually this will be set to the media name, such as a song's name. Even when you specify the item in the History and the New sections, you still have to set the Title property that will be displayed in the Now Playing section.

■ **Note** There is another property called Source that the official documentation defines as unsupported, but if you don't set this property to an empty string, you will not be able to add the item to the Music-Videos hub.

The Code

To demonstrate the Music-Videos hub integration, we have created the MusicVideosHubIntegration Silverlight for Windows Phone 7 application. As you already learned in the previous recipes, you have to add the Microsoft.Xna.Framework.dll assembly and a class implementing the IApplicationService interface to periodically call the Update static method from the FrameworkDispatcher class.

The MainPage.xaml file contains just a label to show the author and song that is playing. The application bar provides buttons to play, pause, and stop the song.

In MainPage.xaml.cs, the core of the application code resides in the OnNavigatedTo method and in the Play button's Click event handler.

The OnNavigatedTo method is called when the application is either first launched or resumed from a tombstone. The first operation to perform is to check whether the Media Player is already playing a song. If it is, the application must continue to play that song. The song can be retrieved via the ActiveSong property from the MediaQueue class. In turn, a MediaQueue object can be retrieved by the Queue property from the MediaPlayer class. Next, if the QueryString property contains the key you have previously stored, it means that the application has been executed from the hub. We previously stored the song index, so you can easily retrieve it by pointing to that index in the Songs collection. Finally, you update the text shown in the user interface and the related buttons' images. Please note that the s variable is a Song class-level field that is set through different classes' methods.

```
protected override void
          OnNavigatedTo(System.Windows.Navigation.NavigationEventArgs e)
{

    if (MediaPlayer.State == MediaState.Playing)
    {
        s = MediaPlayer.Queue.ActiveSong;
    }
    else if (NavigationContext.QueryString.ContainsKey(_key))
    {
        s = library.Songs[int.Parse(NavigationContext.QueryString[_key])];
        MediaPlayer.Play(s);
    }

    if (s != null)
    {
        tbSong.Text = "Now playing " + s.Artist + " " + s.Name;
        btnPlay.IconUri = new Uri("/Images/appbar.transport.pause.rest.png",
                                   UriKind.Relative);
    }

    base.OnNavigatedTo(e);
}
```

In the btnPlay_Click event handler, the main part of the code checks whether the Song s variable is null. If it is, either the song has not been provided by the hub or the user has stopped the song from playing. In either case, a shuffle is done to retrieve a song to be played.

The next operation is calling the Play method from the MediaPlayer class and calling the UpdateNowPlaying and UpdateHistory methods that accomplish the main Music-Videos hub integration job.

```
        private void btnPlay_Click(object sender, EventArgs e)
        {
            if (MediaPlayer.State == MediaState.Playing)
            {
                MediaPlayer.Pause();
            }
            else
            {
                MediaHistory history = MediaHistory.Instance;

                if (s == null)
                {
                    s = DoShuffle();
                    if (s == null)
                    {
                        MessageBox.Show("The media library doesn't contain songs");
                        return;
                    }
                }

                tbSong.Text = "Now playing " + s.Artist + " " + s.Name;
                MediaPlayer.Play(s);
                UpdateNowPlaying();
                UpdateHistory();
            }
        }
```

These methods are pretty similar; you have to set mandatory properties of the `MediaHistoryItem` object and either call the `WriteRecentPlay` method or set the `NowPlaying` property from the `MediaHistory` class.

■ **Note** You can't use the same `MediaHistoryItem` object, but you need to create more than one instance for each item you want to add in the hub's sections.

In the `UpdateNowPlaying` method, you use another way to retrieve the stream data composing the image: the `StreamResourceInfo` class. An object of this class is returned from the `GetResourceStream` static method provided by the `Application` class. The `GetResourceStream` static method accepts a URI object that specifies where to find the resource. The `StreamResourceInfo` class provides the `Stream` property containing the image's stream data that you can assign to the `ImageStream` property of the `MediaHistoryItem` class.

■ **Note** We used a JPEG image so as to reduce the image definition and provide a compatible image size.

Finally, you set the Source and Title properties and you add the song index to the PlayerContext collection so that when the song is requested from the hub, your application can retrieve it from the query string. This new object is assigned to the NowPlaying property of the MediaHistory object that is retrieved with the Instance static property.

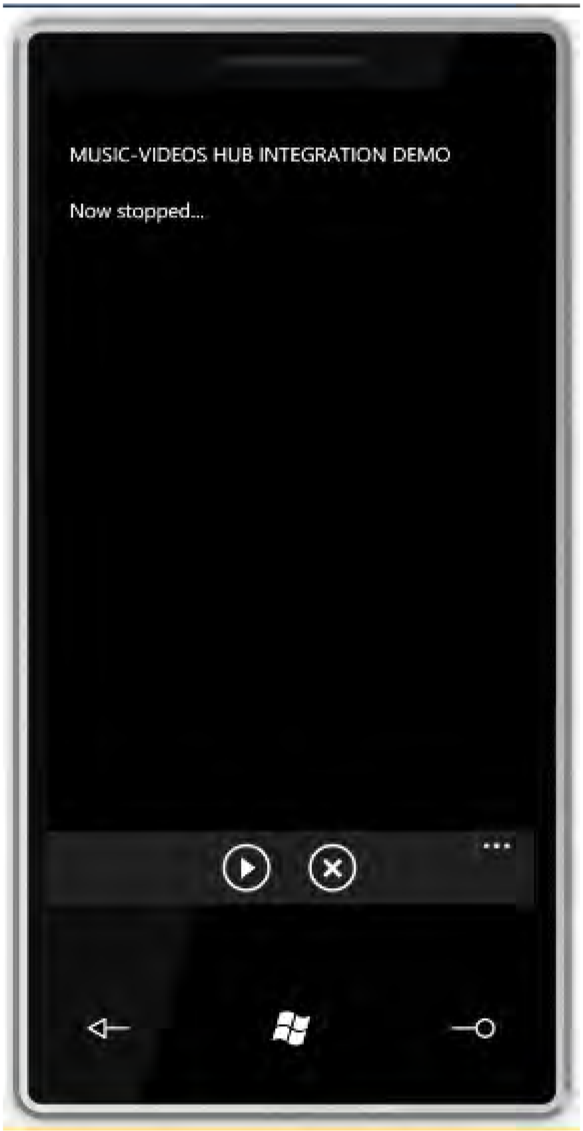
```
private void UpdateNowPlaying()
{
    MediaHistoryItem nowPlaying = new MediaHistoryItem();
    StreamResourceInfo sri = Application.GetResourceStream(
                         new Uri("NowPlayingIcon.jpg", UriKind.Relative));
    nowPlaying.ImageStream = sri.Stream;
    nowPlaying.Source = "";
    nowPlaying.Title = s.Name;
    nowPlaying.PlayerContext.Add(_key, songIndex.ToString());
    MediaHistory history = MediaHistory.Instance;
    history.NowPlaying = nowPlaying;
}
```

The same code is used for the UpdateHistory method, except the final call is to the WriteRecentPlay method instead of the NowPlaying property setting.

```
private void UpdateHistory()
{
    MediaHistoryItem historyItem = new MediaHistoryItem();
    StreamResourceInfo sri = Application.GetResourceStream(
                         new Uri("NowPlayingIcon.jpg", UriKind.Relative));
    historyItem.ImageStream = sri.Stream;
    historyItem.Source = "";
    historyItem.Title = s.Name;
    historyItem.PlayerContext.Add(_key, songIndex.ToString());
    MediaHistory history = MediaHistory.Instance;
    history.WriteRecentPlay(historyItem);
}
```

Usage

For this recipe, you need a physical device, because the emulator doesn't provide the Music-Videos hub. From Visual Studio 2010, select the Windows Phone 7 Device target output and then press Ctrl+F5. The application deploys to the physical device and runs, as shown in Figure 7-12.



MUSIC-VIDEOS HUB INTEGRATION DEMO

Now stopped...

Figure 7-12. The `MusicVideosHubIntegration` *application running on the device*

You can press the Play button on the application bar so that a random song from your media library is picked and played. Now press the Start button and go to the Music-Videos hub, and you should see in the Now Playing section the application icon and the song title (see Figure 7-13).

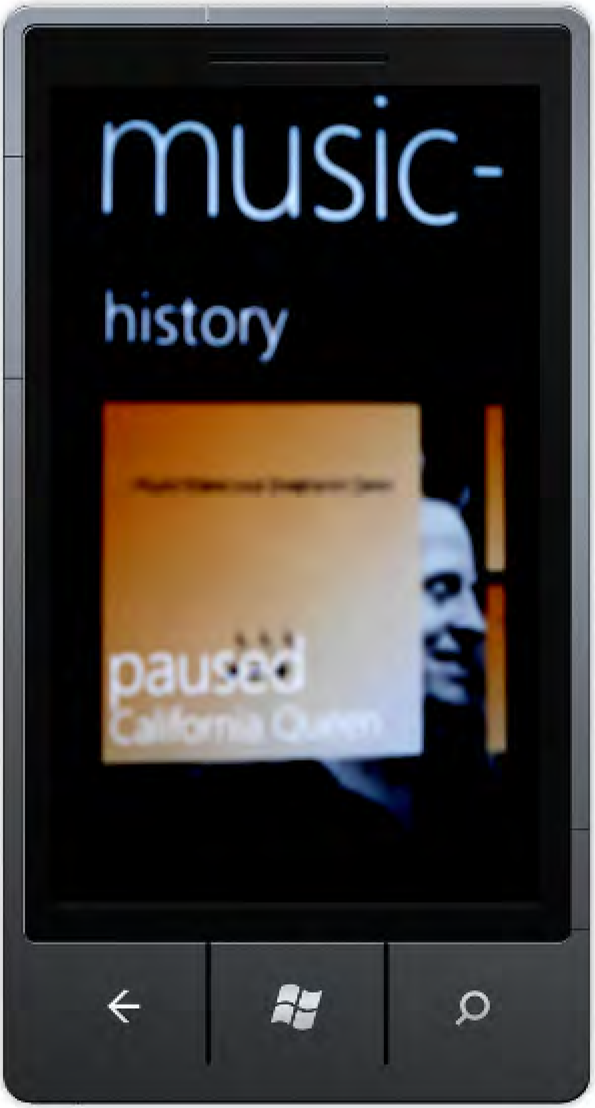


Figure 7-13. In the Music-Videos hub application, the History section shows the last played song.

Press the Now Playing icon from the hub, and the application executes again playing the song. Now press the Stop button and then the Play button again so that another song is played. Stop that song and then press the hardware Start button. Go to the Music-Videos hub and see that the History section is populated with an item. Sadly, there is no title describing the item, but by clicking it, you can discover that our application is running and the first song is being played.

CHAPTER 8

Isolated Storage

The isolated storage in Silverlight for Windows Phone 7 follows in some ways the architectural model used for the desktop version. The concept of this storage is to isolate the physical memory of one application from another. Isolated storage undoubtedly has its advantages: the application's data is available only to us, which means that no one else can compromise security by accessing it. Sure, you can also see disadvantages—our application will not be able to share data even partially with other apps, right? But to solve problems like this, you can just move the data to be shared "in the cloud."

Contained within isolated storage are the files that you choose to create and save in your application as well as the settings of the application itself.

The recipes in this chapter describe how to do the following:

- 8-1. Save a file in isolated storage and load it
- 8-2. Save serialized data
- 8-3. Modify settings of your application
- 8-4. Save a photo in isolated storage

Note If your application is uninstalled, the relative isolated storage is completely removed. Therefore, if the application is installed once again, that installation occurs as if it were being done for the first time. Take care to notify the user of this issue and to save (with prior written permission of the user) the data that the user wants to keep.

8-1. Saving a File in Isolated Storage and Loading It

Problem

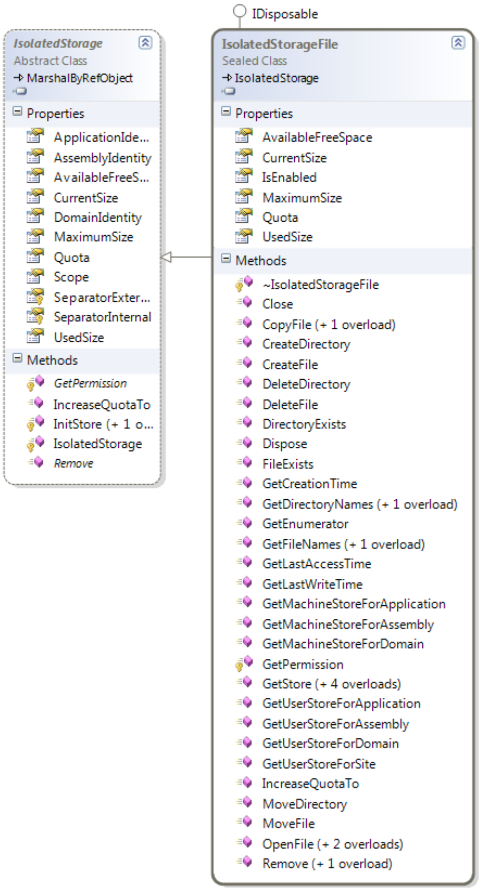
You want to create a simple notepad so the user can store notes locally and simply retrieve them later.

Solution

You must use the `IsolatedStorageFile` class to access isolated storage.

How It Works

The class that provides the ability to access data in isolated storage is `IsolatedStorageFile`, contained in the namespace `System.IO.IsolatedStorage`, which in turn is contained inside the `mscorlib` assembly. As you can see from the class diagram shown in Figure 8-1, you are allowed a number of tasks including creating directories. In this case, for example, you could ask the user whether to save data in a folder hierarchy



.

Figure 8-1. Isolated storage's class diagram

The Code

You start from an interface that will be composed essentially of a main page and two buttons. In the main page, the user will insert the title of the note itself. In the application bar, you will have two buttons: one to save the note and another to display the page that contains the list of notes already written and saved in isolated storage. While on the list page, you will have only a list box in which every item will be a note that is already saved. When a note is selected from the list, it will be loaded on the main page.

```
...
<Grid x:Name="LayoutRoot" Background="Transparent">
        <Grid.RowDefinitions>
            <RowDefinition Height="Auto"/>
            <RowDefinition Height="*"/>
        </Grid.RowDefinitions>
        <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
            <TextBlock x:Name="ApplicationTitle" Text="SIMPLE NOTE APPLICATION"
                                Style="{StaticResource PhoneTextNormalStyle}"/>
        </StackPanel>

        <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
            <Grid.RowDefinitions>
                <RowDefinition Height="45" />
                <RowDefinition Height="*" />
            </Grid.RowDefinitions>
            <TextBox Grid.Row="0" Name="FilenameTextBox" Text="NoteName" />
            <TextBox Grid.Row="1" Name="NoteTextBox" Text="Write  your note here" />
        </Grid>
    </Grid>

<phone:PhoneApplicationPage.ApplicationBar>
        <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
            <shell:ApplicationBarIconButton IconUri="/Images/save.png" Text="Save"
                   Click="SaveButton_Click" />
            <shell:ApplicationBarIconButton IconUri="/Images/notes.png" Text="Open"
                   Click="ListButton_Click" />

        </shell:ApplicationBar>
    </phone:PhoneApplicationPage.ApplicationBar>
...
```

It will be inside the handler `SaveButton_Click` that you will use the `IsolatedStorageFile` and `IsolatedStorageStream` classes, which enable you to create a file in isolated storage and to write within it a text stream.

```
private void SaveButton_Click(object sender, EventArgs e)
{
  try
  {
    using (var store = IsolatedStorageFile.GetUserStoreForApplication())
    using (var stream = new IsolatedStorageFileStream(FilenameTextBox.Text,
                            FileMode.Create,
                            FileAccess.Write,
                            store))
    {
      StreamWriter writer = new StreamWriter(stream);
      writer.Write(NoteTextBox.Text);
      writer.Close();
    }
  }
  catch (Exception)
  {
    MessageBox.Show("Error saving the file");
  }
}
```

First you need the storage dedicated to your application, which will be automatically retrieved from the GetUserStoreForApplication method that is based on your application. Then you create a stream to a file that will store the content in your application. This filename is contained in the Text field of the control FilenameTextBox. At this point, you just have to write the stream you have available, with a StreamWriter (remember to close the stream after you are finished).

If errors occur in the preceding transactions, the application will show a message to the user indicating that there was a problem.

The other handler used to display the page with the list of notes already saved will not be anything other than a call to the Navigate method of the NavigationService property (of the homonym type):

```
private void ListButton_Click(object sender, EventArgs e)
{
        NavigationService.Navigate(new Uri("/Notes.xaml", UriKind.Relative));
}
```

On the page where you will present the list, you will override the OnNavigatedTo event handler, to load the list of all files created in your isolated storage:

```
protected override void OnNavigatedTo(System.Windows.Navigation.NavigationEventArgs e)
{
  using (var store =
         System.IO.IsolatedStorage.IsolatedStorageFile.GetUserStoreForApplication())
  {
    this.NotesListBox.ItemsSource = store.GetFileNames();
  }
}
```

Basically, you're passing as a source of list box items the list of filenames in your store that will be shown onscreen. (The list is created based on a data template that you will see in Chapter 10.)

Click an item within the list to pass it as parameter of the main page via the following code:

```
private void Notes_SelectionChanged(object sender, SelectionChangedEventArgs e)
{
  if (e.AddedItems.Count > 0)
    NavigationService.Navigate(new Uri(
                          string.Format("/MainPage.xaml?note={0}", e.AddedItems[0]),
                          UriKind.Relative));
        }
```

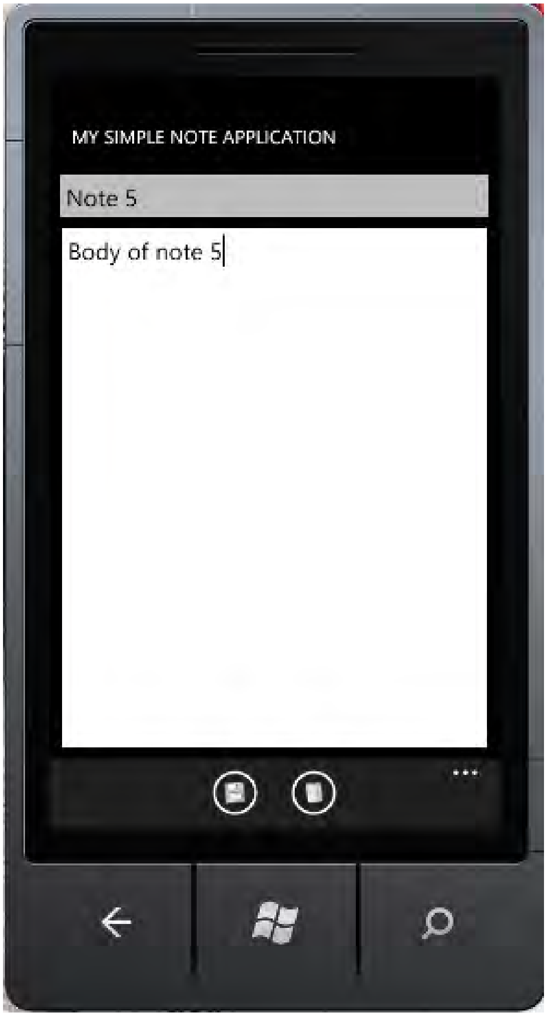
At this point, to complete the code of this application, you need to only override the `OnNavigatedTo` method in the main page. Then you manage the opening of the note by using the following code:

```
protected override void OnNavigatedTo(System.Windows.Navigation.NavigationEventArgs e)
{
  if (NavigationContext.QueryString.ContainsKey("note"))
  {
    string filename = this.NavigationContext.QueryString["note"];
    if (!string.IsNullOrEmpty(filename))
    {
      using (var store = System.IO.IsolatedStorage.IsolatedStorageFile
                .GetUserStoreForApplication())
      using (var stream = new IsolatedStorageFileStream(filename,
                            FileMode.Open,
                            FileAccess.ReadWrite,
                            store))
      {
        StreamReader reader = new StreamReader(stream);
        this.NoteTextBox.Text = reader.ReadToEnd();
        this.FilenameTextBox.Text = filename;
        reader.Close();
      }
    }
  }
}
```

There is not much difference between this code and the code used to save data, except that this time you first check whether a note to be opened has been passed. If it has, you aim to open it instead of creating a new note, as you did before when using a `StreamReader` to read and enter in the text box the body of the note that you read from the file.

Usage

From Visual Studio 2010, launch the application by pressing Ctrl+F5. The application displays, as shown in Figure 8-2. Write something and then click the button to save the note. Click to display the list of saved notes, as shown in Figure 8-3. (We had already saved some.) Click on another note that has been saved for loading and complete the cycle of the application.

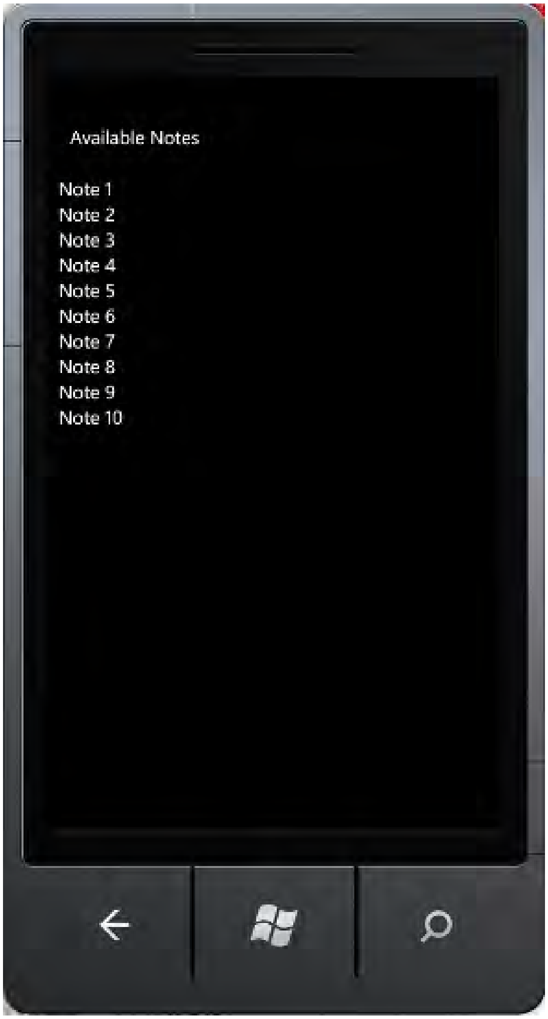


MY SIMPLE NOTE APPLICATION

Note 5

Body of note 5

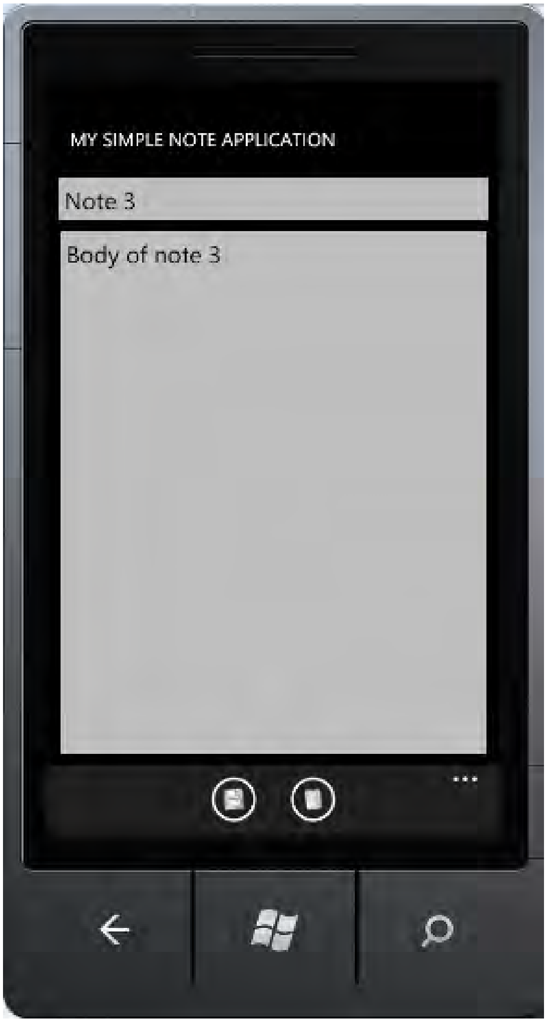
Figure 8-2. Main page of our application



Available Notes

Note 1
Note 2
Note 3
Note 4
Note 5
Note 6
Note 7
Note 8
Note 9
Note 10

Figure 8-3. *List of our notes*



MY SIMPLE NOTE APPLICATION

Note 3

Body of note 3

Figure 8-4. Editing a note

8-2. Saving Serialized Data

Problem

You want to serialize on disk the state of your objects, to load them later.

Solution

You must use XmlSerializer in combination with the IsolatedStorage classes to serialize the state of your objects in a file.

How It Works

The XmlSerializer class serializes (and deserializes) objects to and from XML documents. In serialization, we convert an object and its properties to a serial format (in this case, XML) that can be stored (in our case) or transported (in the case of services, for example). Deserialization is the process of re-creating the object from XML, by decorating the objects that correspond to XmlElement, and their properties that correspond to XmlAttribute.

The Code

For this recipe, we have chosen to complete the application logic of 7Drum by using the ExerciseManager class to save and load the exercises.

Just to refresh your memory, as you can see from the diagram in Figure 8-5, one of the entities involved in this recipe is ExerciseSettings, whose persistence logic (in this case, in the isolated storage) is handled by the ExerciseManager class, which deals simply with loading and saving a list of exercises.

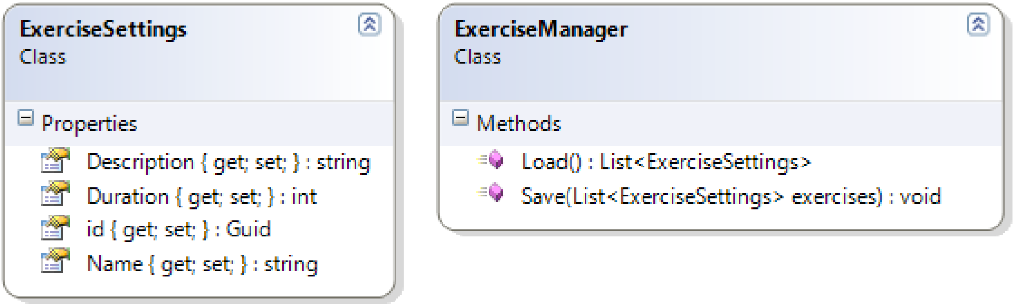

ExerciseSettings
Class
Properties
Description { get; set; } : string
Duration { get; set; } : int
id { get; set; } : Guid
Name { get; set; } : string
ExerciseManager
Class
Methods
Load() : List<ExerciseSettings>
Save(List<ExerciseSettings> exercises) : void

Figure 8-5. *Class Diagram of classes that works with exercise in 7Drum*

The first method that you want to consider is Save. The code is written as follows:

```
public static void Save(List<ExerciseSettings> exercises)
{
        using (var store = IsolatedStorageFile.GetUserStoreForApplication())
        using (var fileStream = store.CreateFile("exercises.xml"))
        using (var writer = new StreamWriter(fileStream))
        {
                XmlSerializer ser = new XmlSerializer(typeof(List<ExerciseSettings>));
                ser.Serialize(writer, exercises);
                writer.Close();
        }
}
```

This code, which makes extensive use of the construct `using`, behaves almost exactly the same way as the code of the previous recipe. In practice, you return the store associated with your application. Then in this store, you create the XML files for the exercises, you associate the `StreamWriter` to this `fileStream`, and finally, thanks to the `XmlSerializer` class, you write the XML serialization that results in the list of exercises. Closing the stream commits the changes, and the `using` statements coming at the end of the scope disposes the three variablese `writer, fileStream` and `store.`

In this way, you just serialized into isolated storage a list of `ExerciseSettings`. It is obvious that if your application requires more than one entity domain, you will have no problem using this code. If you have any doubts, the only thing you need to revise is the use of the `XmlSerializer` class.

The other method to analyze now is the `Load` method, which will deserialize the data from the XML file in our class:

```
public static List<ExerciseSettings> Load()
{
  List<ExerciseSettings> exercises = new List<ExerciseSettings>();
  using (IsolatedStorageFile storage = IsolatedStorageFile.GetUserStoreForApplication())
  if (storage.FileExists("exercises.xml"))
  {
    using (IsolatedStorageFileStream stream = storage.OpenFile("exercises.xml",
                FileMode.Open))
    {
      XmlSerializer xml = new XmlSerializer(typeof(List<ExerciseSettings>));
      exercises = xml.Deserialize(stream) as List<ExerciseSettings>;
      stream.Close();
    }
  }
  return exercises;
}
```

This code is not so difficult to understand if you analyze it step by step:

1. Create a list of `ExerciseSettings`.
2. Return to our store (at this point, it's clear that if you want to access the isolated storage this is a necessary step).
3. If there is an XML file called `exercises` in the store, do the following:
   1. Open a stream pointing to the file.
   2. Create an `XmlSerializer` class to list the `ExerciseSettings`.
   3. Deserialize the stream in the list of `ExerciseSettings`.
   4. Close the stream.

At this point, our application 7Drum is ready to save and upload lists of exercises, to keep them between sessions of our application.

Usage

After adding the implementation of the two methods of the class ExerciseManager, start the application from Visual Studio by pressing F5. To test if you have correctly written the code save a list of exercises and close 7Drum. Then reopen and check that between sessions the whole list of exercises has been saved.

8-3. Modifying Settings of Your Application

Problem

You want to locally save some settings about your application and then retrieve those settings later.

Solution

You must use the IsolatedStorageSettings class to access your application settings adding and deleting keys, like a dictionary.

How It Works

IsolatedStorageSettings enables you to easily and locally store user-specific data as key/value pairs in the object IsolatedStorageFile. You will see that the use of IsolatedStorageSettings is equal to the use of a dictionary <TKey, TValue>.

The Code

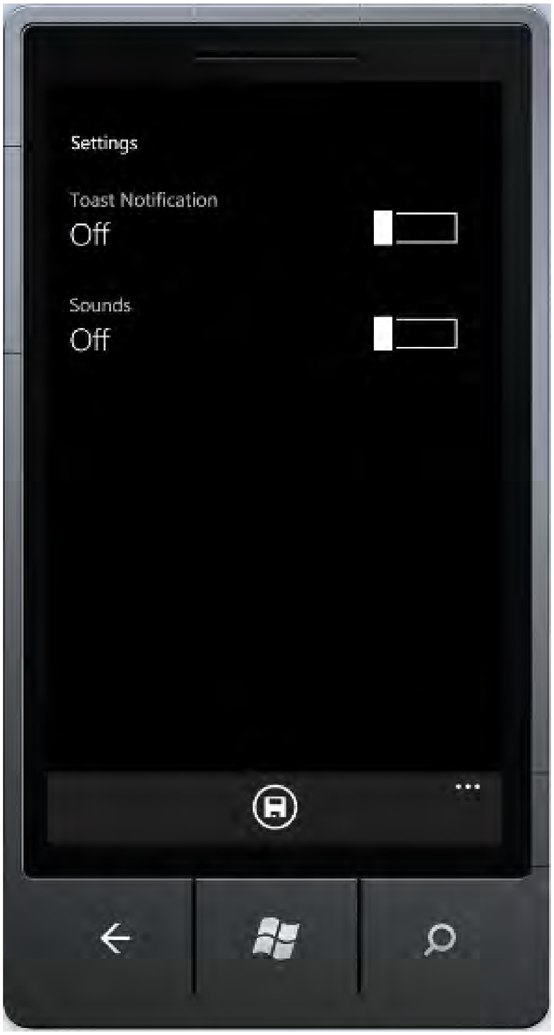
For this recipe, we want to show you how to complete another recipe that you can find in chapter 9 (in the cloud) by using push notification that will be displayed. A type of push notification is toast notification (more information in chapter 9). that requires that your application to be accepted and published on Marketplace must ask users whether they want to be notified with them. What better place for your application to store the user's choice than in the application settings?

To create this recipe, we have not focused on the application's user interface, but on the page of settings. Suppose that our application use notifications and sounds and we want to give to your user the possibility to disable or enable them

```
...
<phone:PhoneApplicationPage.ApplicationBar>
  <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
    <shell:ApplicationBarIconButton x:Name="SaveSettingsButton"
      IconUri="/icons/appbar.save.rest.png"
      Text="Save" Click="SaveSettingsButton_Click" />
  </shell:ApplicationBar>
</phone:PhoneApplicationPage.ApplicationBar>


<Grid x:Name="LayoutRoot" Background="Transparent">
  <Grid.RowDefinitions>
    <RowDefinition Height="Auto"/>
    <RowDefinition Height="*"/>
  </Grid.RowDefinitions>

  <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
    <TextBlock x:Name="PageTitle" Text="Settings" Style="{StaticResource
      PhoneTextNormalStyle}"/>
  </StackPanel>
  <ScrollViewer x:Name="ContentPanel" Margin="12,0,12,0" Grid.Row="1" >
    <StackPanel>
      <toolkit:ToggleSwitch Header="Toast Notification" x:Name="ToastSwitch"  />
      <toolkit:ToggleSwitch Header="Sounds" x:Name="SoundsSwitch" />
    </StackPanel>
  </ScrollViewer>
```

This XAML, inserted into the template of your page, will show an interface similar to that in Figure 8-6. We say *similar* because you might not be using the same icon or the same control to check the settings. For example, you could have chosen a check box or toggle button.

■ **Note** The control `ToggleSwitch` is contained in the Windows Phone controls toolkit, which is available on CodePlex.



Settings

Toast Notification

Off

Sounds

Off

Figure 8-6. The Settings page

In the code-behind, of the `page Settings`, within the constructor you subscribe to the loaded event with Settings_Loaded event handler:

```
public Settings()
{
    InitializeComponent();
    this.Loaded += new RoutedEventHandler(Settings_Loaded);
}
```

And you define two class-level constant strings:

```
...
private const string _toastEnabledKey = "ToastEnabled";
private const string _soundsEnabledKey = "SoundsEnabled";
...
```

Why do you do this? Because basically, by accessing settings through a dictionary, you will have a number of key/value pairs that could potentially include everything.

The event handler Settings_Loaded will retrieve your settings and change the value of the switch with the following code:

```
void Settings_Loaded(object sender, RoutedEventArgs e)
{
  if (IsolatedStorageSettings.ApplicationSettings.Contains(_toastEnabledKey))
  {
    var toast = IsolatedStorageSettings.ApplicationSettings[_toastEnabledKey].ToString();
    this.ToastSwitch.IsChecked = bool.Parse(toast);
  }
  if (IsolatedStorageSettings.ApplicationSettings.Contains(_soundsEnabledkey))
  {
    var sounds = IsolatedStorageSettings.ApplicationSettings[_soundsEnabledkey].ToString();
    this.SoundsSwitch.IsChecked = bool.Parse(sounds);
  }
}
```

Line by line, what happens is as follows:

1. If the dictionary contains the key that you have associated with the settings for the toast notification,
    1. Recover the value from ApplicationSettings (as with a normal dictionary), getting it as a string (in fact, the type of value is an object).
    2. Assuming you have a Boolean value, you just do the Parse. If you can't be sure about what you will (God save you), you might opt for a tryparse. Finally, you associate the parsed value to the IsChecked property of the switch.
2. Repeat the preceding step for the key that relates the sounds.

In this way, you have loaded the settings related to your application, and so now you can see how to save them, with the handler SaveSettingsButton_Click:

```
private void SaveSettingsButton_Click(object sender, EventArgs e)
{
  IsolatedStorageSettings.ApplicationSettings[_toastEnabledKey] =
     this.ToastSwitch.IsChecked;
  IsolatedStorageSettings.ApplicationSettings[_soundsEnabledkey] =
     this.SoundsSwitch.IsChecked;
}
```

The only thing to do to save a setting of the dictionary is assign a key and a value, then thinks at all the class IsolateStorageSetting. In order to pursue this exercise further , consider at this point using the settings to save the BPM of the metronome of our application 7Drum, for example.

Usage

Start the toast notification application by pressing F5 from Visual Studio. Open the Settings page. Change the settings and save them, thereby provoking the tombstoning of this application. Start the application again and open the Settings page to see that your settings have been saved.

8-4. Saving a Photo in Isolated Storage

Problem

You want to create a photo catalog application that captures from the camera device and saves locally, not in the media library.

Solution

You must work with the PictureDecoder class and store the data as an array of bytes, because an image is essentially a stream of bytes. Then you can use this array to write data inside an IsolatedStorageFile class.

How It Works

PictureDecoder is used to decode a JPEG file into a WriteableBitmap that provides a BitmapSource (constant set of pixels) that can be written.

The Code

In this recipe, you will play with some features of Windows Phone, combining them in an interesting application. At this point in the chapter, you know how isolated storage works and how you can add files to it and open them. Now you want to create an organized list of directories (1 directory : 1 album)

Our interface is composed of a home page, from which the user can start to take a photo, and the image gallery, where the user can navigate inside the storage structure.

HomePage.xaml contains this structure:

```
...
<Grid x:Name="LayoutRoot" Background="Transparent">
  <Grid.RowDefinitions>
    <RowDefinition Height="Auto"/>
    <RowDefinition Height="*"/>
  </Grid.RowDefinitions>
  <!--TitlePanel contains the name of the application and page title-->
  <StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
    <TextBlock x:Name="ApplicationTitle" Text="Photo App" Style="{StaticResource
        PhoneTextNormalStyle}"/>
  </StackPanel>

  <Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
    <Button Content="Capture a Photo" Height="72" Margin="47,6,76,0" Name="CameraButton"
          VerticalAlignment="Top" Click="CameraButton_Click" />
    <Image Height="337" HorizontalAlignment="Left" Margin="12,84,0,0" Name="image"
          Stretch="Fill" VerticalAlignment="Top" Width="438" />
    <TextBox Height="72" HorizontalAlignment="Left" Margin="-4,457,0,0"
          Name="FileNameTextBox" Text="TextBox" VerticalAlignment="Top" Width="460" />
    <TextBlock Height="30" HorizontalAlignment="Left" Margin="98,433,0,0"
          Name="textBlock1" Text="Choose a name and album" VerticalAlignment="Top"
Width="242" />
    <ListBox Height="96" HorizontalAlignment="Left" Margin="6,522,0,0" Name="AlbumsListBox"
          VerticalAlignment="Top" Width="444" />
  </Grid>
</Grid>

<phone:PhoneApplicationPage.ApplicationBar>
  <shell:ApplicationBar IsVisible="True" IsMenuEnabled="True">
    <shell:ApplicationBarIconButton IconUri="/icons/appbar.save.rest.png" Text="Save"
       x:Name="SaveButton" Click="SaveButton_Click" />
    <shell:ApplicationBarIconButton IconUri="/icons/appbar.folder.rest.png" Text="Archive"
       x:Name="PhotosButton" Click="PhotosButton_Click" />

    <shell:ApplicationBar.MenuItems>
      <shell:ApplicationBarMenuItem Text="Create Album" x:Name="CreateAlbumButton"
        Click="CreateAlbumButton_Click" />
    </shell:ApplicationBar.MenuItems>
  </shell:ApplicationBar>

</phone:PhoneApplicationPage.ApplicationBar>

...
```

This Xaml will be shown, as you can see in Figure 8-7. When the user clicks the `CameraButton`, you want to start `CameraCaptureTask` and show a preview. Then the user can choose an album and a filename.

Start analyzing the `CreateAlbumButton_Click` event handler, which shows a page where the user can create a new album:

```
...
private void CreateAlbumButton_Click(object sender, EventArgs e)
{
  NavigationService.Navigate(new Uri("/CreateAlbum.xaml", UriKind.Relative));
}
...
```

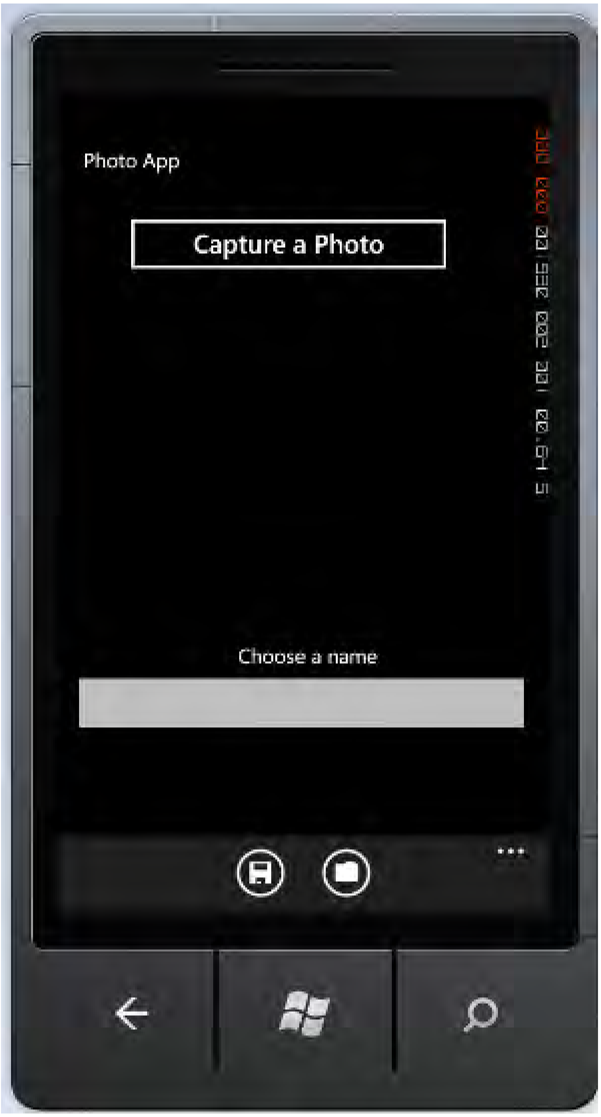


Figure 8-7. *A screenshot of the application's main page*

This code navigates to the `CreateAlbum.xaml` page, which is easy to understand because it's composed of only three elements: a text block, a text box, and a button.

```
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
  <TextBlock Height="30" HorizontalAlignment="Center" Text="Album Name"
    VerticalAlignment="Top" />
  <TextBox Height="72" HorizontalAlignment="Left" Margin="0,42,0,0"
    Name="AlbumNameTextbox" Text="Album" VerticalAlignment="Top" Width="460" />
  <Button Content="Create" Height="72" HorizontalAlignment="Left" Margin="12,120,0,0"
    Name="CreateAlbumButton" VerticalAlignment="Top" Width="438"
    Click="CreateAlbumButton_Click" />
</Grid>
```

The most important part of this code is the event handler associated with the click of CreateAlbumButton, because here you create the directory that will contain the new album:

```
private void CreateAlbumButton_Click(object sender, RoutedEventArgs e)
{
  using (var store = IsolatedStorageFile.GetUserStoreForApplication())
  {
    if (store.DirectoryExists(this.AlbumNameTextbox.Text))
      MessageBox.Show("Album already exists");
    else
    {
      store.CreateDirectory(AlbumNameTextbox.Text);
      NavigationService.Navigate(new Uri("/MainPage.xaml", UriKind.Relative));
    }
  }
}
```

Similarly, by creating a new file, the IsolatedStorageFile class allows us to access the functionality of the directories. So first you check whether an album with that name exists. If it does, you show a warning to the user. Otherwise, you create the album and move into the main window to enable the user to fill the new album.

At this point, it is time to show what happens in the main window when the user clicks CameraButton. But first there are some preliminary steps to be done, including editing the MainPage constructor in the usual way (in order to leave some actions not discriminatory for the operation of the application, when the page is loaded).

```
public MainPage()
{
  InitializeComponent();
  this.Loaded += new RoutedEventHandler(MainPage_Loaded);
}
```

And you declare at the class level the following member:

```
...
CameraCaptureTask cameraTask;
...
```

Now take a look at the implementation of the loaded event handler:

```
...
void MainPage_Loaded(object sender, RoutedEventArgs e)
        {
            cameraTask = new CameraCaptureTask();
            cameraTask.Completed += new EventHandler<PhotoResult>(cameraTask_Completed);
            AlbumsListBox.ItemsSource = IsolatedStorageFile.GetUserStoreForApplication()
                    .GetDirectoryNames();
        if (AlbumsListBox.Items.Count > 0)
            AlbumsListBox.SelectedIndex = 0;
        }
...
```

You initialize cameraTask and associate it to the completed event on your event handler cameraTask_Completed, but this hides the code that allows us to interact with the method GetDirectoryNames, which retrieves the names of all directories in isolated storage. At this point, for the first part of the interface, you complete the click handler for the CameraButton component:

```
private void CameraButton_Click(object sender, RoutedEventArgs e)
{
  cameraTask.Show();
}
```

That does nothing more than start the task to use the photo camera. Now assume that the user has clicked a picture. You must provide a preview, because maybe you have implemented in your application the capability to apply filters or other amazing features (we leave this to your imagination).

We'll show you the preview inside the image control with the code contained within the event handler cameraTask_Completed, but before we do this, you must add another member at the class level:

```
        ...
        byte[] _imageAsByte;
        ...
```

Then all you need to do with _imageAsByte is as you can see below

```
        void cameraTask_Completed(object sender, PhotoResult e)
        {
            if (e.TaskResult == TaskResult.OK)
            {
                _imageAsByte = new byte[e.ChosenPhoto.Length];
                e.ChosenPhoto.Read(_imageAsByte, 0, _imageAsByte.Length);

                e.ChosenPhoto.Seek(0, SeekOrigin.Begin);

                this.image.Source = PictureDecoder.DecodeJpeg(e.ChosenPhoto);
            }
        }
```

This code is responsible for checking that the user has actually accepted the photo from the interface. Then you create an array of bytes as large as the size of the photo taken, and you start reading the photo taken, instantiating the array, and filling it with the image. Finally, returned to the beginning of the image you convert it to JPEG, thanks to the support class PictureDecoder showing the image on the display.

The user is ready, in your case, to apply filters to the image or to edit it as desired (if you allowed that), and then to save it. In the application bar, you have a button that does just this—save the image in the library, according to the folder and filename chosen.

```
private void SaveButton_Click(object sender, EventArgs e)
{
  if (_imageAsByte == null)
  {
    MessageBox.Show("Nothing to Save");
    return;
  }

  using (var store = IsolatedStorageFile.GetUserStoreForApplication())
  {
    if (!store.FileExists(System.IO.Path.Combine(
                    AlbumsListBox.SelectedItem as string,
                   FileNameTextBox.Text)) ||
         store.FileExists(System.IO.Path.Combine(
                    AlbumsListBox.SelectedItem as string,FileNameTextBox.Text))
           && MessageBox.Show("Overwrite the file?", "Question",
                              MessageBoxButton.OKCancel) == MessageBoxResult.OK)
         {
       using (var stream = store.CreateFile(System.IO.Path.Combine(
                  AlbumsListBox.SelectedItem as string, FileNameTextBox.Text)))
       {
           stream.Write(_imageAsByte, 0, _imageAsByte.Length);
       }
     }
  }
}
```

First, by using this method, you ensure that it is legitimate for the user to save an image, because it is actually present. Then you access the isolated storage to ensure that in the selected directory (album), there isn't a file with that name. If there is, you ask the user to overwrite it. If one of these two conditions occurs, you create the file stream in the file contents in the directory specified and write the stream, by using the array of bytes that represents the image.

At this point, the photo has been saved and inserted in the gallery(your gallery and not the media library), and you just have to scroll down to discover the pictures you have saved. Then via the button click to PhotosButton, thanks to the usual Navigation Service, will lead you to that page Albums is the page used to show images

The page consists of two list boxes for albums and other images:

```
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
  <Grid.RowDefinitions>
    <RowDefinition Height="150" />
    <RowDefinition Height="*" />
  </Grid.RowDefinitions>
  <ListBox Height="150" HorizontalAlignment="Left" Name="AlbumsListBox"
           VerticalAlignment="Top" Width="460"
           SelectionChanged="AlbumsListBox_SelectionChanged" />
  <ListBox Grid.Row="1" Height="546" HorizontalAlignment="Left" Margin="-4,0,0,0"
           Name="PhotoListbox" VerticalAlignment="Top" Width="460" />
</Grid>
```

When a new album is selected, the directory changes to list the files in it. But first, you want to show all the directories in the same way in which you showed them on the main page:

```
void Albums_Loaded(object sender, RoutedEventArgs e)
{
  using (IsolatedStorageFile store =
             IsolatedStorageFile.GetUserStoreForApplication())
  {
    this.AlbumsListBox.ItemsSource = store.GetDirectoryNames();
  }
}
```

And when an element of the list `AlbumsListBox` is selected, you change the directory listing:

```
private void AlbumsListBox_SelectionChanged(object sender, SelectionChangedEventArgs e)
{
  using (IsolatedStorageFile store = IsolatedStorageFile.GetUserStoreForApplication())
  {
    this.PhotoListbox.ItemsSource = store.GetFileNames(string.Format("{0}\\*",
              this.AlbumsListBox.SelectedItem));
  }
}
```

As you can see, you've used a search function, which when used with a wildcard, could display all the files in a selected folder. However, you could apply a different pattern in other cases—for example, if the user wanted to do a search within the photos.

Usage

Run the application from Visual Studio by pressing F5. The application can run on either the physical device or the emulator. However, you will not be able to debug the application on the physical device if you are connected to Zune, because it stops the multimedia functionalities. To debug, use WPConnect. Start the application, create an album, take a picture with the camera, and save it in your album. Create another album and take another photo, and save that photo in the second album. Search through the albums in your application to verify the effective functioning of your gallery. The process is shown in Figures 8-8 through 8-13 to give you an idea of how the application works. Notice that the pictures created and saved in this way will be not saved within the media library and Microsoft encourages to interact with Media hub, then consider a function that imports the image inside media library.

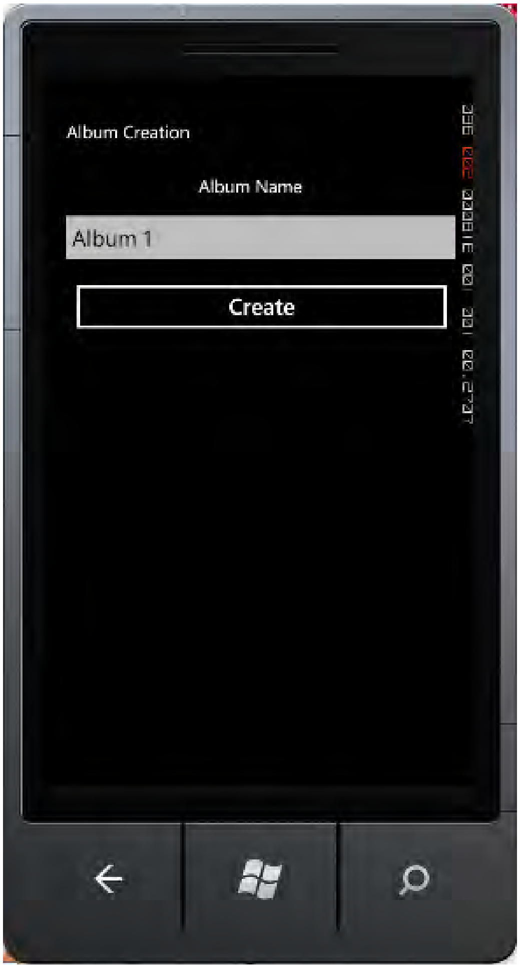


Figure 8-8. Creating an album

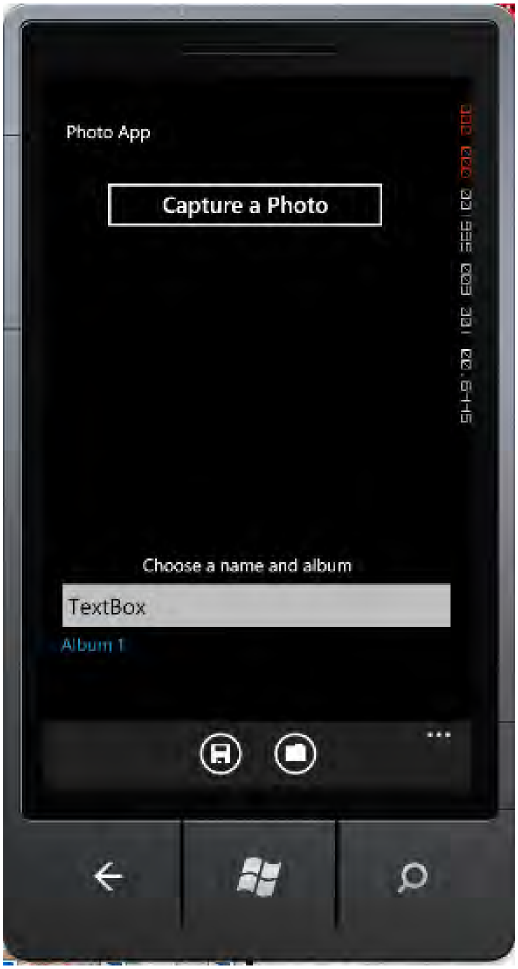


Figure 8-9. Selecting an album

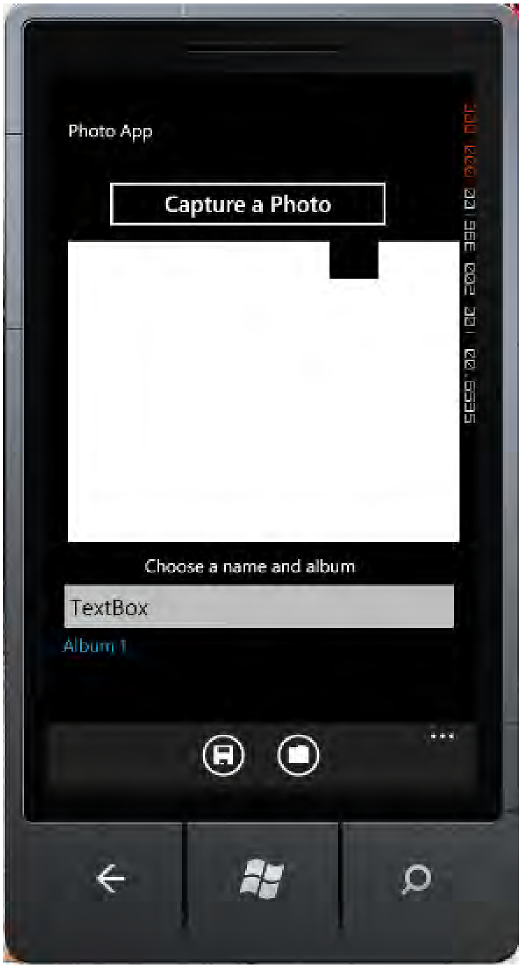


Figure 8-10. Capturing the photo

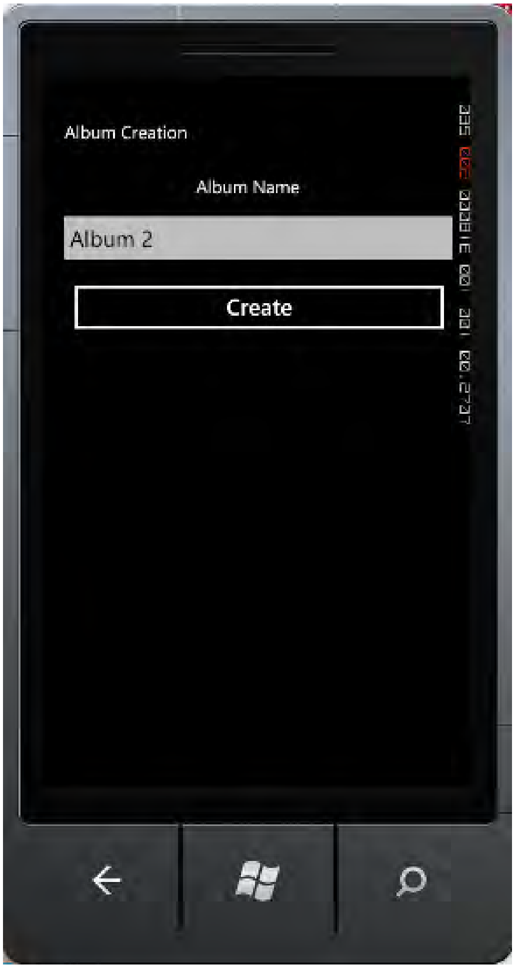


Figure 8-11. Creating another album

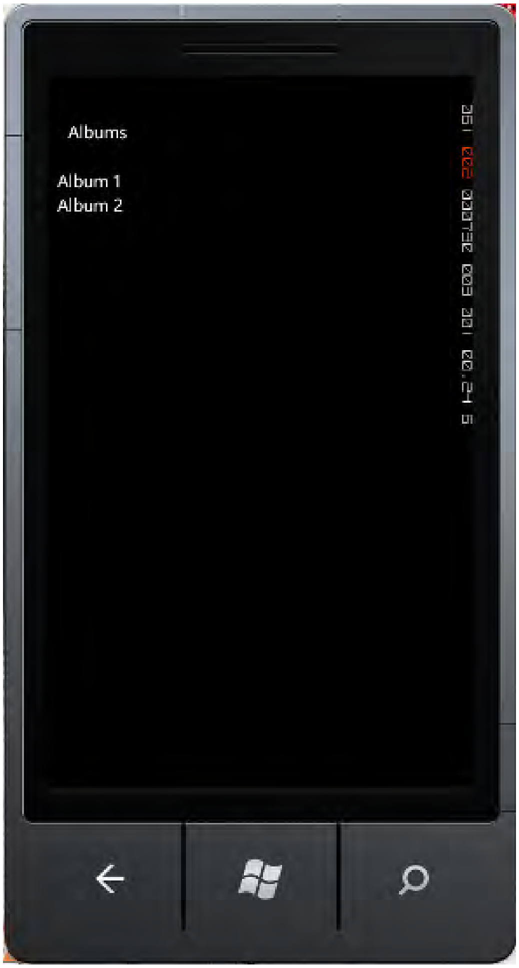


Figure 8-12. Navigating the album

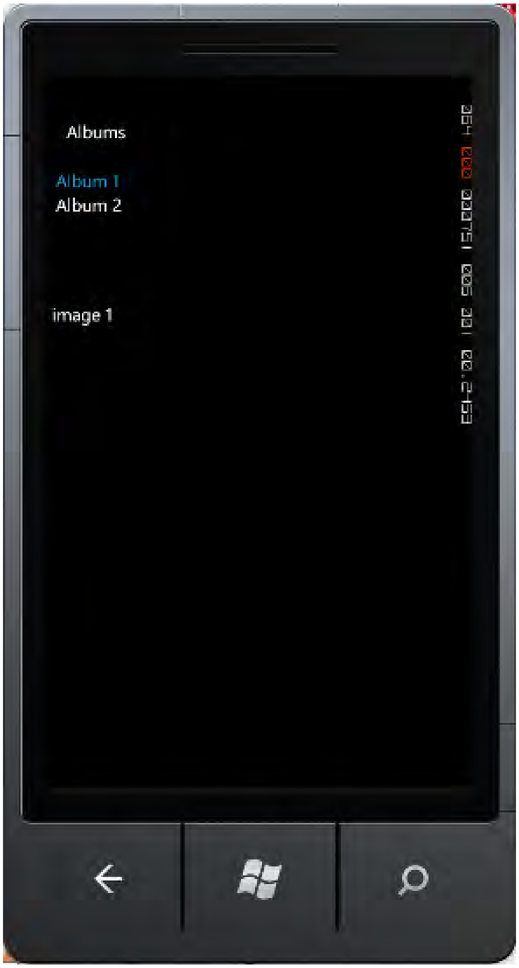


Figure 8-13. Listing the picture in the album

CHAPTER 9

In the Cloud

In last years the mobile device's market is increased because modern devices covers more than the simple necessity to make a call.This chapter covers interactions with services "in the cloud." You will see how Windows Phone 7 is designed to enable users to always remain connected to the services they need.

The recipes in this chapter describe how to do the following:

- Interact with WCF
- Create a feed reader
- Create a Google API–based translator
- Use push notification

9-1. Interacting with WCF

Problem

You want to build an application that interacts with a service by using Windows Communication Foundation (WCF).

Solution

You need to create your service (or get the address of the service that you want to query), and add a reference to that service so that you can query your methods and access the exposed `DataContract`.

How It Works

Windows Phone was created to use services, but you should always remember one thing when you work with it: service access is always asynchronous, because (as with the use of services in Silverlight for the Web) you must not freeze the user interface.

The implementation of Silverlight for Windows Phone provides a limited set of features to work on a network, as compared to its "big brother." Only Windows Communication Foundation, `HttpWebRequest`, and `WebClient` can be used with Silverlight for Windows Phone.

We will use web services, connecting your application to the Microsoft Research Maps service, which enables us to take pictures of the world (via satellite), based on `GeoCoordinate`.

The Code

Unfortunately, you cannot dynamically create a proxy to a service by using the `ChannelFactory<TChannel>` class, because it is not supported by this Windows Phone version. Therefore, to create a reference, you must use the command-line tool `slsvcutil.exe` to create a proxy for use at compile time.

Because creating a WCF service is not the goal of this book. In this section, you will complete Recipe 6-3 from Chapter 6 (which is about the use of the Microsoft Research Maps web service).

To complete the recipe, you need to see how to add a reference to the service (so that Visual Studio is running only the `slsvcutil.exe` utility to create a proxy), as in Figure 9-1.

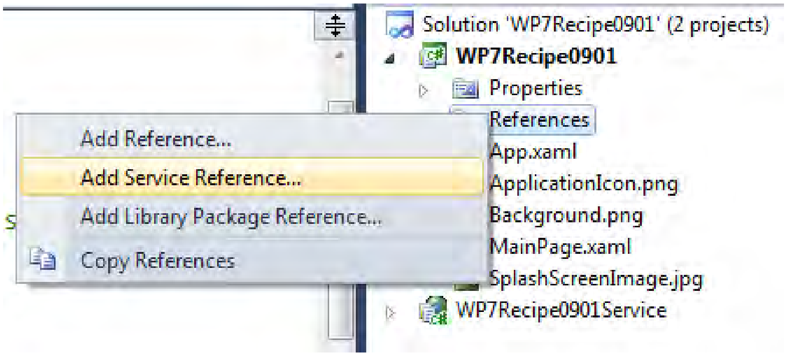
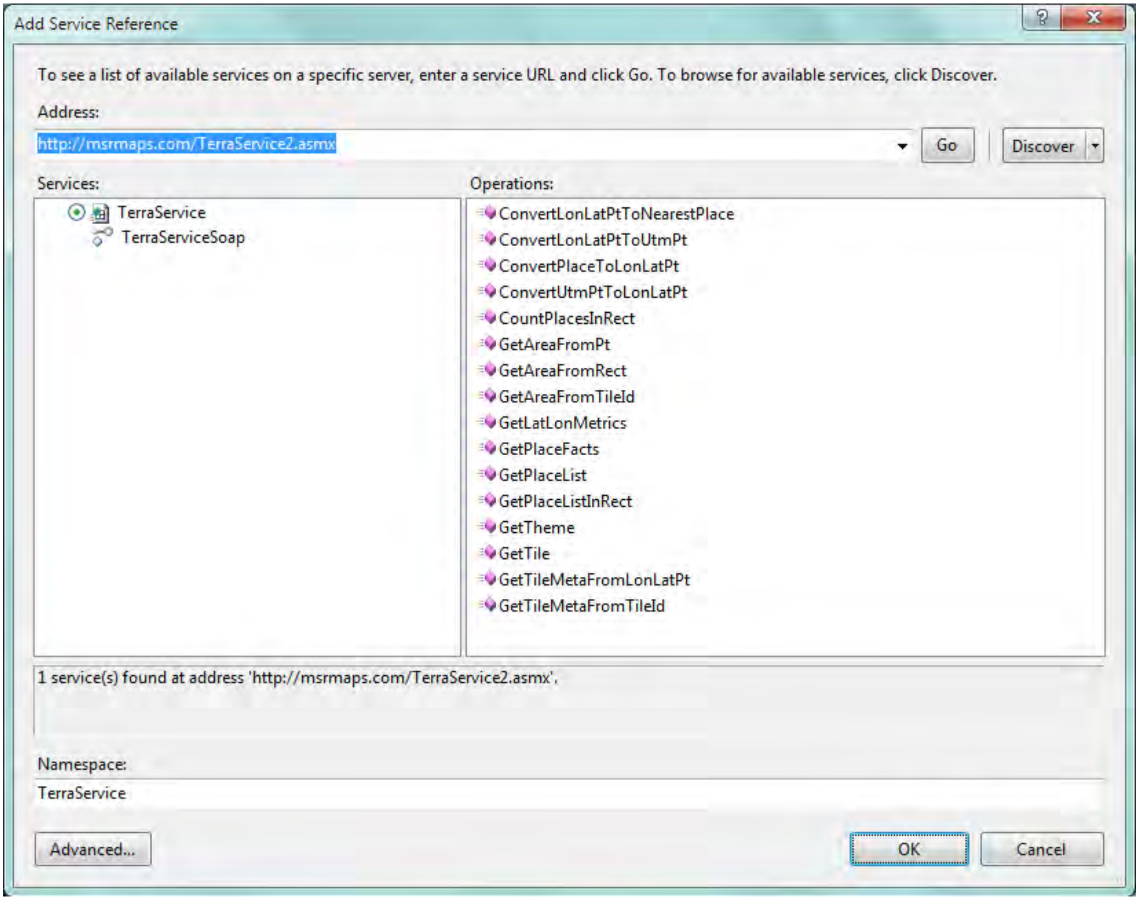


Figure 9-1. Add a service reference.

As you learned in Recipe 6-3, to use Bing Maps, you must be registered as a Windows Phone developer. Therefore, you might prefer to use the map service offered by Microsoft Research.

Then you need to add a reference, calling it `TerraService`, to the service available at `http://msrmaps.com/TerraService2.asmx`, as shown in Figure 9-2,. As you can see in the picture, there are many methods that you can call, but we are interested in `GetAreaFromPt` and `GetTile`.



To see a list of available services on a specific server, enter a service URL and click Go. To browse for available services, click Discover.

Address: http://msrmaps.com/TerraService2.asmx

Services:

- TerraService
  - TerraServiceSoap

Operations:

- ConvertLonLatPtToNearestPlace
- ConvertLonLatPtToUtmPt
- ConvertPlaceToLonLatPt
- ConvertUtmPtToLonLatPt
- CountPlacesInRect
- GetAreaFromPt
- GetAreaFromRect
- GetAreaFromTileId
- GetLatLonMetrics
- GetPlaceFacts
- GetPlaceList
- GetPlaceListInRect
- GetTheme
- GetTile
- GetTileMetaFromLonLatPt
- GetTileMetaFromTileId

1 service(s) found at address 'http://msrmaps.com/TerraService2.asmx'.

Namespace: TerraService

Figure 9-2. Referencing a service

At this point, you have a reference to your service and you can call the method that interests you. It's a best practice to instantiate the server proxy in the Loaded event handler, thereby ensuring that the application starts as soon as possible and that the user maintains control of the phone:

```
using Microsoft.Phone.Net.NetworkInformation;
...

  TerraService.TerraServiceSoapClient proxy = null;
  GeoCoordinateWatcher geoWatcher = null;

  // Constructor
  public MainPage()
  {
    InitializeComponent();
    InizializeServices();
    Loaded += new RoutedEventHandler(MainPage_Loaded);
  }

...

  private void InizializeServices()
  {
    proxy = new TerraService.TerraServiceSoapClient();
    geoWatcher = new GeoCoordinateWatcher();
  }

...

  void MainPage_Loaded(object sender, RoutedEventArgs e)
  {
    if (NetworkInterface.GetIsNetworkAvailable())
      MessageBox.Show("No Network available. The application will not work fine");

    proxy.GetAreaFromPtCompleted +=
        new EventHandler<TerraService.GetAreaFromPtCompletedEventArgs>(
                proxy_GetAreaFromPtCompleted);
    proxy.GetTileCompleted +=
        new EventHandler<TerraService.GetTileCompletedEventArgs>(
                proxy_GetTileCompleted);

    geoWatcher.PositionChanged +=
        new EventHandler<GeoPositionChangedEventArgs<GeoCoordinate>>(
               geoWatcher_PositionChanged);

    geoWatcher.StatusChanged +=
        new EventHandler<GeoPositionStatusChangedEventArgs>(
               geoWatcher_StatusChanged);

    geoWatcher.Start();

}
```

As you can see in this code, you subscribe an event handler to two events (GetAreaFromPtCompleted and GetTileCompleted) because service calls are made asynchronously, because you are working with Silverlight (and this is the default way of working with Silverlight) and because it would make no sense to lock the phone interface for too long.

Then you look at the code to see whether a network connection is available. If you need access to a web service, it's a good idea to indicate that users will have access to a limited version of your software if they don't activate a network interface.

```
void geoWatcher_PositionChanged(object sender, GeoPositionChangedEventArgs<GeoCoordinate> e)
{
  if (!e.Position.Location.IsUnknown)
  {
    proxy.GetAreaFromPtAsync(
    //the ActualPosition
    new TerraService.LonLatPt()
      {
        Lat = e.Position.Location.Latitude,
        Lon = e.Position.Location.Longitude
      },
    1,
    TerraService.Scale.Scale2km,
    (int)ContentPanel.ActualWidth,
    (int)ContentPanel.ActualHeight);
  }
}
```

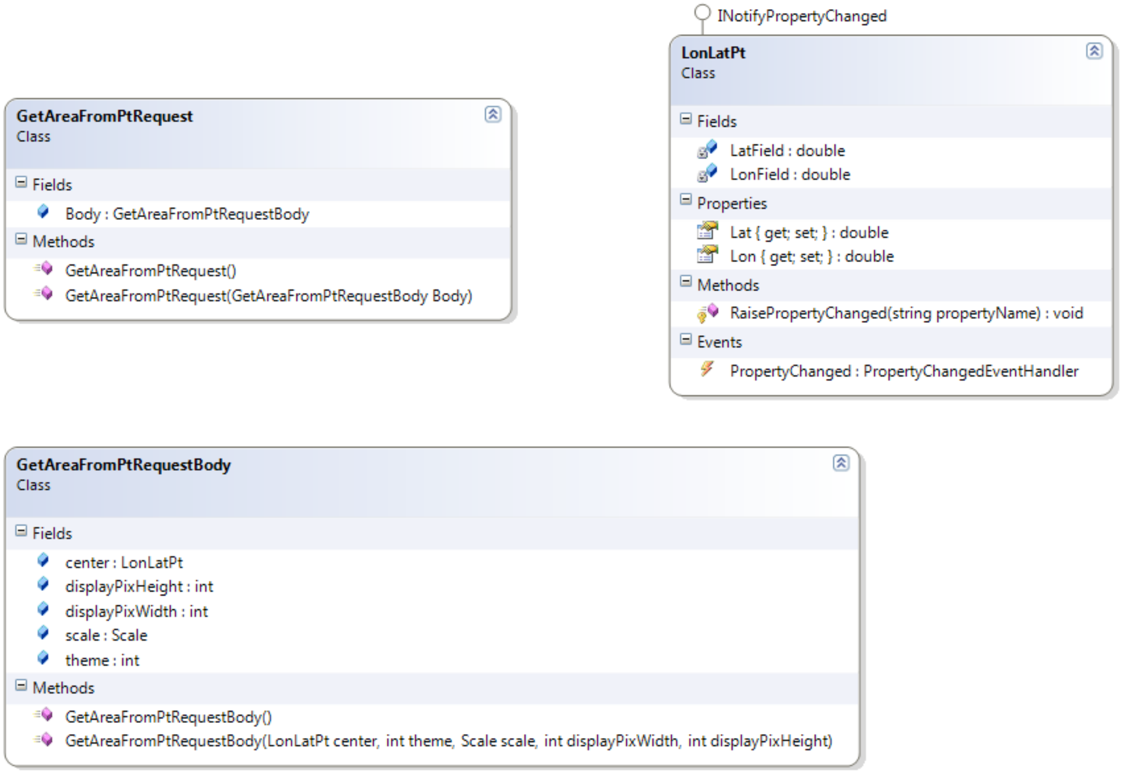

INotifyPropertyChanged
LonLatPt
Class
Fields
LatField : double
LonField : double
Properties
Lat { get; set; } : double
Lon { get; set; } : double
Methods
RaisePropertyChanged(string propertyName) : void
Events
PropertyChanged : PropertyChangedEventHandler
GetAreaFromPtRequest
Class
Fields
Body : GetAreaFromPtRequestBody
Methods
GetAreaFromPtRequest()
GetAreaFromPtRequest(GetAreaFromPtRequestBody Body)
GetAreaFromPtRequestBody
Class
Fields
center : LonLatPt
displayPixHeight : int
displayPixWidth : int
scale : Scale
theme : int
Methods
GetAreaFromPtRequestBody()
GetAreaFromPtRequestBody(LonLatPt center, int theme, Scale scale, int displayPixWidth, int displayPixHeight)

***Figure 9-3.** Class diagram of classes used by* `GetAreaFromPt`

In Figure 9-3, you can see all the classes you need to prepare a `GetAreaFromPt` request, for whose response you must analyze the implementation of the event handler that handles the response.

```
void proxy_GetAreaFromPtCompleted(object sender,
                                  TerraService.GetAreaFromPtCompletedEventArgs e)
{
  if (e.Error == null)
  {
    int startX = e.Result.NorthWest.TileMeta.Id.X;
    int endX = e.Result.NorthEast.TileMeta.Id.X;
    int startY = e.Result.NorthWest.TileMeta.Id.Y;
    int endY = e.Result.SouthWest.TileMeta.Id.Y;

    for (int x = startX; x < endX; x++)
      for (int y = startY; y >= endY; y--)
      {
        Image image = new Image();
        image.Stretch = Stretch.None;
        image.Margin = new Thickness(
             (x - startX) * 200 - e.Result.NorthWest.Offset.XOffset,
             (startY - y) * 200 - e.Result.NorthWest.Offset.YOffset,
             0,
             0);
        ContentPanel.Children.Insert(0, image);

        TileId tileId = e.Result.NorthWest.TileMeta.Id;
        tileId.X = x;
        tileId.Y = y;

        proxy.GetTileAsync(tileId, image);
      }
  }
  else
    MessageBox.Show(e.Error.Message);
}
```

In this way, you will call the GetTile method as many times as needed to display each image according to the level of detail chosen. You will build a mosaic of images that are inserted as children of the container that you had prepared ad hoc in Recipe 6-3 in Chapter 6.

```
void proxy_GetTileCompleted(object sender, TerraService.GetTileCompletedEventArgs e)
{
    if (e.Error == null)
    {
        Image img = e.UserState as Image;
        BitmapImage bitmap = new BitmapImage();
        bitmap.SetSource(new MemoryStream(e.Result));
        img.Source = bitmap;
    }
}
```

To further clarify, the use of this service presents some pros and cons:

> *Pros*: The service allows you to retrieve maps for educational purposes without worrying about record in any place like happens when you use bing maps, but simply making requests. The service responses are rapid, and the service can be interrogated via different protocols.
>
> *Cons*: The service provides no support for maps outside the United States.

Usage

Normally this application needs to run on a physical device, so change your output target to Windows Phone 7 Device and start the application pressing F5 than wait that your application become available and look that the map charges.

9-2. Creating a Feed Reader

Problem

You want to create a feed reader about a service and follow the link attached to every news to see the destination insinde the browser.

Solution

You must use an object of the `WebClient` class and open the link by using `WebBrowserTask`.

How It Works

For our application, we chose an Atom feed made available by the British Broadcasting Corporation (BBC), but it's clear that you can use all feeds in Atom format.

A feed is simply a document made available on the Web (we hope always at the same address) in an XML format that follows a specific syntax, described in this XSD:

```
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema" elementFormDefault="qualified"
                 xmlns:atom="www.atom.com">
  <xs:import namespace="www.atom.com" schemaLocation="atom.xsd"/>
  <xs:element name="rss">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="channel"/>
      </xs:sequence>
      <xs:attribute name="version" type="xs:string"/>
      <xs:attribute name="xmlns:atom" type="xs:string"/>
    </xs:complexType>
  </xs:element>
  <xs:element name="channel">
```

```
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="link"/>
        <xs:element ref="title"/>
        <xs:element ref="link"/>
        <xs:element ref="description"/>
        <xs:element ref="language"/>
        <xs:element ref="copyright"/>
        <xs:element ref="item" maxOccurs="unbounded"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <xs:element name="title" type="xs:string"/>
  <xs:element name="link" type="xs:string"/>
  <xs:element name="description" type="xs:string"/>
  <xs:element name="language" type="xs:string"/>
  <xs:element name="copyright" type="xs:string"/>
  <xs:element name="item">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="title"/>
        <xs:element ref="description"/>
        <xs:element ref="link"/>
        <xs:element ref="pubDate"/>
        <xs:element ref="guid"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <xs:element name="pubDate" type="xs:string"/>
  <xs:element name="guid" type="xs:string"/>
</xs:schema>
```

The Code

You can start with the preceding XSDto generate classes that work to serialize/deserialize according to the structure defined by the schema. And this is what you are going to do now. Create three classes in your project with these names:

- `Rss`
- `Channel`
- `Item`

In Rss.cs, include the following code:

```
[XmlRoot(ElementName="rss",Namespace="")]
public class Rss
{
  private Channel _channel;

  private string _version;
  [XmlElement(ElementName="channel")]
  public Channel Channel
  {
    get
    {
      return this._channel;
    }
    set
    {
      this._channel = value;
    }
  }

  [XmlElement(ElementName = "version")]
  public string Version
  {
    get
    {
      return this._version;
    }
    set
    {
      this._version = value;
    }
  }
}
```

The attributes used on class and properties say clearly that you are going to use `XmlSerializer` to deserialize the response in your classes and then go up with `Channel.cs`:

```
[DataContract]
public class Channel
{
        private string _atomLink;
        private string _title;
        private string _link;
        private string _description;
        private string _language;
        private string _copyright;
        private Item[] _items;

        [XmlElement(ElementName = "atom:link")]
        public AtomLink AtomLink
        {
            get
            {
                return this._atomLink;
            }
            set
            {
                this._atomLink = value;
            }
        }

        [XmlElement(ElementName = "title")]
        public string Title
        {
            get
            {
                return this._title;
            }
            set
            {
                this._title = value;
            }
        }

        [XmlElement(ElementName = "link")]
        public string Link
        {
            get
            {
                return this._link;
            }
            set
            {
                this._link = value;
            }
        }

        [XmlElement(ElementName = "description")]
        public string Description
        {
            get
            {
                return this._description;
            }
            set
            {
                this._description = value;
            }
        }

        [XmlElement(ElementName = "language")]
        public string Language
        {
            get
            {
                return this._language;
            }
            set
            {
                this._language = value;
            }
        }

        [XmlElement(ElementName = "copyright")]
        public string Copyright
        {
            get
            {
                return this._copyright;
            }
            set
            {
                this._copyright = value;
            }
        }

        [XmlElement(ElementName = "item")]
        public Item[] Items
        {
            get
            {
                return this._items;
            }
            set
            {
                this._items = value;
            }
        }
    }
```

And last but not least, here is `Item.cs` (this is the most important class in our project as it will contain the news items in the feed):

```
    public class Item
    {
        private string _title;

        private string _description;

        private string _link;

        private string _pubDate;

        private string _guid;
        [XmlElement(ElementName = "title")]
        public string Title
        {
            get
            {
                return this._title;
            }
            set
            {
                this._title = value;
            }
        }

        [XmlElement(ElementName = "description")]
        public string Description
        {
            get
            {
                return this._description;
            }
            set
            {
                this._description = value;
            }
        }

        [XmlElement(ElementName = "link")]
        public string Link
        {
            get
            {
                return this._link;
            }
            set
            {
                this._link = value;
            }
        }

        [XmlElement(ElementName = "pubDate")]
        public string PubDate
        {
            get
            {
                return this._pubDate;
            }
            set
            {
                this._pubDate = value;
            }
        }
        [XmlElement(ElementName = "guid")]
        public string Guid
        {
            get
            {
                return this._guid;
            }
            set
            {
                this._guid = value;
            }
        }
e    }
```

Now that you have prepared the containers for your data, it's time to retrieve them from the cloud by using the WebClient class.

In your MainPage.xaml, you define a list box that will show all links to news and the titles:

```
<ListBox x:Name="NewsList">
  <ListBox.ItemTemplate>
    <DataTemplate>
      <StackPanel Margin=”0,5,0,5”>
        <TextBlock FontFamily="Tahoma" FontWeight="Bold" Text="{Binding Title}" />
        <HyperlinkButton Content="{Binding Link}"  Click="HyperlinkButton_Click"/>
      </StackPanel>
    </DataTemplate>
  </ListBox.ItemTemplate>
</ListBox>
```

The Click event of all HyperlinkButton controls created by the ItemTemplate will be handled by the HyperlinkButton_Click event handler, which will do the true work.

Then in the code-behind of your application, you will have the following:

```
...
WebBrowserTask webBrowserTask = null;
...
```

This declares at the class level your WebBrowserTask object, which will enable you to launch the web browser application.

As you can see in figure 9-4 the two most important members of this class are the URL property and the Show method. URL represents the target address, while Show shows the browser . In Chapter XX, you'll learn more about tasks in Windows Phone.

As with the other recipe, you do the work inside the PageLoaded event:

```
    void MainPage_Loaded(object sender, RoutedEventArgs e)
        {
            WebClient wc = new WebClient();
            wc.OpenReadCompleted += new OpenReadCompletedEventHandler(wc_OpenReadCompleted);
            wc.OpenReadAsync(new Uri("http://feeds.bbci.co.uk/news/world/rss.xml"));
            webBrowserTask = new WebBrowserTask();
        }
```

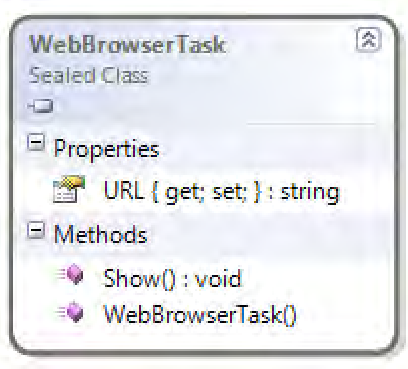


Figure 9-4. Class diagram for `WebBrowserTask`

You instantiate a `WebClient` and then subscribe to the `OpenReadComplete` event, which fires after `OpenReadAsync` completely executes. `OpenReadComplete` only deserializes the result of the request in your object:

```
...
void wc_OpenReadCompleted(object sender, OpenReadCompletedEventArgs e)
{
  XmlSerializer xms = new XmlSerializer(typeof(Rss));
  Rss des = xms.Deserialize(e.Result) as Rss;
  NewsList.ItemsSource = des.Channel.Items;
}
...
```

At this point, all you have to do is to manage the click of the hyperlink button by the user opening the browser:

```
private void HyperlinkButton_Click(object sender, RoutedEventArgs e)
{
  HyperlinkButton hpb = sender as HyperlinkButton;
  webBrowserTask.URL = hpb.Content.ToString();
  webBrowserTask.Show();
}
```

■ **Note** There is a problem in `WebBrowserTask` that sometimes doesn't open the site; we have noticed this problem only when the device is connected to Zune.

Usage

From Visual Studio 2010, press Ctrl +F5. The type of target is not important, as this recipe can work as fine on the emulator as on the device. The application will start, briefly showing the splash screen and then the main page. After a few seconds (depending on your Internet connection), a list of news items will display. Click the hyperlink button to access the Browse function and open the link relative to the news.

9-3. Creating a Google API–Based Translator

Problem

You want to create an application that interacts with a Representational State Transfer (RESTful) service that returns a response in JavaScript Object Notation (JSON) format.

Solution

You must use `WebClient` and `DataContractJsonSerializer`.

How It Works

`WebClient` provides common methods for sending and receiving data to and from a resource identified by a URI. In this case, the resource will give you a response in JSON format. Then you will use `DataContractJsonSerializer` to deserialize the response inside your object graph.

The Code

For the purposes of this exercise, you will use an API made available by Google for the translation of texts. (To use this API, you must have a key to access the service itself).

The application that you will create in terms of the UI is quite simple. It will have a text box for entering text to be translated, a button to start the interaction with the service, and a text block to show the result of your request (which in this case will be a translation from English to Italian).

Here is the XAML that composes our interface:

```
<Grid X:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
  <Grid.RowDefinitions>
    <RowDefinition Height="*" />
    <RowDefinition Height="Auto" />
    <RowDefinition Height="*" />
  </ Grid.RowDefinitions>
  <TextBox Name="TextToTranslateTextbox" Text="Translate Me" />
  <Button Name = "TranslateButton" Content = "Translate" Grid.Row = "1"
                  Click = "TranslateButton_Click" />
  <TextBlock Name="TranslatedTextblock" Grid.Row="2" />
</ Grid>
```

Then in the code-behind of your PhoneApplicationPage, add class-level member as follows:

```
WebClient proxy = null;
```

The WebClient class provides common methods for sending and receiving data from a resource identified by an URI, so it's perfect for our purpose:

```
private WebClient proxy = null;
```

And now in the constructor of your page you need to instantiate the proxy and prepare it to manage the response of an OpenRead request,

```
proxy = new WebClient ();
proxy.OpenReadCompleted + = new OpenReadCompletedEventHandler (proxy_OpenReadCompleted);
```

In the event handler, you will insert code to handle the response, but let's focus first on the request, which will be linked to the click of TranslateButton:

```
…
private void TranslateButton_Click (object sender, RoutedEventArgs e)
{
  try
  {
    if (String.IsNullOrEmpty (TextToTranslateTextbox.Text))
    {
      Uri request = buildGoogleTranslateRequest (TextToTranslateTextbox.Text);
      proxy.OpenReadAsync (request);
    }
  }
  catch (Exception ex)
  {
    // Do something with this exception
  }
}

...
```

And buildGoogleTranslateRequest(string) is our private method that creates the URI for your request:

```
private Uri buildGoogleTranslateRequest(string textToTranslate)
{
        return new Uri("https://www.googleapis.com/language/translate/v2?
                    key=YOUR_API_KEY_HERE&
                    q=" + textToTranslate + "
                  &source=en
                  &target=it
                  &prettyprint=true");
}
```

As a result of this request, the application will give you an object serialized in JSON format—more precisely, the format is as follows:

```
{
    "Data": {
        "Translations": [
            {
                "TranslatedText": "Text"
            }
        ]
    }
}
```

That tells you that the root object of the object graph has an internal object of type `Date`, which in turn contains an array of objects of type `Translations`, which in turn contains a property of type `string` called `TranslatedText`. Figure 9-5 shows the class diagram.

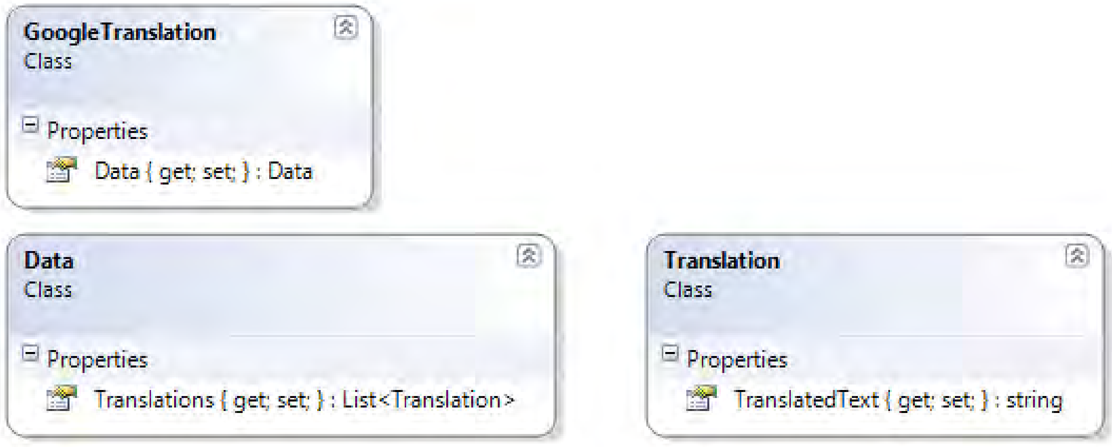

GoogleTranslation
Class
Properties
Data { get; set; } : Data
Data
Class
Properties
Translations { get; set; } : List<Translation>
Translation
Class
Properties
TranslatedText { get; set; } : string

***Figure 9-5.** Class diagram of classes used to deserialize the objects*

The implementation of `GoogleTranslation` is as follows:

GoogleTranslation.cs

```
[DataContract]
public class GoogleTranslation
{
    [DataMember (Name = "data")]
    public Data Data {get; set;}
}
```

Data.cs

```
    [DataContract]
    public class Data
    {
        [DataMember (Name = "translations")]
        public List <Translation> Translations {get, set;}
    }
```

Translation.cs

```
    [DataContract]
    public class Translation
    {
        [DataMember (Name = "translatedText")]
        public string TranslatedText {get, set;}
    }
...
```

The annotations on classes says you which type of serializer you will use —that is, `DataContractJsonSerializer`, which will be the focus of the implementation dell'eventHandler `proxy_OpenReadCompleted.Il DataContractJsonSerializer System.ServiceModel.Web` is contained in the assembly (so remember to add this reference to your project).

```
void proxy_OpenReadCompleted(object sender, OpenReadCompletedEventArgs e)
{
  var serializer = new DataContractJsonSerializer(typeof(GoogleTranslation));
  GoogleTranslation translation = serializer.ReadObject(e.Result) as GoogleTranslation;

  this.TranslatedTextblock.Text = translation.Data.Translations.FirstOrDefault() != null
  ? translation.Data.Translations.FirstOrDefault().TranslatedText
  : "error in translation";
}
```

As you can see, the interaction with a REST service is very simple, as is the use of JSON instead of XML. The only difficulty you may encounter is the interpretation of the object graph, to create a model for the deserialization of the response (or the serialization of a request).

Usage

Open Visual Studio and start deploying the application to the emulator. Write a sentence in the text box and look for the translation. Of course, you need to stay connected to the Internet to use this recipe.

9-4. Pushing Your Notification

Problem

You want to build an application that uses push notification to indicate to the user that something has changed in the cloud.

Solution

You must use the Push Notification Service to indicate the change that has happened.

How It Works

The Microsoft Push Notification Service in Windows Phone gives you the capability to send information and updates to an application from a web service. This new way of interacting with a service hides the lack of multitasking in Windows Phone 7. Push notification works as shown in Figure 9-6.

Another good reason to use push notification is the need to preserve battery power. If applications are continuously polling to check for new notifications, the device's battery will quickly run down.

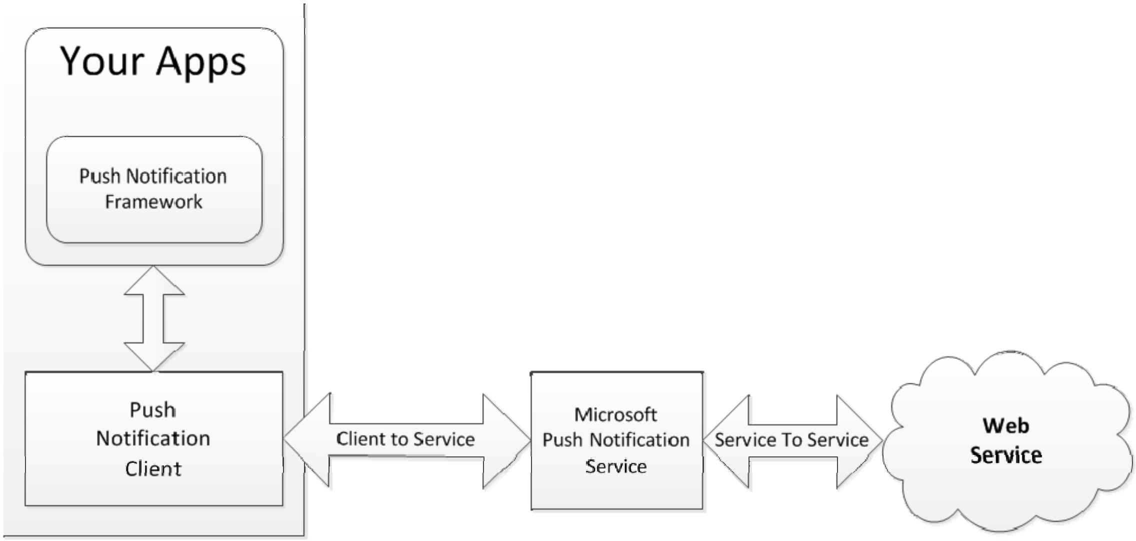


Figure 9-6. *Push notification architecture*

Your web service sends a notification to the Microsoft Push Notification Service , which routes the notification to the user's device interfacing with *push notification client* that notify to your application that something new is ready do know.

■ **Note** Your application will have only one channel available to establish a connection to the Push Notification Service. The user can activate a maximum of 15 applications that use push notification. If your application results in exceeding these quotas, an "InvalidOperationException (Channel quota exceeded)" error will be raised.

After your notification is delivered, the Push Notification Service sends a response to your service. But remember that you will not receive a confirmation that your notification was delivered.

There are three types of push notification that you can use: tile, toast, and raw.

The details are as follows:

Tile notification: Every application has a *tile* (a dynamic representation of the application) that is displayed on the start screen if the user chooses this option. Figure 9-7 shows, inside the rectangle, the default settings that your application will use for tile notification. A tile is composed of the following three elements, which you can update:

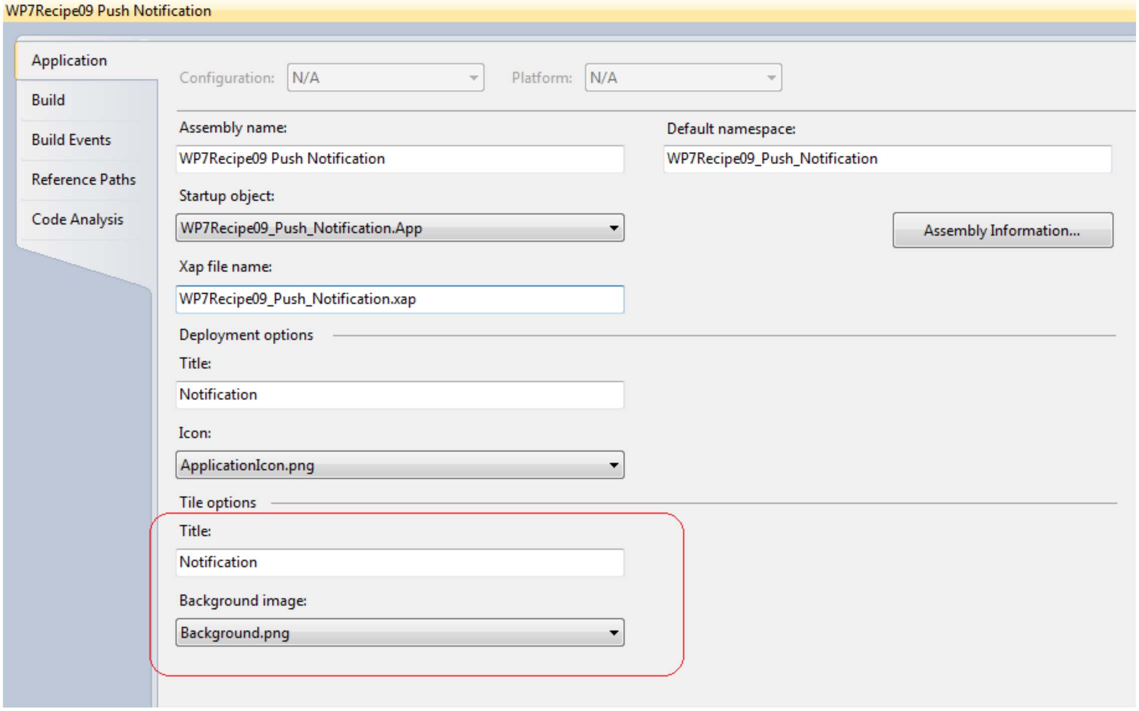
Count: An integer that can assume a value between 1 and 99 and that is displayed on the tile in a circle image

Title: A string set during development (see Figure 9-7)

Background: The background image contained in your project (see Figure 9-8)

■ **Note** The title must fit on a single line of text. If you don't set this value, will be displayed the already defined title.

■ **Note** If no Count values are set, nothing will be shown. If you want to reset the count in the tile, you must use 0 (zero) as the value.



WP7Recipe09 Push Notification

Configuration: N/A
Platform: N/A

Assembly name: WP7Recipe09 Push Notification
Default namespace: WP7Recipe09_Push_Notification

Startup object: WP7Recipe09_Push_Notification.App

Xap file name: WP7Recipe09_Push_Notification.xap

Deployment options

Title: Notification

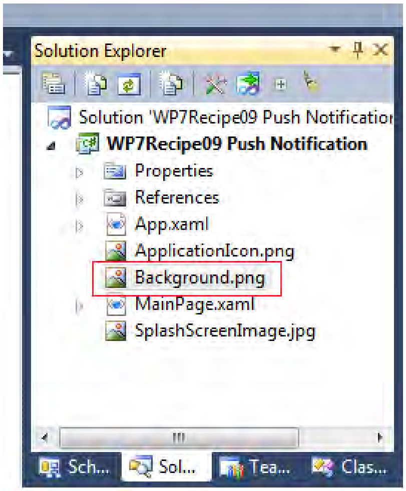
Icon: ApplicationIcon.png

Tile options

Title: Notification

Background image: Background.png

Figure 9-7. Tile options in the project properties



Solution Explorer

- Solution 'WP7Recipe09 Push Notificatio
  - **WP7Recipe09 Push Notification**
    - Properties
    - References
    - App.xaml
    - ApplicationIcon.png
    - Background.png
    - MainPage.xaml
    - SplashScreenImage.jpg

Figure 9-8. The background image in Solution Explorer

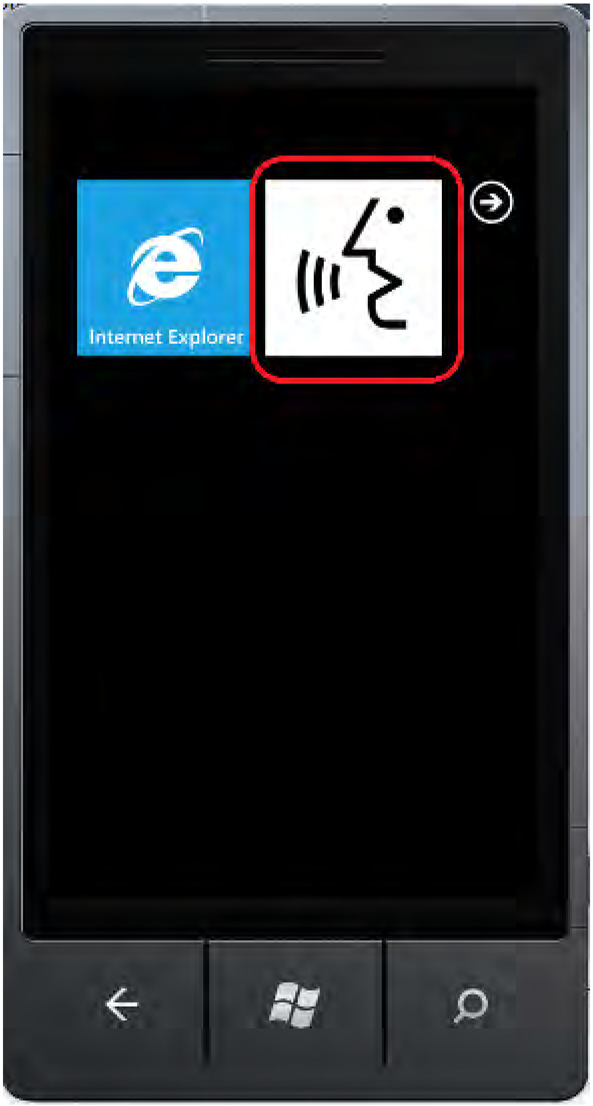


Figure 9-9. The Background image pinned in the start page

Toast notification: This consists of a message shown in the top part of the screen and composed of a title and a subtitle. These two properties are simply strings, with the title having a bold weight and the subtitle appearing as normal text. You can see an example of toast notification when you receive a text message, and you will havethe name of the person contacting you as the title and the text as the subtitle.

Raw notification: This notification is sent directly to your application and can be maximum of 1 KB.

■ **Note** If you send a raw notification, and your app is not running, the Push Notification Service will discard your notification.

In this recipe, you will simulate a notification by sending a message to the Microsoft Push Notification Service via an application created by us. (This is only a simulation because it's not the purpose of this book to explain how to write a web service.)

The Code

Create a new solution, naming it `WP7Recipe0904 Push Notification`. The first thing to do is to define a constant as a string in the code, which identifies the channel that your application will use in the future.

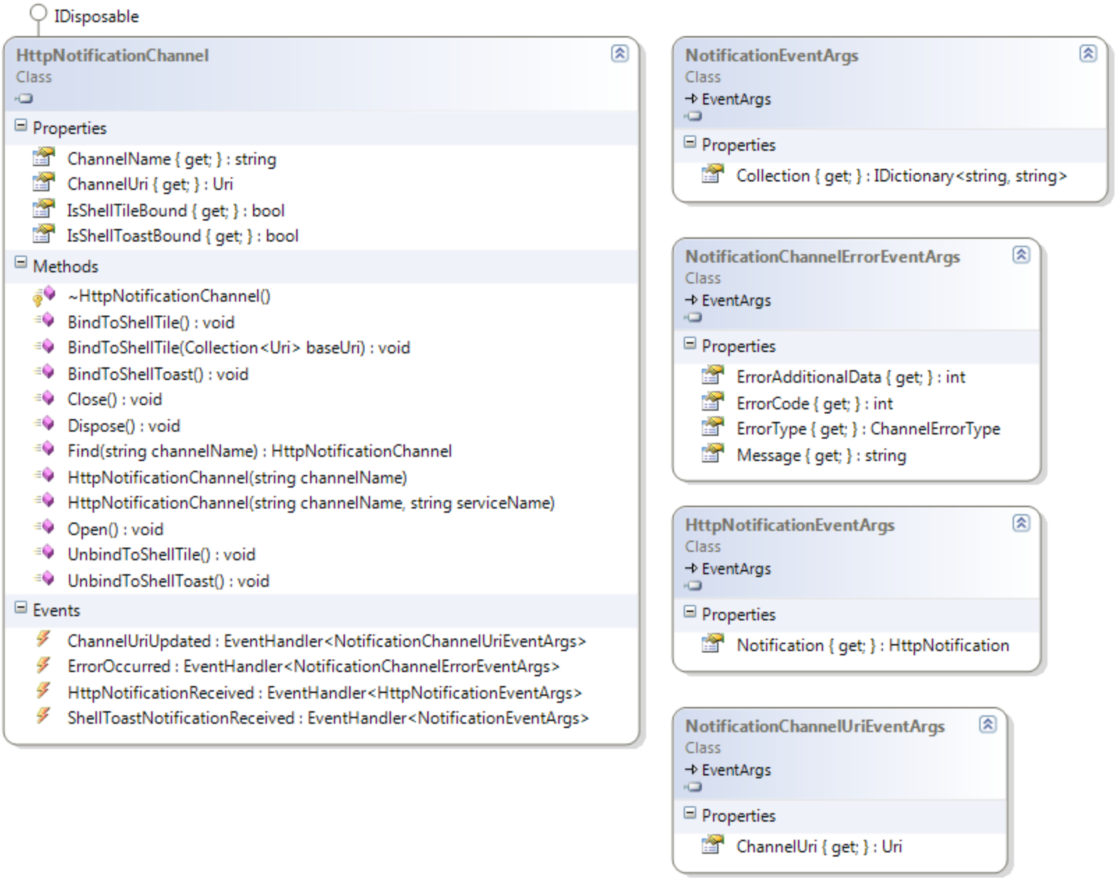
Then in `App.xaml.cs`, you write this:

```
...
//Change this value with your channel name
private const string channelName = "NotificationTest";
...
```

Now you have the channel name, but you're missing the most important object: `HttpNotificationChannel`. So you declare it:

```
...
HttpNotificationChannel notificationChannel;
...
```

`HttpNotificationChannel` is the class that supports (on the client side) the process of notification to the user, as you can see in Figure 9-10. This class puts at your disposal several methods, the first of which is `Find`. The `Find` method is used to check whether any notification channels with the name that you have set (`channelName`) already exist on the device. and if exist returns it, This method is very important for controlling the maximum number of channels that can be created on a device. Also in figure 9-10, you can see that `HttpNotificationChannel` doesn't have a parameterless constructor, because you need to specify at least the channel name.



IDisposable

HttpNotificationChannel
Class

Properties
- ChannelName { get; } : string
- ChannelUri { get; } : Uri
- IsShellTileBound { get; } : bool
- IsShellToastBound { get; } : bool

Methods
- ~HttpNotificationChannel()
- BindToShellTile() : void
- BindToShellTile(Collection<Uri> baseUri) : void
- BindToShellToast() : void
- Close() : void
- Dispose() : void
- Find(string channelName) : HttpNotificationChannel
- HttpNotificationChannel(string channelName)
- HttpNotificationChannel(string channelName, string serviceName)
- Open() : void
- UnbindToShellTile() : void
- UnbindToShellToast() : void

Events
- ChannelUriUpdated : EventHandler<NotificationChannelUriEventArgs>
- ErrorOccurred : EventHandler<NotificationChannelErrorEventArgs>
- HttpNotificationReceived : EventHandler<HttpNotificationEventArgs>
- ShellToastNotificationReceived : EventHandler<NotificationEventArgs>

NotificationEventArgs
Class
→ EventArgs

Properties
- Collection { get; } : IDictionary<string, string>

NotificationChannelErrorEventArgs
Class
→ EventArgs

Properties
- ErrorAdditionalData { get; } : int
- ErrorCode { get; } : int
- ErrorType { get; } : ChannelErrorType
- Message { get; } : string

HttpNotificationEventArgs
Class
→ EventArgs

Properties
- Notification { get; } : HttpNotification

NotificationChannelUriEventArgs
Class
→ EventArgs

Properties
- ChannelUri { get; } : Uri

Figure 9-10. Class diagram of `HttpNotificationChannel` *and event args classes*

Now let's take a look at the method to call inside the constructor of the app to see the others important properties and events to subscribe to:

```
...
private void initNofiticationChannel()
{
  try
  {
    notificationChannel = HttpNotificationChannel.Find(channelName);
    if (notificationChannel == null)
    {
      notificationChannel = new HttpNotificationChannel(channelName);
    notificationChannel.ErrorOccurred += new
            EventHandler<NotificationChannelErrorEventArgs>(
            notificationChannel_ErrorOccurred);

    notificationChannel.ChannelUriUpdated += new
            EventHandler<NotificationChannelUriEventArgs>(
            notificationChannel_ChannelUriUpdated);
    notificationChannel.Open();

    }

    if (!notificationChannel.IsShellTileBound)
      notificationChannel.BindToShellTile();

    if (!notificationChannel.IsShellToastBound)
      notificationChannel.BindToShellToast();

    notificationChannel.HttpNotificationReceived += new
           EventHandler<HttpNotificationEventArgs>(
           notificationChannel_HttpNotificationReceived);
    notificationChannel.ShellToastNotificationReceived += new
           EventHandler<NotificationEventArgs>(
           notificationChannel_ShellToastNotificationReceived);

  }
  catch (InvalidOperationException ex)
  {
    //notify the user of this problem
    MessageBox.Show("If you want to use all funcionality of this application,
           you must disable notification in others app,
           because you have too many channels opened");
    //disable Push Notification in your application
  }
}
```

As you can see, you call the `Find` method to determine whether a channel already exists—of course, because without a channel, nothing works.

If the channel is not present, you need to create one with the name that you decided to enter into the constant. (Keep in mind that it is not critical to insert the name of the channel in the constant, but it is a good way to avoid common errors.) `notificationChannel` object initialization does not means that you opened it

Subscribe to events that might be raised during the opening of the first

- `ErrorOccurred` occurs whenever there is a problem in the use of class (and also later during the reception of notifications could be raised)
- `ChannelUriUpdated` will be raised after you receive the URI on Microsoft Push Notification Service of your channel that will allow you to send notifications directly on your device.

Then open the channel. This may trigger the exception that we mentioned earlier, InvalidOperationException. This tells you that there are already too many applications that use push notification on the device. If you don't have permission to use notification in your app, you may want to notify the user (for example, with a message box) that having too many open channels on the device blocks the full use of your application (especially if your application is meant to make wide use of notifications).

In this example, you bind the channel directly to the notifications (tile and toast). However, remember that to use toast notification, you must allow the user to turn them off from the control panel of your application (see Chapter 10 for further explanation). After this, you subscribe to the two events, HttpNotificationReceived and ShelToastNotificationReceived.

The first will be raised when a raw notification is received. The second will be raised when the application receives a toast notification. (This event will occur only if the application is running in the foreground.)

Now take a look at the ChannelUriUpdated event handler. In this example, you write at the debug console the channel URI, but you have to add the logic to notify your web service of the address to which the push notification is sent.

```
...
void notificationChannel_ChannelUriUpdated(object sender, NotificationChannelUriEventArgs e)
{
        Debug.WriteLine(e.ChannelUri);
        //this is the code to notify your webservice ofthe Uri of the channel
}
```

The channelUri object will be something like this:

```
http://db3.notify.live.net/throttledthirdparty/01.00/XXXXXXXXXXXXXXXXX...
```

You would replace all the Xs with the identification of your channel.

The concept is simple: you have received this channel, and now your service can send notifications. However, because it is not our aim to show you how to make a service, we will instead show you how to build a small test application to send notifications to the device.

Open Visual Studio. Create a desktop application and call it SendNotificationApplication. In the XAML of the main page, create the following structure:

```
<Window
        xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
        xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
        xmlns:d=http://schemas.microsoft.com/expression/blend/2008
        xmlns:mc=http://schemas.openxmlformats.org/markup-compatibility/2006
        mc:Ignorable="d"
        x:Class="SendNotificationApplication.MainWindow"
        Title="Main Window">
    <Grid>
        <Grid.ColumnDefinitions>
            <ColumnDefinition Width="100" />
            <ColumnDefinition Width="*" />
        </Grid.ColumnDefinitions>
        <Grid.RowDefinitions>
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="25" />
            <RowDefinition Height="*" />
        </Grid.RowDefinitions>
        <TextBlock Text="Notification Uri" />
        <TextBox x:Name="NotificationUriTextBox" Grid.Column="1"/>
        <TextBlock Text="Text 1 " Grid.Row="1"  />
        <TextBox x:Name="FirtsRowTextBox" Grid.Row="1" Grid.Column="1" />
        <TextBlock Text="Text 2 " Grid.Row="2" />
        <TextBox x:Name="SecondRowTextBox" Grid.Row="2" Grid.Column="1" />

        <TextBlock Text="Background" Grid.Row="4" />
        <TextBox x:Name="BackgroundTextBox" Grid.Row="4" Grid.Column="1" />

        <TextBlock Text="Count" Grid.Row="5" />
        <TextBox x:Name="CountTextBox" Grid.Row="5" Grid.Column="1" />

        <TextBlock Text="Title" Grid.Row="6" />
        <TextBox x:Name="TitleTextBox" Grid.Row="6" Grid.Column="1" />

        <Button x:Name="SendTileNotificationButton" Grid.Row="7" Grid.ColumnSpan="2"
                Content="Send Tile Notification"
                Click="SendTileNotificationButton_Click" />
        <Button x:Name="SendToastNotificationButton" Grid.Row="3" Grid.ColumnSpan="2"
                Content="Send Toast Notification"
                Click="SendToastNotificationButton_Click" />
        <TextBlock x:Name="ResponseTextBox" Grid.Row="8" TextAlignment="Left"
                Grid.ColumnSpan="2" />
    </Grid>
</Window>
```

That will display something like Figure 9-11. Then you write the two event handlers for the two buttons. The first event handler is `SendTileNotificationButton_Click`, which takes the subscription URI from the text box and then creates the request. You must always remember that you can't send a notification via the `GET` method, but only with `POST`.

After this, the next step is to add headers to your request. Optionally, you can add an `X-MessageID` header that uniquely identifies your notification message, and will be returned in a response. Then, if something goes wrong with a message, you can associate the request with the response to know what's happened at a specific request. If a response doesn't satisfy your requirements, you can can stop it from being sent to the user.

`X-NotificationClass` can assume three values: 1, 11, and 21. With 1 as the value, your notification will be sent immediately; with 11, you will have a delay of 450 seconds; and with 21, you will have a delay of 900 seconds.

```
private void SendTileNotificationButton_Click(object sender, RoutedEventArgs e)
        {
            string subscriptionUri = this.NotificationUriTextBox.Text;
            HttpWebRequest sendNotificationRequest =
(HttpWebRequest)WebRequest.Create(subscriptionUri);

            sendNotificationRequest.Method = "POST";

            sendNotificationRequest.Headers.Add("X-MessageID", Guid.NewGuid().ToString());
            sendNotificationRequest.ContentType = "text/xml";
            sendNotificationRequest.Headers.Add("X-WindowsPhone-Target", "token");
            sendNotificationRequest.Headers.Add("X-NotificationClass", "1");

            string tileMessage = "<?xml version=\"1.0\" encoding=\"utf-8\"?>" +
                                    "<wp:Notification xmlns:wp=\"WPNotification\">" +
                                      "<wp:Tile>" +
                                        "<wp:BackgroundImage>{0}</wp:BackgroundImage>" +
                                        "<wp:Count>{1}</wp:Count>" +
                                        "<wp:Title>{2}</wp:Title>" +
                                      "</wp:Tile> " +
                                    "</wp:Notification>";

            byte[] notificationMessage = new System.Text.UTF8Encoding().GetBytes(
                     string.Format(tileMessage,
                     BackgroundTextBox.Text,
                     CountTextBox.Text,
                     TitleTextBox.Text));

            // Sets the web request content length.
            sendNotificationRequest.ContentLength = notificationMessage.Length;

            using (Stream requestStream = sendNotificationRequest.GetRequestStream())
            {
                requestStream.Write(notificationMessage, 0, notificationMessage.Length);
            }

            HttpWebResponse response = (HttpWebResponse)
                                sendNotificationRequest.GetResponse();

            StringBuilder sb = new StringBuilder();
            foreach (var item in response.Headers)
            {
                sb.AppendLine(string.Format("{0}-->{1}",
                         item.ToString(),
                         response.Headers[item.ToString()]));
            }

            ResponseTextBox.Text = sb.ToString();

        }
```

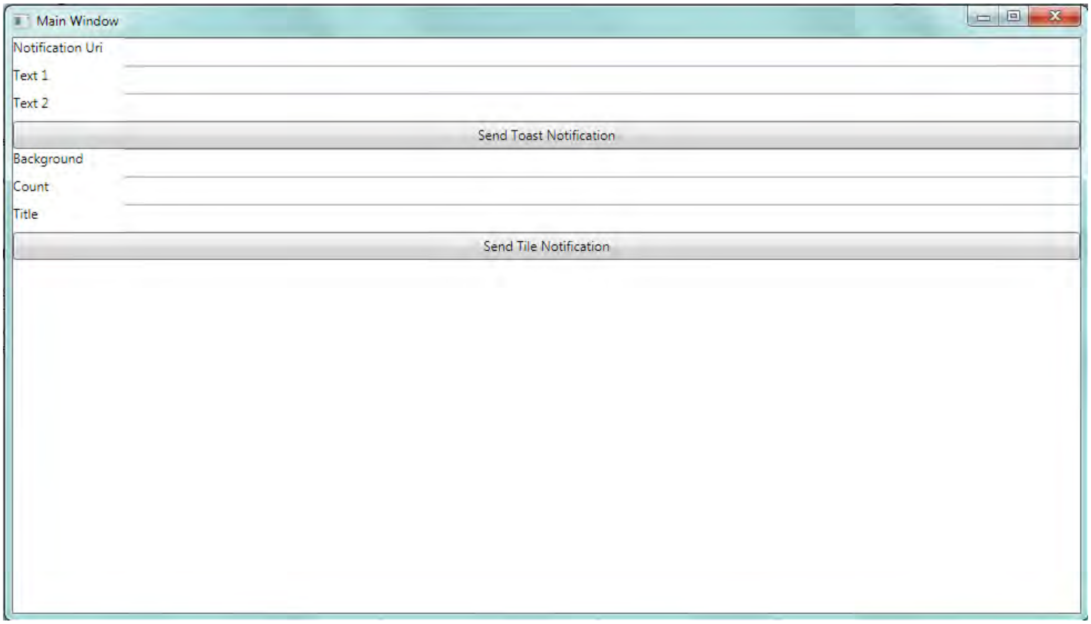


Figure 9-11. The Send Notification application interface

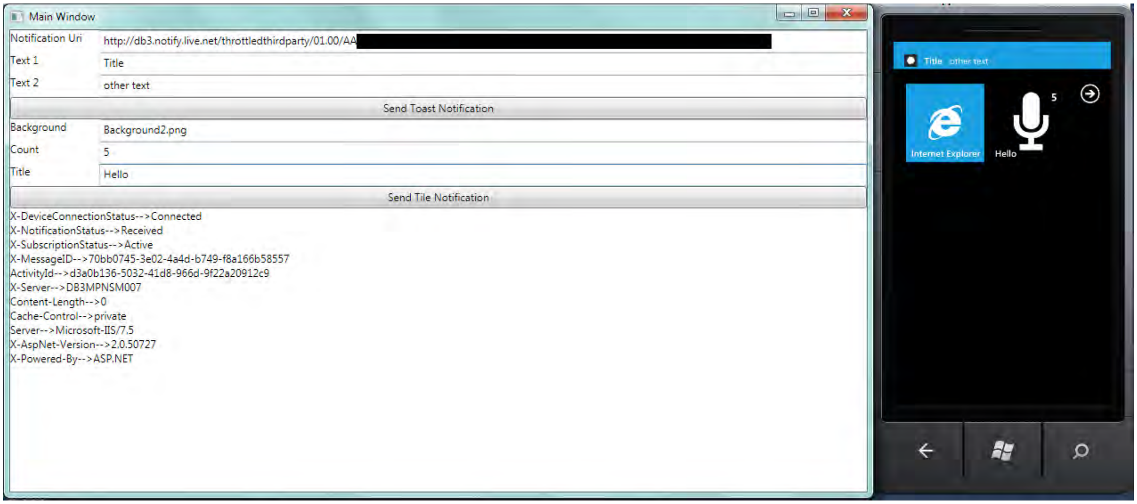
On the other hand, you have the code to send a toast notification that appears largely similar to the code for the tile notification. The main difference is in the format of the XML that makes up the notification.

In this case, `X-NotificationClass` can take the value 2, 12, or22, reflecting a delay in sending the notification of 0, 450, and 900 seconds, respectively.

```
...
private void SendToastNotificationButton_Click(object sender, RoutedEventArgs e)
{
        string subscriptionUri = this.NotificationUriTextBox.Text;
        HttpWebRequest sendNotificationRequest = (HttpWebRequest)
                              WebRequest.Create(subscriptionUri);

        sendNotificationRequest.Method = "POST";
        sendNotificationRequest.Headers.Add("X-MessageID", Guid.NewGuid().ToString());
        sendNotificationRequest.ContentType = "text/xml";
        sendNotificationRequest.Headers.Add("X-WindowsPhone-Target", "toast");
        sendNotificationRequest.Headers.Add("X-NotificationClass", "2");
```

```
    string toastMessage = "<?xml version=\"1.0\" encoding=\"utf-8\"?>" +
                          "<wp:Notification xmlns:wp=\"WPNotification\">" +
                                "<wp:Toast>" +
                                  "<wp:Text1>{0}</wp:Text1>" +
                                  "<wp:Text2>{1}</wp:Text2>" +
                               "</wp:Toast>" +
                            "</wp:Notification>";

        byte[] notificationMessage = new System.Text.UTF8Encoding().GetBytes(
                      string.Format(toastMessage,
                                    FirstRowTextBox.Text,
                                    SecondRowTextBox.Text ));

        sendNotificationRequest.ContentLength = notificationMessage.Length;

        using (Stream requestStream = sendNotificationRequest.GetRequestStream())
        {
            requestStream.Write(notificationMessage, 0, notificationMessage.Length);
        }

        HttpWebResponse response = (HttpWebResponse)
                              sendNotificationRequest.GetResponse();

        StringBuilder sb = new StringBuilder();
        foreach (var item in response.Headers)
        {
            sb.AppendLine(string.Format("{0}-->{1}",
                          item.ToString(),
                          response.Headers[item.ToString()]));
        }

        ResponseTextBox.Text = sb.ToString();
    }
```

You can see the effects of sending these two notification in Figure 9-12



Notification Uri: http://db3.notify.live.net/throttledthirdparty/01.00/AA[redacted]
Text 1: Title
Text 2: other text
Background: Background2.png
Count: 5
Title: Hello

```
X-DeviceConnectionStatus-->Connected
X-NotificationStatus-->Received
X-SubscriptionStatus-->Active
X-MessageID-->70bb0745-3e02-4a4d-b749-f8a166b58557
ActivityId-->d3a0b136-5032-41d8-966d-9f22a20912c9
X-Server-->DB3MPNSM007
Content-Length-->0
Cache-Control-->private
Server-->Microsoft-IIS/7.5
X-AspNet-Version-->2.0.50727
X-Powered-By-->ASP.NET
```

Figure 9-12. The result of sending the notification

Usage

Open these two projects and start deploying the application to the Windows Phone Emulator. Get the notification URI from the debug console and then use it in `SendNotificationApplication`. Remember that to see the toast notification, you must have your application running in the background.

CHAPTER 10

Testing Windows Phone Applications

When your application is complete, you are ready to publish it (unless you have made it only as an exercise). Even if Microsoft were to raise the limit of free applications that you could publish to 100, none of those applications should be useless.

To be installed, your application must be signed by Microsoft with an Authenticode certificate. The best way to obtain an Authenticode certificate is to follow Microsoft's rules and understand the Application Certification Guidelines (which are available at `go.microsoft.com/?linkid=9730558`).

However, Microsoft's Authenticode certificate is only part of what is needed for a successful application. Say, for example, that Microsoft believes that your application complies with the rules of the marketplace, but for some "inexplicable" reason your application crashes while the user uses it. The user might not mind the first time, hoping that the crash was an extraordinary case. But if a crash occurs more often, the user will likely delete your application, and you will have wasted your time.

This chapter introduces you to concepts including Separation of Concerns and the Model-View-ViewModel pattern. These enable you not only to provide a separation of roles between your components, but also to make your application capable of undergoing unit testing. But first you must understand what is meant by SoC and unit testing.

Separation of Concerns (SoC) is one of the key principles of software engineering. To achieve software of a good quality—that is, software that has robustness, adaptability, maintainability, and reausability—you must decouple the concern of one element from another. For example, it is the concern of the View to show information, and the way to do it, but ViewModel is responsible for retrieving information and preparing that information for View.

In *unit testing*, code is written to test a small piece of source code that represents a single functionality—or, to be more accurate, to test that functionality in a particular condition. Therefore, one functionality can have more than one unit test.

To underline the importance of unit testing, let's compare this approach with the debug approach. If you write a test and then change your code, you can run the test suite again to see whether something was broken by your modifications (this is known as regression testing). However, if you choose to always debug your application, you will not have the same result with the same velocity. Of course, you must perform integration testing and functional testing before you can say that your application was completely tested. Again, it's our opinion that the test must be written before you write the code, especially if the programmer who writes the code is the same person who will test the code.

The recipes in this chapter describe how to do the following:

- 10-1. Implement MVVM on Windows Phone by using MVVMLight
- 10-2. Use MVVM and perform unit testing

10-1. Implementing MVVM on Windows Phone by Using MVVMLight

Problem

You want your application implementation to have a consistent separation of concerns between modules. You want the view to have only the task of displaying information, and to remove from the view everything that requires some logic or data access. You need to create a view with only a set of controls (such as TextBlock, TextBox, Button,…) binding them with the `DataContext` (`ViewModel`) of the view. Then the view it's not responsible of data-retrieving, but it's a task reserved to the `ViewModel` that will aggregate data if necessary, and put it in properties, bindable by the view.

Solution

You must implement the Model-View-ViewModel (MVVM) pattern, and because you don't want to reinvent the wheel, you'll also use the MVVMLight framework , which is available on CodePlex (`http://mvvmlight.codeplex.com`). MVVMLight provides some important classes and "gears" necessary to implement MVVM on Silverlight for Windows Phone, such as `EventToCommand` and `MessageBroker` (a.k.a. `Messenger`).

How It Works

MVVM (based on a specialization of Martin Fowler's Presentation Model) is a design pattern used to realize the separation of concerns. Elements of the MVVM pattern are as follows:

- *View* is responsible for showing information, as in other MV*x* patterns (where *x* could be C = controller, P = presenter, and so forth) to display controls (for example: buttons and text boxes).
- *ViewModel* is responsible for preparing data taken from the model for the visualization.
- *Model* represents the model of your application (that is, your data source).

In order to implement MVVM, you need to understand some basic concepts such as commands and binding. Then you'll learn about the basics of MVVM and after that, you will see unit testing. and their importance within your application life cycle.

Let's start with binding. A *binding* is simply an association between two properties of two different classes. You can bind the `Value` of a `Slider` with the `Text` property of a `TextBox`, or in the case of the MVVM implementation, you can bind the value of a property in our ViewModel with the property of a control on the view. Typically, you will use properties with the same or similar types. There are different options for binding:

- `Path`
- `Mode`
- `UpdateTrigger`
- `BindsDirectlyToSource`
- `Converter`

`Path` represents the path to the binding source property. For example, if your binding source is a product and you are binding `TextBox.Text` to show the category name, your path will be `Path=Category.Description`.

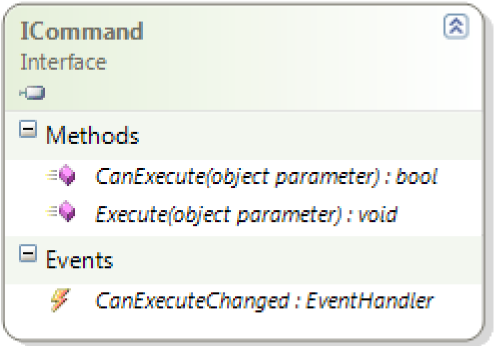
In Silverlight for Windows Phone, as in Silverlight for the Web, the `Mode` attribute can assume three values: `OneWay`, `OneTime`, and `TwoWay`. By default, the binding `Mode` is set to `OneWay`. This means that when you update the source of the binding, the target is updated. As you might guess from its name, `TwoWay` mode means that updating the target value will reflect on the source value, and vice versa. Finally, when you use `OneTime`, the target will be updated only the first time, when you create the binding.

`UpdateTrigger` in Silverlight for Windows Phone, as in its cousin for the Web, accepts only two values: `Default` and `Explicit`. With `Explicit`, you must indicate to the binding engine to update the source. `Default` mode updates the value when a lost focus (of the control) occurs. There is a way to use `UpdateOnPropertyChanged` as in WPF, by using Coding4Fun tools available on CodePlex (`http://coding4fun.codeplex.com`).

`BindsDirectlyToSource`, when set to `false`, causes `Path` to be evaluated relative to the data item; otherwise, `Path` is evaluated relative to the data source.

Last but not least is the concept of a *converter*. With a converter, you can bind properties of different types, defining the way in which the view must evaluate the value. For example, sometimes you will need to bind a Boolean property to the visibility of a control. As you know, visibility is an enumeration, so when you try to apply a Boolean, nothing happens. The solution? A converter! You will see this in the following "The Code" section.

Now you need to understand what a command is. The concept of a command comes from the command pattern, which allows you to isolate the part of code that executes an operation from the part that requests the execution. Inside the code of our ViewModel, a *command* is a class that implements the `ICommand` interface, which represents the contract to implement commanding. As you can see in the class diagram shown in Figure 10-1, `ICommand` exposes the methods `CanExecute` and `Execute`, and the event `CanExecuteChanged`. As you can imagine, `CanExecute` is the method that enables the control bound with the command to be enabled, and `Execute` is the method that describes what you want to do with that command. Unfortunately, in this version of Silverlight for Windows Phone, even if the `ICommand` interface is available, the command cannot be bound with controls without using `EventToCommand,` because the controls don't expose the `Command` property. However, we are confident that this capability will be introduced in future versions. It's important to remember that when you bind a command to a control through the `Command={Binding MyCommand}` syntax, where `MyCommand` is your command exposed by your ViewModel, this command refers to the default event of the control (for example, the `Click` event of a button).



ICommand
Interface

Methods

CanExecute(object parameter) : bool

Execute(object parameter) : void

Events

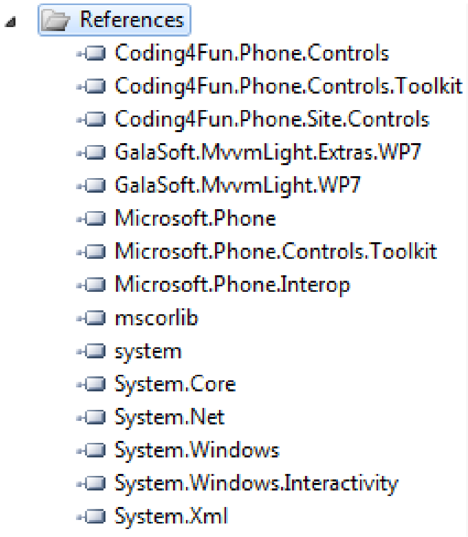
CanExecuteChanged : EventHandler

Figure 10-1. Class diagram for ***ICommand***

The Code

Before you begin to create a new project, download the libraries indicated in the preceding “How it Works” section. Of course, if you want to get the most from MVVMLight, you should also install the templates for Visual Studio 2010 (Express or not, depending on your version) that the package contains.

To begin, create a new Windows Phone application, and add a reference to the MVVMLight DLLs and to the Coding4Fun libraries, as shown in Figure 10-2.



References
- Coding4Fun.Phone.Controls
- Coding4Fun.Phone.Controls.Toolkit
- Coding4Fun.Phone.Site.Controls
- GalaSoft.MvvmLight.Extras.WP7
- GalaSoft.MvvmLight.WP7
- Microsoft.Phone
- Microsoft.Phone.Controls.Toolkit
- Microsoft.Phone.Interop
- mscorlib
- system
- System.Core
- System.Net
- System.Windows
- System.Windows.Interactivity
- System.Xml

Figure 10-2. Adding the MVVM light and Coding4Fun DLLs to your project

Your application is now ready for a quick implementation of the pattern, and to use a workaround, notorious among people who work with Silverlight. This workaround helps you to update the source of the binding, every times a change accours inside a textbox, then will be raised PropertyChanged event every time you write something in a text box, because as you know the default UpdateSourceTrigger, set the value of the source property only when the control has lost the focus.

To do it you need to import the Coding4Fun.Phone.Controls.Binding namespace in this way

```
xmlns:local="clr-namespace:Coding4Fun.Phone.Controls.Binding;
              assembly=Coding4Fun.Phone.Controls"
```

Then the only thing that you need to do now it's to set inside the TextBox the attached property TextBoxBinding .UpdateSourceOnChange to True in this way:

```
<TextBox Text="{Binding Text}"local:TextBoxBinding.UpdateSourceOnChange="True" />
```

After the explanation of the workaround we are ready to continue the implementation of the pattern. The first step is to add the ViewModelLocator of MVVMLight to your application. Then you must create the folder ViewModels and add an item of type ViewModelLocator, calling it ViewModelsLocator.

Immediately after this, you must edit your App.xaml by adding the namespace of ViewModelsLocator to it, and creating a resource of type ViewModelsLocator, at shown here:

```
<Application
    x:Class="Wp7Recipe_10_2_MVVM.App"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:vm="clr-namespace:Wp7Recipe_10_2_MVVM.ViewModels">

    <!--Application Resources-->
    <Application.Resources>
        <vm:ViewModelsLocator xmlns:vm="clr-namespace:Wp7Recipe_10_1_MVVM.ViewModels"
                                   x:Key="Locator" />
    </Application.Resources>
    ...
</Application>
```

Now that you have a way of accessing your ViewModels, you can start creating them. You'll begin with the ViewModel for the main page.

■ **Tip** A naming convention for Views and ViewModels is important. If you have a view named CategoriesView, you could name the relative ViewModel CategoriesViewModel. Although you do not have to always have a 1:1 correspondence of Views and ViewModels, perhaps there is some case where you will have only one ViewModel for CRUD (Create, Read, Update, and Delete) operations for all your typological entities.

As before, add a new item to your ViewModels folder, of type ViewModel , and call it MainPageViewModel. As you can see in the constructor, this will ready a piece of code that has been commented out:

```
////if (IsInDesignMode)
////{
////    // Code runs in Blend --> create design time data.
////}
////else
////{
////    // Code runs "for real": Connect to service, etc...
////}
```

This is the first important feature to consider, because by using this code, you will have the ViewModel available at design time, and this is significant when you want to test your binding inside DataTemplate. In addition, you must specify in ViewModelsLocator a property of type MainPageViewModel, and bind it to the data context of the view (MainPage, in this case).

```
#region MainPageViewModel
private static MainPageViewModel _mainPageViewModel;

  /// <summary>
  /// Gets the MainPageViewModel property.
  /// </summary>
  public static MainPageViewModel MainPageViewModelStatic
  {
    get
    {
      if (_mainPageViewModel == null)
      {
        CreateMainPageViewModel();
      }
      return _mainPageViewModel;
    }
  }

  /// <summary>
  /// Gets the MainPageViewModel property.
  /// </summary>
  [System.Diagnostics.CodeAnalysis.SuppressMessage("Microsoft.Performance",
  "CA1822:MarkMembersAsStatic",
  Justification = "This non-static member is needed for data binding purposes.")]
  public MainPageViewModel MainPageViewModel
  {
    get
    {
      return MainPageViewModelStatic;
    }
  }
```

```
/// <summary>
/// Provides a deterministic way to delete the MainPageViewModel property.
/// </summary>
public static void ClearMainPageViewModel()
{
  _mainPageViewModel.Cleanup();
  _mainPageViewModel = null;
}

/// <summary>
/// Provides a deterministic way to create the MainPageViewModel property.
/// </summary>
public static void CreateMainPageViewModel()
{
  if (_mainPageViewModel == null)
  {
    _mainPageViewModel = new MainPageViewModel();
  }
}

/// <summary>
/// Cleans up all the resources.
/// </summary>
public static void Cleanup()
{
  ClearMainPageViewModel();
}
#endregion
```

■ **Tip** To quickly write these parts of the code, you must install snippets that are available inside the MVVMLight package that you download from CodePlex. The `mvvmlocatorproperty` snippet creates a property of ViewModel inside your `ViewModelLocator`. Another really helpful snippet is `mvvminpc`, which rapidly creates a bindable property in your ViewModel that raises `PropertyChangedEvent`.

Now you have the most important step to do: binding the data context of the view to your ViewModel. In this way, all properties exposed by the ViewModel will be available for binding controls inside the view. You do this with a simple binding, as you can see in the following code:

```
<phone:PhoneApplicationPage
    x:Class="Wp7Recipe_10_2_MVVM.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:phone="clr-namespace:Microsoft.Phone.Controls;assembly=Microsoft.Phone"
    xmlns:shell="clr-namespace:Microsoft.Phone.Shell;assembly=Microsoft.Phone"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d" d:DesignWidth="480" d:DesignHeight="768"
    FontFamily="{StaticResource PhoneFontFamilyNormal}"
    FontSize="{StaticResource PhoneFontSizeNormal}"
    Foreground="{StaticResource PhoneForegroundBrush}"
    SupportedOrientations="Portrait" Orientation="Portrait"
    shell:SystemTray.IsVisible="True"
    DataContext="{Binding Source={StaticResource Locator}, Path=MainPageViewModel}">
...
```

In this way, you have the view (MainPage) data context bound to the property MainPageViewModel of the Locator resource that you have defined in App.xaml.

These are all the preliminary steps to start with MVVM, but it's clear that you must add properties at your ViewModel to bind them to the controls on the user interface, and you should start with simply the strings ApplicationName and PageName.

```
        ...
        /// <summary>
        /// The name of our application
        /// </summary>
        public string ApplicationName { get { return "Learning MVVM"; } }

        /// <summary>
        /// The name of the page
        /// </summary>
        public string PageName { get { return "Main Page"; } }
        ...
```

As you learned in the section "How It Works," binding is important in implementing MVVM, and so you bind the properties to the TextBlocks of the view, called ApplicationTitle and PageTitle:

```
<StackPanel x:Name="TitlePanel" Grid.Row="0" Margin="12,17,0,28">
  <TextBlock x:Name="ApplicationTitle" Text="{Binding Path=ApplicationName}"
             Style="{StaticResource PhoneTextNormalStyle}"/>
  <TextBlock x:Name="PageTitle" Text="{Binding Path=PageName}" Margin="9,-7,0,0"
             Style="{StaticResource PhoneTextTitle1Style}"/>
</StackPanel>
```

At this point, if you use Microsoft Blend, you can see another point of strange of MVVM Light that supports the "Blendability" then you will see the ApplicationTitle TextBlock Text property valued with text of property ApplicationName of the ViewModel (Figure 10-3) and PageTitle set with PageName.

All of this introduces you to the concept of MVVM, but you want to use it in a real case—for example, with an application that helps the user to keep track of expenses. Then in MainPage, you would have a form for inserting data, with fields such as Date, Amount, and Motivation, and a button to bind to a command. Unfortunately, buttons in Windows Phone 7 don't support "clean" commands (for example, Command={Binding SaveCommand}) in this release.

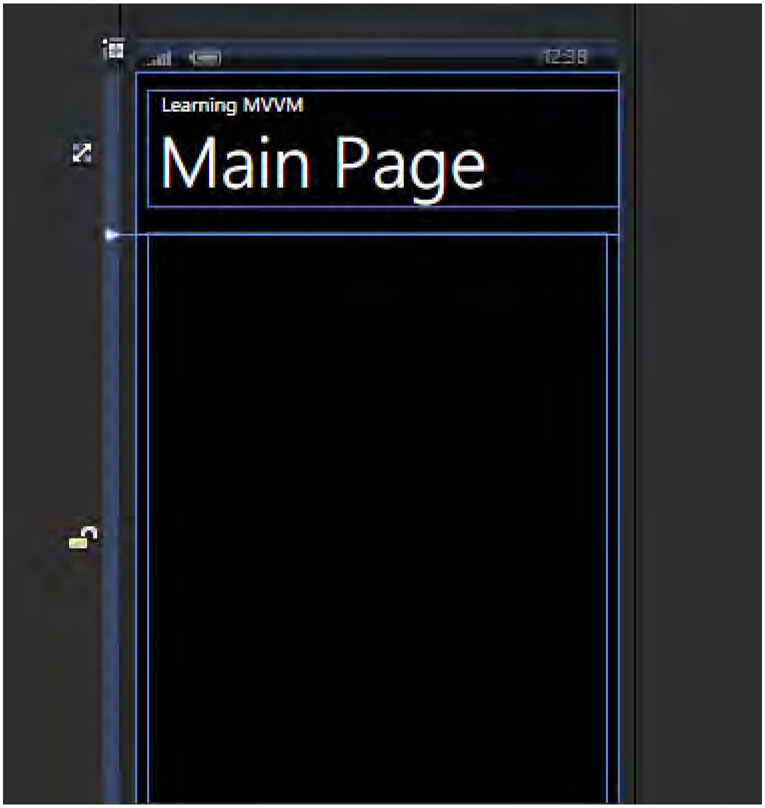


Figure 10-3. MainPageViewModel supports blendability

At this point, your view XAML will be something like this:

```
...
<Grid x:Name="ContentPanel" Grid.Row="1" Margin="12,0,12,0">
  <Grid.ColumnDefinitions>
    <ColumnDefinition Width="0.421*"/>
     <ColumnDefinition Width="0.579*"/>
  </Grid.ColumnDefinitions>
  <Grid.RowDefinitions>
    <RowDefinition Height="80"/>
    <RowDefinition Height="80"/>
    <RowDefinition Height="80"/>
    <RowDefinition Height="80"/>
    <RowDefinition/>
  </Grid.RowDefinitions>
  <TextBlock Margin="0" TextWrapping="Wrap" Text="Date" TextAlignment="Center"
            VerticalAlignment="Center"/>
  <TextBlock Margin="0" Grid.Row="1" TextWrapping="Wrap" Text="Amount"
            TextAlignment="Center" VerticalAlignment="Center"/>
  <TextBlock Margin="0" Grid.Row="2" TextWrapping="Wrap" Text="Motivation"
            TextAlignment="Center" VerticalAlignment="Center"/>
  <TextBox Margin="0" Grid.Column="1" Grid.Row="1" TextWrapping="Wrap"
           TextAlignment="Center" VerticalAlignment="Center"
           Text="{Binding Path=Amount, Mode=TwoWay}"
            local:TextBoxBinding.UpdateSourceOnChange="True" />
  <TextBox Margin="0" Grid.Column="1" Grid.Row="2" TextWrapping="Wrap"
           TextAlignment="Center" VerticalAlignment="Center"
           Text="{Binding Path=Motivation, Mode=TwoWay}"
           local:TextBoxBinding.UpdateSourceOnChange="True"/>

  <toolkit:DatePicker Grid.Column="1" VerticalAlignment="Bottom" Height="77"
                      HorizontalContentAlignment="Center"
                      Value="{Binding Path=Date, Mode=TwoWay}"
                      local:TextBoxBinding.UpdateSourceOnChange="True" />

  <Button Content="Save It" Grid.Column="0" HorizontalAlignment="Center" Grid.Row="3"
          Width="152" Grid.ColumnSpan="2" >
    <i:Interaction.Triggers>
      <i:EventTrigger EventName="Click">
        <cmd:EventToCommand Command="{Binding SaveCommand}"/>
      </i:EventTrigger>
   </i:Interaction.Triggers>
 </Button>
</Grid>
...
```

As you can see, in this XAML you have two “new” namespaces, `cmd` and `i`, which come from the MVVMLight libraries. In this way, you have bound the event `Click` with a command (inside ViewModel) named `SaveCommand` demanding to this command the interest to execute the logic of this operation, so when `Button.Click` raises, `SaveCommand.Execute` will be called. Of course, to use these namespaces, you must import them in your XAML, in this way:

```
...
xmlns:i="clr-namespace:System.Windows.Interactivity;assembly=System.Windows.Interactivity"
xmlns:cmd="clr-namespace:GalaSoft.MvvmLight.Command;assembly=GalaSoft.MvvmLight.Extras.WP7"
...
```

As you can see from the XAML, you bound your controls to the properties of ViewModel named `Date`, `Amount`, and `Motivation`. In the same way as before, you can use a snippet (`mvvminpc`) to create these properties inside your ViewModel. The advantage of using this snippet is that you don’t need to add any call to the `RaisePropertyChanged` method that raises the `PropertyChanged` event for subscribed handlers (in this case by binding engine).

■ **Note** The `RaisePropertyChanged` method call raises the `PropertyChanged` event in `ViewModelBase` (a class inside of the MVVMLight toolkit) that derives from the interface `INotifyPropertyChanged`. The binding engine will handle the event, looking for updated properties, and informing the source of the binding that something has changed.

As you can imagine, the ViewModel has become a little longer because you have to bind more properties and a command:

```
...
    public class MainPageViewModel : ViewModelBase
    {
        /// <summary>
        /// The name of our application
        /// </summary>
        public string ApplicationName { get { return "Learning MVVM"; } }

        /// <summary>
        /// The name of the page
        /// </summary>
        public string PageName { get { return "Main Page"; } }

        public GalaSoft.MvvmLight.Command.RelayCommand SaveCommand { get; set; }

        #region DateProperty

        /// <summary>
        /// The <see cref="Date" /> property's name.
        /// </summary>
        public const string DatePropertyName = "Date";

        private DateTime _date = DateTime.Now.AddDays(-4);

        public DateTime Date
        {
            get
            {
                return _date;
            }

            set
            {
                if (_date == value)
                {
                    return;
                }
                var oldValue = _date;
                _date = value;

                // Update bindings, no broadcast
                RaisePropertyChanged(DatePropertyName);
            }
        }
        #endregion

        #region Amount Property
        /// <summary>
        /// The <see cref="Amount" /> property's name.
        /// </summary>
        public const string AmountPropertyName = "Amount";

        private decimal _amount = 0;

        public decimal  Amount
        {
            get
            {
                return _amount;
            }

            set
            {
                if (_amount == value)
                {
                    return;
                }

                var oldValue = _amount;
                _amount = value;

                // Update bindings, no broadcast
                RaisePropertyChanged(AmountPropertyName);

            }
        }
        #endregion

        #region Motivation Property

        /// <summary>
        /// The <see cref="Motivation" /> property's name.
        /// </summary>
        public const string MotivationPropertyName = "Motivation";

        private string _motivation = string.Empty;

        public string Motivation
        {
            get
            {
                return _motivation;
            }

            set
            {
                if (_motivation == value)
                {
                    return;
                }

                var oldValue = _motivation;
                _motivation = value;

                // Update bindings, no broadcast
                RaisePropertyChanged(MotivationPropertyName);

            }
        }

        #endregion

        /// <summary>
        /// Initializes a new instance of the MainPageViewModel class.
        /// </summary>
        public MainPageViewModel()
        {
            SaveCommand = new GalaSoft.MvvmLight.Command.RelayCommand(SaveCommandExecute);
        }

        private void SaveCommandExecute()
        {
            //put your logic to save here
        }
    }
}
```

Usage

This application can run in the emulator or the physical device. This recipe is a good start point for a real financial tracking application, all you need to do is to add your preferred logic for saving data (look at Chapter 8 for inspiration) and start the application. Make sure that you have decoupled the view from the related ViewModel, so that the only interest of the view is to know how to show data (ViewModel is view-ignorant). In this way, if you change your logic for saving information, nothing must be done on your view. Furthermore, if you want to test your ViewModel, you can do it with unit tests without problems—as opposed to the events approach, that requires that an event be raised

10-2. Using MVVM and Performing Unit Testing

Problem

You want to write an application and test its logic by using a unit test, instead of using the F5 debug approach.

Solution

You must write your application by using the MVVM pattern, then you will be able to write Unit Test for each ViewModel. To test your ViewModels, you need to use the Silverlight Unit Test Framework tweaked for Windows Phone 7 by Jeff Wilcox.

How It Works

Unit tests are important for testing the singular functionality of your classes. In this recipe, you will build on Recipe 10-1 by creating logic for the `SaveCommandExecute` method. You will then create a test class with two test methods, one that always fails and another that always works. This way, you will learn how to run tests on your ViewModel and how to write them, with the scope of automatically test your business logic without any needs of interaction by you with the user interface (this is not completely exact, because Silverlight Unit Test Framework requires a couple of tap by you to run the Test).

The Code

Open the project created for Recipe 10-1. The first thing to do is to add a reference to the two assemblies contained in the package for unit testing and mentioned in the “Solution” section of this recipe at this address `www.jeff.wilcox.name/2010/05/sl3-utf-bits/` Now that you have these references, you need to add a little more logic to `MainPageViewModel` because without a logic, you will not have something to test.

Because the scope of this recipe is to show you how to unit test your Windows Phone applications, we added dummy logic to `ViewModel`, introducing the enumeration states:

```
public enum States : uint { Saved, Unsaved};
```

and a property inside `MainPageViewModel` of this type

```
...
    #region State Property

        /// <summary>
        /// The <see cref="State" /> property's name.
        /// </summary>
        public const string StatePropertyName = "State";
        private States _state = States.Unsaved;

        /// <summary>
        /// Gets the State property.
        /// </summary>
        public States State
        {
            get
            {
                return _state;
            }

            set
            {
                if (_state == value)
                {
                    return;
                }

                var oldValue = _state;
                _state = value;

                // Update bindings, no broadcast
                RaisePropertyChanged(StatePropertyName);
            }
        }

        #endregion
...
```

As you can see, this property notifies the interface that a change has occurred, because when you save an object, it's good practice to let the user know what is being done.

Our last change to MainPageViewModel for this recipe is in SaveCommandExecute, which checks for the state of the view model and sets the State property to "saves" or "unsaves" data (of course, the logic that we show you its really simple but only because we use it for a didactical purpose)

```
        private void SaveCommandExecute()
        {
            State = (this.Amount == 0 || string.IsNullOrEmpty(Motivation))
                ? States.Unsaved : States.Saved;
        }
```

Now that you have logic inside your ViewModel, you are ready to test it. Create a folder inside your project with the name UnitTests and add a class inside it named MainPageViewModelTest.

This class must be decorated with the TestClass attribute and needs to inherit from the SilverlightTest class contained in the namespace Microsoft.Silverlight.Testing, which is inside the assembly Microsoft.Silverlight.Testing.dll. We added three methods inside this class—TestSaveAlwaysFails, TestSaveOk, and TestSaveKo—decorating them with the TestMethod attribute. As you can guess from the names, the first test always fails, the second test results in a successful save, and the last results in an incorrect save

```
[TestClass]
public class MainPageViewModelTest : SilverlightTest
{
    [TestMethod]
    public void TestSaveAlwaysFails()
    {
            MainPageViewModel vm = new MainPageViewModel();
            vm.Motivation = string.Empty;
            vm.SaveCommand.Execute(null);
            Assert.IsTrue(vm.State == MainPageViewModel.States.Saved);
    }

    [TestMethod]
    public void TestSaveOk()
    {
        MainPageViewModel vm = new MainPageViewModel();
        vm.Motivation = "Shopping";
        vm.Amount = 200;
        vm.SaveCommand.Execute(null);
        Assert.IsTrue(vm.State == MainPageViewModel.States.Saved);
    }

    [TestMethod]
    public void TestSaveKo()
    {
        MainPageViewModel vm = new MainPageViewModel();
        vm.Motivation = string.Empty;
        vm.SaveCommand.Execute(null);
        Assert.IsFalse(vm.State == MainPageViewModel.States.Saved);
    }

}
```

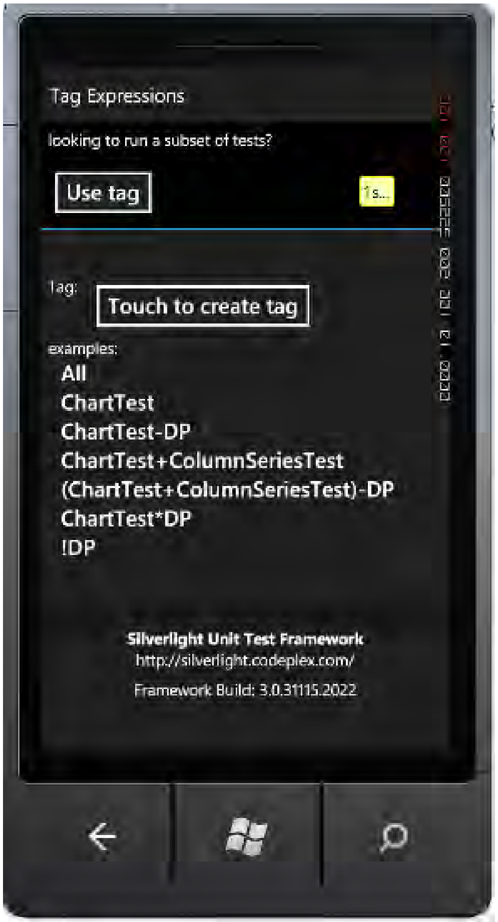
The last thing you need to do is to set the entry point for your suite of tests. Load the test execution page just after loading the main page of the application, as follows:

```
    public MainPage()
    {
        InitializeComponent();
        Loaded += new RoutedEventHandler(MainPage_Loaded);
    }

    void MainPage_Loaded(object sender, RoutedEventArgs e)
    {
        SystemTray.IsVisible = false;
        var testExecutionPage = UnitTestSystem.CreateTestPage() as IMobileTestPage;
        BackKeyPress += (k, ek) => ek.Cancel = testExecutionPage.NavigateBack();
        (Application.Current.RootVisual as PhoneApplicationFrame).Content =
                                             testExecutionPage;
    }
```

Now you are ready to test your application.

Usage

Run the project by using Visual Studio, targeting the emulator (if you run it on the device itself, some text blocks will be too small to read well, but we think that by the quantity of information shown inside the test page, there is nothing more to do). Wait a few seconds while the test page runs (see Figure 10-4). Then look for the result (see Figure 10-5). As planned, one test failed, and other two passed (That in Test Driven Develepement TDD traducts in “correct the bug then run the test again”)



Tag Expressions

looking to run a subset of tests?

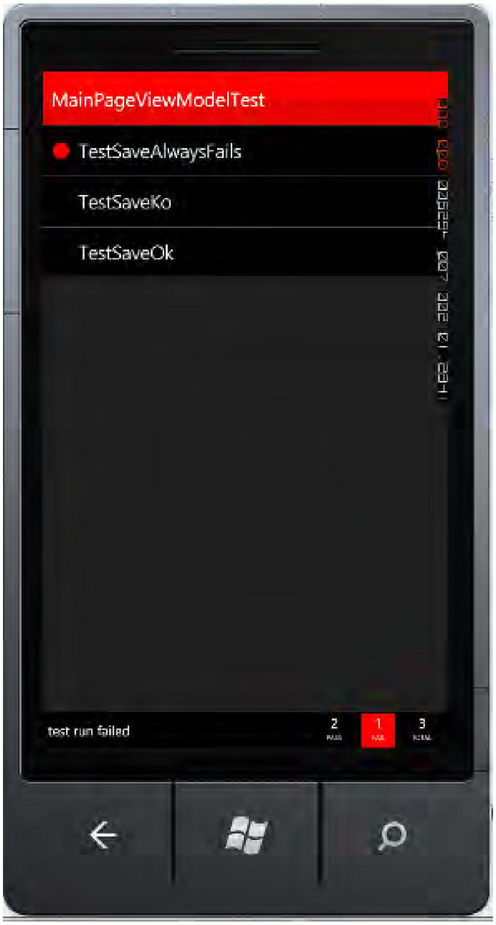
Use tag Ts...

Tag: Touch to create tag

examples:
All
ChartTest
ChartTest-DP
ChartTest+ColumnSeriesTest
(ChartTest+ColumnSeriesTest)-DP
ChartTest*DP
!DP

Silverlight Unit Test Framework
http://silverlight.codeplex.com/
Framework Build: 3.0.31115.2022

Figure 10-4. *Starting the unit test*



MainPageViewModelTest
● TestSaveAlwaysFails
TestSaveKo
TestSaveOk

test run failed 2 1 3

Figure 10-5. *Testing result*

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A Problem-Solution Approach

Fabio Claudio Ferracchiati
Emanuele Garofalo

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To Simona and Claudia, women of mine –Fabio

To my mommy and daddy, my lighthouse in the fog – Emanuele

Contents

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Emanuele Garofalo

About This Book

Are you interested in Windows Phone 7 configuration and development? Learn to build, configure, and distribute your applications through a wide variety of step-by-step recipes. This book contains extensive code samples and detailed walk-throughs.