

Discover the world of 2D and 3D game programming in C#
with XNA and Silverlight for Windows Phone 7 devices



Windows Phone 7 Game Development

Adam Dawes

Apress®

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For Ritu and Kieran.

Contents at a Glance

■ Contents	v
■ About the Author	xix
■ About the Technical Reviewer.....	xx
■ Acknowledgments.....	xxi
■ Introduction	xxii
Part I: The Beginning	1
■ Chapter 1: Windows Phone and .NET	3
Part II: XNA	21
■ Chapter 2: Getting Started with XNA	23
■ Chapter 3: Creating a Game Framework	59
■ Chapter 4: User Input	99
■ Chapter 5: Sounding Out with Game Audio	147
■ Chapter 6: Drawing with Vertices and Matrices	159
■ Chapter 7: The World of 3D Graphics	211
■ Chapter 8: Further 3D Features and Techniques.....	257
■ Chapter 9: Enhancing Your Game.....	313
■ Chapter 10: The Application Life Cycle.....	333
Part III: Silverlight	351
■ Chapter 11: Getting Started with Silverlight	353
■ Chapter 12: Silverlight Controls and Pages	389
■ Chapter 13: Gaming with Silverlight	423
■ Chapter 14: Enhancing Your Silverlight Games	463
Part IV: Distribution.....	495
■ Chapter 15: Distributing Your Game.....	497
■ Chapter 16: Running on Other Platforms	517
■ Index	539

Contents

■ Contents at a Glance	iv
■ About the Author	xix
■ About the Technical Reviewer	xx
■ Acknowledgments	xxi
■ Introduction	xxii
Part I: The Beginning	1
■ Chapter 1: Windows Phone and .NET	3
Looking Closely at Visual Studio Development for Windows Phone	4
Language Choices	5
IDE Features	5
Windows Phone Platform	7
Using Visual Studio for Windows Phone Development	9
Installing Visual Studio.....	9
Creating a Windows Phone Project	11
Designing a Page	12
Running the Application.....	14
Running on a Real Device	14
Getting Help	18
Windows Phone Game Development	19
Suitable Games	19
Selecting an Application Framework	19

Welcome to the World of Windows Phone Development	20
Part II: XNA	21
■ Chapter 2: Getting Started with XNA	23
What Is XNA?	23
Your First XNA Project.....	24
Creating the Project	24
Adding Some Content	25
Displaying the Graphic	26
Moving the Graphic	29
Examining the Solution in More Detail	31
Sprites in Detail.....	34
Supported Graphic Formats	34
Scaling	35
Rotation.....	37
Tinting	38
Partial Image Rendering.....	40
Layer Depth.....	41
Sprite Transparency.....	42
Alpha Tinting	44
Useful Sprite Effects	45
Setting a Background Image.....	45
Fading to Black	46
Fading between Images.....	48
Displaying Text.....	49
Font Support	49
Creating SpriteFont Objects	51
Displaying Text.....	52
Other Graphics Options	55
Rendering in Full Screen Mode.....	55
Supporting Portrait and Landscape Orientations	55

Graphic Scaling	57
Suppressing Drawing	58
Experiment and Play with XNA.....	58
■ Chapter 3: Creating a Game Framework	59
Designing the Game Framework.....	59
The GameObjectBase Class	60
The SpriteObject Class	60
The TextObject Class.....	64
The GameHost Class	66
The GameHelper Class	71
Using the Game Framework	71
Referencing the GameFramework Project.....	72
Setting Inheritance for the Main Game Class.....	73
Creating Derived SpriteObject Classes	73
Adding Game Objects to the Game Host	78
Removing Objects from the Game Host	80
Overriding Object Properties	80
Benchmarking and Performance	83
The BenchmarkObject Class	84
Using BenchmarkObject.....	85
Performance Considerations.....	86
Game in Focus: Cosmic Rocks (Part I)	89
Designing the Game	90
Creating the Graphics	90
Creating the Game Objects	91
Running the Game.....	97
Creating XNA Games	98
■ Chapter 4: User Input	99
Using the Touch Screen	99
Reading Raw Touch Data	100

Reading Input Using the Touch Gestures	103
Sprite Hit Testing	108
Initiating Object Motion	119
Finger-Friendly Gaming	123
Reading the Keyboard and Text Input	124
Using a Hardware Keyboard	124
Prompting the User to Enter Text	127
Reading the Accelerometer	129
Initializing the Accelerometer	129
Using the Accelerometer Data	131
Simulating the Accelerometer in the Emulator	132
Game in Focus: Cosmic Rocks (Part II)	133
Making the Player's Ship Shoot	134
Making the Player's Ship Move	141
Implementing Hyperspace	143
Considering Input Design	145
■ Chapter 5: Sounding Out with Game Audio	147
Sound Effects and Music	147
Playing Sound Effects	147
Adding Sound Effects to your Project	148
Playing the Sound Effects	149
Integrating Sound Effects into the Game Framework	150
Sound Effect Instances	150
Other Sound Effect Properties	152
Obtaining Sound Effects for your Game	152
An Interactive Example	153
Playing Music	153
To Play or Not To Play	153
Adding Music to your Project	154
Playing the Music	155

Game in Focus: Cosmic Rocks (Part III)	157
Make Some Noise	158
■ Chapter 6: Drawing with Vertices and Matrices	159
A New Approach to Drawing	159
Matrix-Based Positioning	159
Abstract Coordinate System	160
Drawing Primitives	160
Textures	161
XNA is a State Engine.....	161
Creating our First Vertex Rendering Project	161
Setting Up the Environment	162
Rendering the Object	164
Moving the Object	166
Adding some Sparkle	167
Tinting Objects	168
Understanding Matrix Transformations	169
Setting the Identity Matrix.....	169
Applying Translation Transformations	170
Applying Rotation Transformations.....	171
Applying Scaling Transformations	172
Applying Multiple Transformations	173
Specifying Vertex Positions.....	176
Drawing Multiple Objects at Different Positions	176
Drawing Primitives.....	178
Drawing Lines	178
Drawing Triangles.....	179
Drawing Points.....	181
Applying Textures	181
Loading Graphics	181
Setting the Active Texture.....	182

Applying the Texture to an Object.....	182
Preparing the Effect for Texture Mapping.....	185
Configuring the Sampler State.....	187
Supported Texture Image Formats	190
Using Different Textures Within the Same Draw Call.....	190
Using Transparency and Alpha Blending	191
Enabling and Disabling Alpha Blending	192
XNA's Built-In Blend States.....	192
Creating Custom Blend States	195
Object Transparency	199
Handling Orientations	199
Graphic Scaling.....	201
Integration into the Game Framework	201
The MatrixObjectBase Class	202
Updates to the GameHost Class.....	207
Using the Game Framework for Matrix Rendering.....	209
Enter the Matrix	209
■ Chapter 7: The World of 3D Graphics	211
Perspective Projection	211
The Viewing Frustum	211
Defining the Viewing Frustum in XNA	215
Rendering 3D Objects	216
Defining a 3D Object	216
The Depth Buffer	219
Enabling and Disabling the Depth Buffer	220
Clearing the Depth Buffer.....	222
Rendering Transparent Objects with the Depth Buffer	222
Hidden Surface Culling	223
Vertex and Index Buffers.....	226

Using Vertex Buffers	226
Using Indexed Vertices.....	228
Using Vertex Buffers and Indexing Together.....	230
Lighting	232
Lights and Materials	232
Types of Illumination.....	232
Material Properties.....	234
Light and Material Interaction.....	235
Using Multiple Lights	236
Reusing Lights	236
Types of Light Source	236
How XNA Calculates Light Reflections.....	237
Adding Lighting to Games	242
Orthographic Projection	250
The Viewing Frustum	250
Defining the Orthographic Viewing Frustum in XNA	252
Isometric Projection	253
Pixel-Aligned Projection.....	255
Mastering the 3D World	256
■ Chapter 8: Further 3D Features and Techniques.....	257
Importing Geometry	257
SketchUp.....	258
Importing Saved Geometry into XNA Projects.....	261
Rendering Imported Geometry.....	263
Adding Support into the Game Framework.....	266
The Google SketchUp 3D Warehouse.....	268
Importing Other File Formats	269
Working with the Camera	269
Camera Position and Orientation	269
Integrating Camera Support into the Game Framework	271

Creating a Chase Cam.....	274
Adding Fog.....	284
Adding a Skybox	285
Creating Skyboxes	286
Implementing the Skybox into the Game Framework.....	287
Particles	290
How Particles are Implemented.....	290
Billboarding.....	290
Adding Particle Support to the Game Framework.....	292
Creating Fire and Smoke.....	292
Vapor and Smoke Trails	294
Fairy Dust.....	295
Using Effect Objects.....	296
Effect Capabilities	297
AlphaTestEffect.....	298
DualTextureEffect.....	300
EnvironmentMapEffect.....	304
SkinnedEffect.....	308
Mixing Sprite and Matrix Rendering	308
A Universe of Possibilities.....	311
■ Chapter 9: Enhancing Your Game.....	313
Managing Game Settings.....	313
Class Structure.....	314
Setting and Retrieving Values	314
Displaying a Settings Screen	316
Creating the Settings User Interface	318
Planning a Game’s Navigation Model	322
Adding a High Score Table.....	323
Implementing the High Score Table.....	324
Using the HighScore Classes in a Game	330

Reusing Game Components	332
■ Chapter 10: The Application Life Cycle	333
The Effects of Losing Focus	333
Life Cycle Events	334
The Launching Event.....	335
The Closing Event.....	335
The Deactivated Event	335
The Activated Event	336
Handling the Life Cycle Events.....	336
Seeing the Events in Action	337
Persisting Session State	338
Controlling Serialization	340
DataContract and Inheritance	341
Persisting Nonserializable Data	342
Tombstoning in the Game Framework.....	343
Setting up the GameHost Event Handlers	343
Preparing the Classes for Serialization	344
Persisting Content References.....	344
Automatic Storage and Retrieval of Game Objects in the State Dictionary.....	347
Identifying Specific Objects After Tombstoning	348
Game Initialization	349
Troubleshooting Serialization	349
Returning from the Grave.....	349
Part III: Silverlight	351
■ Chapter 11: Getting Started with Silverlight	353
A Brief History of Silverlight.....	353
Windows Presentation Foundation	353
Silverlight.....	354
Silverlight on Windows Phone	355

Creating Silverlight Projects for Windows Phone.....	355
Choosing a Project Template	356
Working with Silverlight Projects	358
Examining the Solution in More Detail	359
Referencing Other Projects	361
Exploring XAML	362
What Is XAML For?	362
The Silverlight Page Structure	363
XAML's Syntax	364
Working with the Page Designer.....	371
Adding and Positioning Elements	371
The Document Outline Window	372
Using the Properties Window	373
Understanding Control Alignment	376
Colors and Brushes	378
Color Specifications	378
Brushes	379
Setting Colors in Code.....	386
Using Brushes Together	387
Exploring Silverlight	388
■ Chapter 12: Silverlight Controls and Pages	389
The Silverlight Controls	389
Display Controls	389
Interactive Controls	395
Layout Controls	401
User Interface Design.....	409
Using Control Transforms and Projections.....	409
Using RotateTransform	409
Using ScaleTransform	411
Using SkewTransform.....	411

Using TranslateTransform.....	412
Using TransformGroups	412
Using CompositeTransform.....	413
Using Projection.....	414
Orientation	416
Running in Full Screen Mode.....	417
Multipage Projects	417
Adding New Pages to a Project.....	418
Navigating Between Pages	419
Passing Values When Navigating.....	420
Game On... ..	421
■ Chapter 13: Gaming with Silverlight	423
Creating Sprites	423
Sprite User Control.....	423
Sprite Image Handling.....	425
Positioning the Sprite.....	430
Sprite Transformations	431
Adding Sprites to a Silverlight Page.....	431
Creating Sprites at Runtime	433
Sprite Examples	434
Sprite Movement.....	436
Procedural Animation.....	436
Storyboard Animation	439
Silverlight Performance	446
Reading the Frame Rate Counters	446
Using Cache Visualization	448
Viewing Redraw Regions	449
User Input.....	449
Control Events.....	449
Touch Events.....	452

Gestures	454
Accelerometer	456
Game in Focus: Diamond Lines, Part I	457
Sprite Configuration	458
Game Flow	459
Input Processing	460
Sprite Animation	461
Using Silverlight for Game Development	462
■ Chapter 14: Enhancing Your Silverlight Games	463
Game Navigation.....	463
Defining the Navigation Flow	464
Redirecting Navigation.....	465
Implementing the Navigation Flow	466
Navigating Between Pages	469
Maintaining Game State.....	470
Game Settings.....	472
Creating a High Score Table	474
The High Score Table Classes.....	474
Instantiating the HighScores Object.....	476
Adding New Score Entries	477
Displaying the Scores	478
Playing Music and Sound Effects.....	479
Accessing the XNA Audio Library	480
Initializing the XNA Dispatch Timer	480
Playing Sound Effects	481
Playing Music.....	484
Application Life Cycle.....	485
Exploring Tombstoning Behavior in Silverlight	486
Storing and Restoring State	486
Game in Focus: Diamond Lines, Part II	488

Adding Game Navigation.....	488
Maintaining Game State.....	488
Tombstoning Support.....	490
Adding Game Settings.....	492
Implementing the Sound Effects.....	493
Gaming with Silverlight.....	494
Part IV: Distribution.....	495
■ Chapter 15: Distributing Your Game.....	497
Testing Your Game.....	497
Trial Mode	498
Detecting Trial Mode.....	499
Purchasing the Full Version	502
Offering Promotional Upgrades.....	503
Submission Requirements	504
Content Policies	504
Application Requirements.....	504
Localization	504
Application Features	504
Reliability and Performance.....	505
Technical Information	505
Music and Sound	505
Preparing for Distribution.....	506
Setting the Assembly Information.....	506
Setting the Assembly Version	507
Setting the Project Properties	509
Setting the Manifest Properties	510
Providing Graphics Files.....	510
Compiling the Game.....	511
Selling or Giving Your Game for Free	511
Submitting Your Game to the Marketplace	512

Promoting Your Game	513
Capturing Your Game in Motion	513
Editing Your Video Clip	515
Go Create!	516
■ Chapter 16: Running on Other Platforms	517
Running XNA Projects in Windows.....	517
Porting Projects to Windows	518
Using Conditional Compilation	520
Project Differences.....	521
Display Differences	521
Input Differences.....	524
Isolated Storage	526
Application Life Cycle.....	526
Converting the Game Framework to Run on Windows	526
Trial Mode	529
Distribution.....	529
Revisiting Some Example Projects.....	530
Developing Games for Windows Phone 7 and Windows.....	531
Running Silverlight Projects in the Browser	531
Differences between Silverlight and Silverlight for Windows Phone	532
Converting Projects from Windows Phone 7	532
Example Projects	537
Let's Play...	538
■ Index	539

About the Author



■ **Adam Dawes** is a software developer and systems architect working at a cutting-edge online service development company.

He has been a compulsive programmer since the age of four, when he was first introduced to a monochrome Commodore PET. The love affair has continued through three subsequent decades, flourishing through the days of the 8-bit dinosaurs to today's era of multicore processors and pocket supercomputers.

A constant throughout Adam's career has been his fondness for computer games. From the very first time *Nightmare Park* displayed its devious maze of pathways in green symbols back in 1980, he has been a games player across a variety of genres and styles. These days, he spends his spare time playing the latest 3D titles on his PC, or

enjoying some of the classics in his stand-up arcade machine or sit-in cockpit driving cabinet. Creating his own games has always been a hobby and, while he has no intention of becoming part of the professional games industry, he has a lot of fun developing his own titles.

Adam lives with his wife Ritu and son Kieran in southeast England. His web site is at www.adamdawes.com (all his finished projects can be downloaded there) and he can be emailed at adam@adamdawes.com. He would particularly like to see the results of your own game development projects.

About the Technical Reviewer

■ **Don Sorcinelli** has been involved with planning, developing, and deploying enterprise applications for over 15 years. His involvement in these processes expanded to include the PDA platforms starting in the late 1990s. He is currently a Product Engineer focused on Mobile Device Management solutions.

Don frequently presents on Windows Mobile topics for users, developers, and IT professionals. As a result, he was awarded Most Valuable Professional status for Windows Mobile Devices by Microsoft Corporation in January 2004 for his work with the Windows Mobile community.

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Introduction

This Goal of This Book

Gaming on the move has become very popular during recent years. With the arrival of the Nintendo Gameboy, people realized that they could take their games out and about with them, and as technology has become more sophisticated these games have grown, too. They now encompass complex game mechanics, advanced 2D and 3D graphics, and engrossing stories and game worlds that the player can literally become lost in.

Alongside this phenomenon is the explosion in popularity of mobile communication devices. Nearly everyone carries a phone with them every time they leave the house. These devices have become much more than just phones, however; they provide contact management, e-mail, web browsing, satellite navigation, and entertainment.

Writing games for mobile devices allows both these trends to be brought together into the same place. It is very easy for people to “pick up and play” a game on their mobile device as they always have it in their pocket—whether they are progressing through a sprawling role-playing game on a train or simply want the few minutes of casual diversion that mobile gaming can provide while waiting for an appointment.

Windows Phone 7 Game Development aims to bring you the knowledge and techniques that you will need to create your own games for devices running the Microsoft’s powerful Windows Phone 7 operating system. Starting with the basics of the platform and its development environment, and progressing through to advanced topics such as 3D graphics, it will guide you step by step toward creating a simple and manageable environment into which you can write your own mobile games and distribute them to the world for fun or profit. Example projects are provided to demonstrate all the techniques discussed and are ideal as a basis for experimentation.

Both of the application environments supported by Windows Phone 7 are addressed, exploring how games can be produced in the dedicated gaming environment, XNA, and also in the more general-purpose and user-interface-driven Silverlight.

Who This Book Is For

This book is written for those who are already familiar with programming one of the two main managed Visual Studio languages: C# or Visual Basic.NET. It is assumed that you already have a grasp of the fundamentals of programming and are familiar with using the environment for PC-based application development. This is not an introduction to programming or to Visual Studio itself.

You will, however, be given a complete guide to setting up the development environment for Windows Phone 7 programming, getting your first programs to compile, and interactively debugging your games as they run either on the Windows Phone 7 emulator included with the phone’s free software development kit or on a real device.

In order to develop software for your device, you will need to use the Visual Studio 2010 development environment. If you already have Visual Studio 2010, you can integrate the Windows Phone 7 development tools into your existing environment; if you do not have it, you can obtain Visual

Studio 2010 Express for Windows Phone free of charge via a simple download from the Microsoft web site.

Although most of the projects in the book can be developed using the provided emulator, it is strongly recommended that you also have access to a real device to test your games.

The examples in this book are all written using C#, the only development language fully supported for Windows Phone 7 development. Developers who are more familiar with VB.NET should find that the language code and concepts translate over to C# fairly easily, so this should not present too much of a barrier to entry.

Chapter Overview

The following is a brief description of each chapter. The chapters tend to build on one another, so it is recommended that you read them in sequence to avoid knowledge gaps in later chapters.

Chapter 1 introduces Windows Phone 7 and using the Visual Studio 2010 development environment to create Windows Phone 7 games and applications. It explains how to set up simple .NET projects running against the emulator and real devices, explores debugging techniques, and begins to look at the two application environments: XNA and Silverlight.

Chapter 2 dives into XNA, exploring in detail the structure of XNA projects, the approach to displaying and updating graphics, how *sprites* can be used to create complex 2D graphics output, and how to work with fonts and text.

Chapter 3 takes the concepts explored so far and builds them into a simple reusable game framework that simplifies many of the tedious elements of setting up a game project. This allows you to focus on the game itself rather than getting weighed down with object management. This chapter also introduces the first of the example game projects in this book: *Cosmic Rocks*.

Chapter 4 covers the subject of user input. All sorts of input devices are available on Windows Phone 7 devices, from touch screens and keyboards through to accelerometers, and they are explored in detail to show how they can be used to allow your games to be controlled.

Chapter 5 turns up the volume and reveals the options for game audio. Covering simple sound effects to MP3 music playback, everything you need to know about sound for your games can be found here.

Chapter 6 begins to explore rendering with vertices and matrices instead of using sprites. Matrix transformations are uncovered and explained so that graphics can be rotated, scaled, and translated; and concepts such as texture mapping, blending, and alpha effects in this environment are explored.

Chapter 7 lifts the XNA feature set up into the third dimension, explaining how to create 3D game worlds. Subjects covered include perspective and orthographic projections, the depth buffer, and lighting so that your scenes really come to life.

Chapter 8 continues the exploration of XNA in the third dimension and introduces a number of useful new rendering features. These features include importing 3D objects from third-party modeling packages, moving and manipulating the camera within a game world, using particle effects, creating background imagery with sky boxes, applying fog to a 3D scene, and using XNA's Effect objects to add new features and capabilities to your game.

Chapter 9 provides some useful reusable components that can be used in any game. A simple mechanism for loading and saving user settings and a high-score table implementation are provided to allow you to focus on writing your game rather than having to reinvent these features yourself.

Chapter 10 exposes the Windows Phone 7 application life cycle and *tombstoning*, an essential topic that you will need to get to grips with so that your game can live side by side with other applications that the user chooses to open on their device.

Chapter 11 moves away from XNA and begins to explore Windows Phone 7's other application environment: Silverlight. While not specifically geared around games, Silverlight still has plenty of capabilities and great potential for game development. This chapter introduces the environment and explores how it is used.

Chapter 12 takes a more detailed look at the controls that are available for use in Silverlight projects, and also explores topics such as page navigation, orientation, and full-screen mode.

Chapter 13 focuses on game development in Silverlight, building a simple but flexible sprite control, and covering topics such as hardware acceleration, storyboard animation, game timing, and user input. It also begins development of this book's second example game project: *Diamond Lines*.

Chapter 14 steps through a series of additional Silverlight topics, exploring subjects including navigation through the different stages of a game, music and sound effects, game settings, high-score tables, and Silverlight's view of the application life cycle.

Chapter 15 sets up shop inside the Windows Phone Marketplace. This is the outlet that you need to use to distribute your game to the rest of the world, and possibly make some money from it, too. The chapter contains a guide to the Marketplace submission requirements, as well as tips on testing your game, managing versions, creating trial versions, and promoting your game to encourage people to try it.

Chapter 16 brings things to a close by stepping back from the phone and looking at how both XNA and Silverlight games can be brought to life on other platforms. XNA games can be played on Windows PCs (as well as the Xbox 360), and Silverlight games can be run in a variety of web browsers. This chapter shows you how to painlessly convert your games so that they run in these environments.

PART 1



The Beginning



Windows Phone and .NET

It is a genuine pleasure to develop software for Windows Phone 7 devices using Visual Studio .NET.

Microsoft's latest version of its mobile operating system provides a very different environment from the versions that came before it. Virtually everything about Windows Phone is new to the mobile platform: it includes an entirely redesigned user interface, implements the powerful XNA audio/visual libraries for high-performance gaming, and has standard high-specification hardware requirements that all devices are obliged to meet.

There is one key element of Windows Phone that has stayed essentially the same as the platforms that preceded it: the use of the .NET programming environment to create games and applications. This brings with it some exceedingly powerful and flexible programming languages and one of the best development environments available anywhere.

The development platform for Microsoft's mobile devices has advanced substantially over the last decade. During the early years of the original Windows Mobile/Pocket PC operating system, programming involved using the suite of eMbedded Visual tools. They came supporting two different languages: eMbedded Visual Basic and eMbedded Visual C++.

eMbedded Visual Basic was based on the same technologies as Visual Basic for Applications (VBA). It was similar in a number of ways to Visual Basic 6 (VB6), the desktop version of VB that was current at the time, but had many shortcomings, such as the lack of strongly typed variables and poor object orientation features. Programs were written using a stand-alone integrated development environment (IDE), which had its own peculiarities and different ways of working than VB6.

eMbedded Visual C++ presented more of a challenge because of differences not only in the IDE but also in the code. Although established C++ programmers would no doubt have managed to pick up this language without too many problems, those who were less well versed in the intricacies of C++ might have found the amount of new information they needed to learn a significant barrier to entry.

All this changed with the release of Visual Studio .NET and the .NET Compact Framework (.NET CF). .NET CF provides a set of class libraries that are parallel to the desktop .NET Framework. The libraries are not identical because parts of the full .NET Framework functionality are missing from .NET CF. However, a substantial set of identical functionality does exist, and any programmer who is comfortable developing C# or VB .NET applications for Windows will be instantly at home developing against .NET CF, too.

Windows Phone development uses the very latest Visual Studio 2010. The IDE has made advances in a number of ways since that of the earlier versions of Visual Studio, but best of all, Microsoft has chosen to release an "Express" version of Visual Studio that supports Windows Phone development completely free of charge. Although there are charges and fees involved in some areas of development and in distribution of finished applications (as we will see later in this book when we discuss this subject in more detail), these are generally fairly modest and do not create the barriers to entry that having to purchase the full versions of Visual Studio presented in the past.

The Windows Phone development environment also integrates into the full versions of Visual Studio seamlessly if you have such a version already installed.

On Windows Phone devices, all applications are written using managed .NET code. The Silverlight and XNA runtime libraries are preinstalled on the device, so no awkward installation is required of your end users. Finished games and applications are distributed through a central Marketplace operated by Microsoft, which has support for useful features such as update notifications, trial versions, and protection against piracy.

A major advantage of developing for Windows Phone using Visual Studio .NET is that the exact same IDE is used as for desktop Windows development. There is no need to learn the details or keyboard shortcuts of a new IDE; instead, you will be working within the environment you are already used to, which includes all your user interface tweaks and preferences changes. Developing an application for Windows Phone is simply a question of creating a different project type.

Programming within Visual Studio .NET also means that the Windows Phone developer can take advantage of the maturity of the Visual Studio.NET development environment. Microsoft has spent many years improving the user interfaces and functionality of Visual Studio, and countless versions and releases have cumulated in an extremely powerful and user-friendly studio for application design, development, and debugging. All this is at your disposal when developing Windows Phone games and applications.

The Framework also retains much of the power of its desktop cousin, including extensive object orientation features, strong variable typing, generics, flexible collections, and powerful XML processing functions.

Finally, the use of .NET, Silverlight, and XNA means that there are great opportunities for cross-platform development with only a small amount of additional effort. Silverlight games can be modified to run in the browser on a desktop PC, and XNA games can be made to run on a PC or Xbox 360 in addition to the phone.

In this chapter, we will take a closer look at the .NET Framework, at setting up and using Visual Studio, and at creating your first simple Windows Phone application. We will also examine some of the options that are available for game development.

Looking Closely at Visual Studio Development for Windows Phone

Let's start by taking a look at the versions of Visual Studio that we can use for developing software for Windows Phone.

We can develop either using Visual Studio 2010 Express for Windows Phone, which is available free of charge, or by using one of the full versions of Visual Studio. Both products will produce the same resulting games and applications. Visual Studio 2010 has system requirements that necessitate a reasonably modern PC, running either Windows Vista with Service Pack 2 or Windows 7. Both x86 and x64 versions of the operating system can be used, but the Starter Editions of Windows are not supported. A DirectX 10 or later graphics card with a WDDM 1.1 driver is required for developing games using XNA. In practice, this requirement will be met by most graphics cards from the last couple of years, although many mobile graphics chips present in laptop computers might lack these capabilities.

There is no support for developing for Windows Phone in earlier versions of Visual Studio. The good news is that Visual Studio 2010 will install side by side with earlier versions of Visual Studio without causing any problems, so if you need to keep Visual Studio 2005 or 2008 on your PC, you can.

Language Choices

.NET development offers the choice of a number of different languages including C#, VB, and C++. Currently, however, only C# is supported for Windows Phone development. Microsoft is promising support for VB in the near future, so check the latest version of the development environment if you want to use VB for your development.

If you are already familiar with VB, you should find that both reading and writing C# will come naturally with a little practice. In this book we will focus on C# for all of our samples and example code.

IDE Features

As would be expected from Visual Studio, a number of very useful features are available to help develop and debug Windows Phone applications.

Emulators

Visual Studio offers a Windows Phone emulator to help test and debug your programs. Although it is essential to use a real device regularly during your application development process to ensure that everything works properly on actual hardware, being able to use the emulator for general coding and testing is extremely useful. A screenshot of the Windows Phone emulator is shown in Figure 1-1.

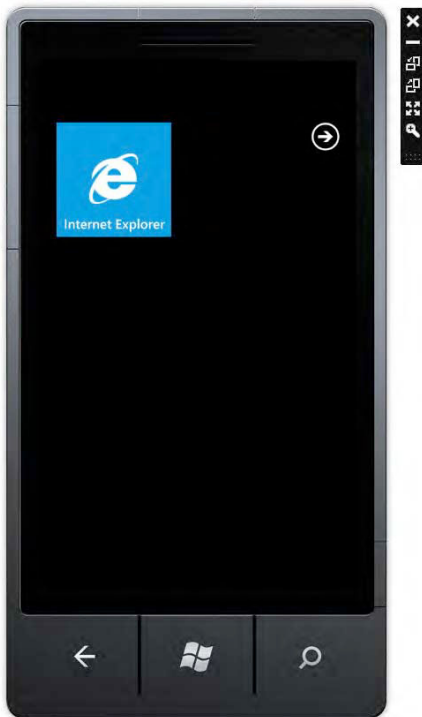


Figure 1-1. Windows Phone emulator

The emulator offers a full implementation of the physical device and is capable of running genuine Windows Phone applications. It offers access to a number of features of the device, including the ability to simulate networking, screen rotation, and touch screen input using the mouse cursor. (In fact, if you are developing on a Windows 7 computer with a touch-enabled screen, you can perform touch and multitouch operations on the emulator by touching your PC screen.)

Running your application in an emulator is as simple as can be: just select to use the emulator within the Visual Studio IDE and start your application. The emulator will appear, and your program will run.

When we fire up the emulator shortly, note that it takes a little while to initialize itself. This would get frustrating very quickly when you are in a repeat modify/compile/test cycle, but the emulator can be left running in the background when you stop your code from executing and will then resume much more quickly the next time you begin a debug session. When the emulator's Close button is clicked, it will prompt for confirmation that the emulator is really no longer required, which is very useful protection against accidentally closing the window without actually meaning to.

Silverlight Page Designer

A fully featured page designer is available to lay out windows and controls for use within Silverlight programs. The designer goes as far as to display an image of the device around the edge of your page to help visualize its appearance.

Silverlight pages can be created and modified by either using the designer or by editing the underlying eXtensible Application Markup Language (XAML, which is generally pronounced “zammel”). We will look at XAML and the Silverlight page designer in a great deal more detail later in this book. Visual Studio will display both the designer and the XAML editor as side-by-side panels within the IDE, as shown in Figure 1–2, and any change made to either will be immediately reflected in the corresponding panel. This provides a very flexible mechanism for page design, allowing each panel to work together to perform their actions more efficiently.

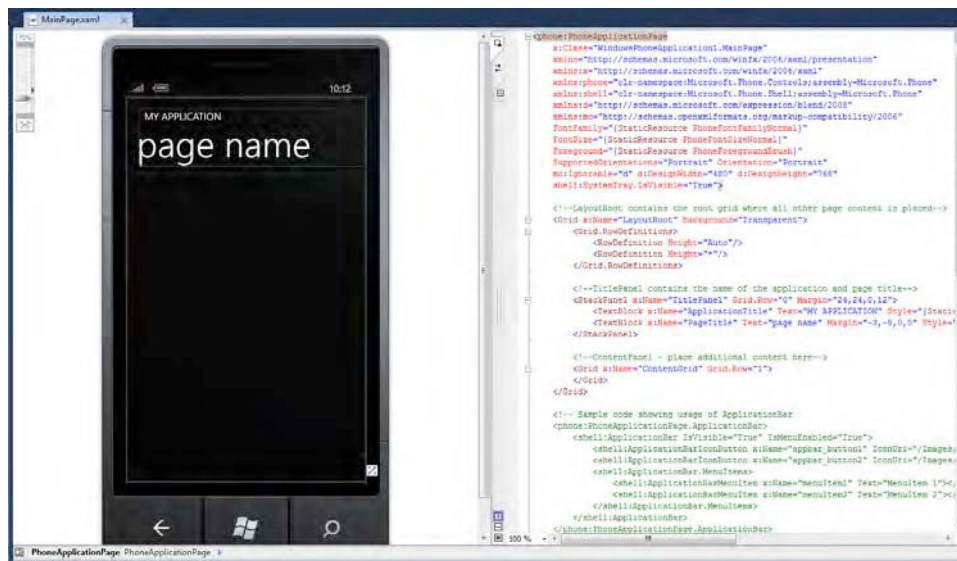


Figure 1–2. The Silverlight page editor showing the designer and page source together