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Beginning ASP.NET 2.0

Chris Hart, John Kauffman, David Sussman, Chris Ullman

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Chris Ullman: All my love to my wife Kate and the boys.

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Chris works full-time as a developer at Trinity Expert Systems Plc, based in Coventry (UK), where she's worked on several major .NET, SharePoint, and CMS applications. She enjoys having a job where she gets to learn and play with new technologies on a regular basis, often working on-site with customers. She's been using .NET since the pre-Alpha days, and yet still enjoys the fun of working with beta software.

Chris lives in Birmingham (UK, not Alabama) with her extremely understanding husband James, as she tries to fit writing alongside her hectic job and her attempts at gardening. She collects computers in much the same way as some old ladies collect cats.

Chris Hart contributed Chapters 3–5 and 11 and Appendix C to this book.

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John Kauffman contributed Chapters 1, 2, 7, and 8 and Appendix D to this book.

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Dave Sussman contributed Chapters 6, 9, 14, and 15 and Appendix E to this book.

Chris Ullman

Chris Ullman is a freelance web developer and technical author who has spent many years stewing in ASP/ASP.NET, like a teabag left too long in the pot. Coming from a Computer Science background, he started initially as a UNIX/Linux guru, who gravitated toward MS technologies during the summer of ASP (1997). He cut his teeth on Wrox Press ASP guides, and since then he has written on more than 20 books, most notably as lead author for Wrox's bestselling Beginning ASP/ASP.NET 1.x series, and has contributed chapters to books on PHP, ColdFusion, JavaScript, Web Services, C#, XML, and other Internet-related technologies too esoteric to mention, now swallowed up in the quicksands of the dot.com boom.

Quitting Wrox as a full-time employee in August 2001, he branched out into VB.NET/C# programming and ASP.NET development and started his own business, CUASP Consulting Ltd, in April 2003. He maintains a variety of sites from `www.cuasp.co.uk`, his "work" site, to `www.atomicwise.com`, a selection of his writings on music and art. The birth of his twins, Jay and Luca, in February 2005 took chaos to a new level. He now divides his time between protecting the twins from their over-affectionate three-year-old brother Nye, composing electronic sounds on bits of dilapidated old keyboards for his music project, Open E, and tutoring his cats in the art of peaceful coexistence, and not violently mugging each other on the stairs.

Chris Ullman contributed Chapters 10, 12, 13, and 16 and Appendix B to this book.

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Introduction

Many different technologies are available today for developing complex web sites and web applications, and with so many to choose from, it's great that there's one technology in particular that stands out from the crowd and is such a joy to use. ASP.NET 2.0 is a fantastic technology that enables you to develop web sites and applications with very little hassle. Developing web applications was never this easy, yet even though it may appear simple, there is real power and depth to this technology that enables it to host even the most complex applications available today.

With every new release from Microsoft comes a new way of thinking, new technologies designed to make your life easier, and the best-ever programming experience; ASP.NET 2.0 is no exception to this rule. Whether you have developed web applications before, or if you are completely new to the world of web development, there's a lot to learn about this particular version of the technology.

Built on top of version 2.0 of the .NET Framework, ASP.NET 2.0 extends on the functionality first seen in ASP.NET 1.0 and 1.1. At its core, you have a *control-based*, *event- driven* architecture, which means that you have the ability to add small blocks of code to a page, and see dynamic results with minimal effort, and you can react to user input to provide a smooth and intuitive user experience.

The biggest change since the previous edition of ASP.NET is in the amount of code you have to write—the ASP.NET team aimed for a 70% reduction in the amount of code you write, and having spent time myself working with ASP.NET 2.0 in the field, even if this claim does sound somewhat large, the reduction in time spent with fingers on keys is very noticeable. The mundane and repetitive tasks that you would have previously had to complete have been simplified. For example, providing user login functionality to a site is now a very swift process—adding a few controls to a page and setting up some user accounts is pretty much all you need to do to get basic user login functionality implemented on a site, and personalizing the user experience is just a step away from there!

Now add the new development environment designed for building ASP.NET 2.0 applications, Visual Web Developer (available on its own, or as part of Visual Studio 2005), and you will find building dynamic, feature-rich applications to be a fast, smooth process.

Visual Web Developer is a new innovation from Microsoft, and was developed mostly in response to developer demand. Previous editions of Visual Studio .NET were not great when it came to web programming, and you'd often find your code had been "fixed" for you behind the scenes because your HTML came out looking very different thanthe way it went in originally! Visual Web Developer has a fantastic HTML editing environment, and a really smooth and intuitive interface for developing complex ASP.NET applications. Best of all, it's a low-cost product, which makes it accessible to a wide audience who may not be able to afford the complete Visual Studio package.

Who This Book Is For

This book teaches you how to program web applications in ASP.NET 2.0 that can display data stored in a database, provide a personalized user experience to your users, and even offer shopping functionality.

All of these sorts of web applications can be developed using ASP.NET 2.0, so if these are the sorts of applications that you are interested in developing, then this is a great place to start!

This book is for anyone new to web programming, or who has a small amount of knowledge of web programming concepts. Maybe you want to start a career as a web developer? Or perhaps you just want to learn how to use some cool server-side technology to put together some sites in your spare time? In either case, this book teaches you what you need to know, and gives you a good feel for how the technology works, how to use the Visual Web Developer environment to speed up your development, and to give you total control over the development process.

The early chapters in this book ease you into the world of ASP.NET development, and if you already have some knowledge of programming, you will find these early chapters a swift and pleasant read. Note, though, that ASP.NET 2.0 has a lot of neat tricks and tools at its disposal, and we'll be introducing these throughout the book. As with other Wrox *Beginning* books, you should find that the concepts discussed in one chapter are then used and extended in other chapters.

What This Book Covers

This book teaches you ASP.NET 2.0, with the help of the Visual Web Developer IDE (Integrated Development Environment). Working through this book, you will learn how to develop powerful data-driven web applications, and even to expose functionality using web services. Here's how the book shapes up over the next 16 chapters.

Chapter 1: An Introduction to ASP.NET 2.0 and the Wrox United Application

This chapter provides an overview of ASP.NET 2.0 and the Visual Web Developer environment, and gives you a chance to create and run a simple page. You'll also learn about the Wrox United sample web site, which is used in examples throughout the book to demonstrate different aspects of ASP.NET 2.0.

Chapter 2: Site Design

Now that you've gained some familiarity with creating simple pages, this chapter discusses the concept of site design, and introduces the concept of a Master page, which can be used to provide a consistent look for all pages on a site. It also introduces `Web.config` and `Global.asax`—two important ASP.NET files that control the behavior of a site, and the concept of a site map, for defining a site page hierarchy.

Chapter 3: Page Design

This chapter starts by providing a quick crash-course (or a refresher course as the case may be) in HTML and XHTML development, and introduces the crucial concept of server controls. The chapter continues by demonstrating several of the built-in server controls in action to provide navigation functionality on a site.

Chapter 4: Membership and Identity

One of the big new features of ASP.NET 2.0 is the addition of the `Login` server controls, so this chapter introduces these controls, alongside discussions of how to create user accounts, how to configure roles, and how to enable login functionality on a site.

Chapter 5: Styling with Themes

Once the functionality of a site has been developed, it's important to make a site look and feel the right way. This chapter introduces CSS style sheets, and integrates them into the discussion of ASP.NET's Theme functionality, making it simple to keep your functionality and your site styling cleanly separated—great for future maintainability!

Chapter 6: Events and Code

Reacting to events involves writing code, so this chapter talks about server-side coding concepts and how web servers work. It walks you through the basics of HTTP so that you will gain an understanding of the *postback*, and how you can write code to handle postback events.

Chapter 7: Reading Data

Developing a site will almost always involve reading data stored in a database, and displaying that data on the screen, so this chapter talks about how you can use ASP.NET controls (such as the `GridView`, `DataLists`, and `DetailsView` controls) to connect to a database and display data. This chapter also discusses reading data stored in an XML file.

Chapter 8: Writing Data

The storing and updating of data is the next topic to be covered in this book, and in this chapter, you'll learn some useful techniques for safely updating the data stored in the database using parameters and referring to data using keys that uniquely identify items in a database.

Chapter 9: Code

This chapter teaches you the fundamental programming concepts that you will need to understand if you are to become a fully fledged .NET developer. It starts by taking you through basic variables and data types, before looking at collections, statements, operators, branches, and loops. Then it introduces some object orientation and talks about classes, properties, methods, and simple class design principles.

Chapter 10: Componentization

Having learned all about the principles of code in the previous chapter, this chapter takes those building blocks and talks about creating pages with separate code files, and about how to design applications with logic stored in different classes or files. This chapter also introduces the concept of user controls, which are great for storing pieces of code that can be reused across pages on a site.

Chapter 11: Roles and Profiles

Following on from simple user accounts and roles as introduced in Chapter 4, this chapter builds on the concept of site design, and changing the appearance of a site depending on which user is accessing the site. This chapter also looks at storing user profiles and populating profiles in code, as well as switching the theme used on a site according to user preferences.

Chapter 12: Web Services

At this stage in the book, you'll have gained sufficient experience with ASP.NET 2.0 and coding that you should now be ready to enter the world of web services. First, you'll learn how to consume a third-party web service, and use that functionality on a page. Next, you'll get the chance to build your own web services, and you'll learn about proxies and WSDL.

Chapter 13: E-Commerce

Adding e-commerce functionality to a site can be a bit tricky, so this chapter walks you through the e-commerce facilities built into the Wrox United sample application, looking at how to implement a product catalog, and build a shopping cart system that links in to user's profiles.

Chapter 14: Performance

You may find your rather lovely web applications may crawl to a halt if you haven't quite tweaked them the right way to make them perform well under heavy loading, so this chapter talks about many of the different ways you can enhance the performance of an application. This includes concepts such as disposing of objects, using stored procedures, and making efficient use of caching.

Chapter 15: Dealing with Errors

Errors happen whenever you develop any application, so this chapter talks you through some of the most common ways to handle errors, how to trap exceptions, and how to present custom error pages to users of your site. After all, they don't need to know that your database server collapsed, but they would like to know, if the site is down, that faults will be rectified shortly. You can then use some of the excellent debugging and tracing functionality available in ASP.NET.

Chapter 16: Deployment, Builds, and Finishing Up

The final chapter of the book talks you through the ideal way to deploy a finished web application to a live server. The application used as an example is the Wrox United application, which you can publish using both the Visual Web Developer tools and what's known as XCOPY deployment. This chapter also looks at testing the deployment and looking out for common deployment problems. The final part of the chapter reviews the different parts of the Wrox United application, and recaps where each part of the application was discussed in the book. Finally, we'll give you some pointers as to where you can head next to further your ASP.NET development career!

How This Book Is Structured

This book takes time to explain concepts step-by-step, using worked examples and detailed explanations, to tell the story of how to develop ASP.NET applications. Each chapter assumes knowledge developed in previous chapters, so you will likely find a front-to-back study approach works best to understand the concepts explained. Four authors worked on this book as a team, and we all worked quite closely together (with some great editorial support), to give you a steady and complete tutorial of the basics of developing ASP.NET applications.

What You Need to Use This Book

To gain the most from this book, you should have the following software installed on your system:

- A minimum of Windows XP Home Edition as your operating system
- Microsoft Visual Web Developer
- Microsoft SQL Server 2005 Express Edition

Because Visual Web Developer includes the .NET Framework and ASP.NET 2.0, these three pieces of software are all you will need to develop ASP.NET applications.

Conventions

To help you get the most from the text and keep track of what's happening, we've used a number of conventions throughout the book.

Try It Out

The *Try It Out* is an exercise you should work through, following the text in the book.

1. They usually consist of a set of steps.
2. Each step has a number.
3. Follow the steps through with your copy of the code.

How It Works

After each *Try It Out*, the code you've typed will be explained in detail.

Boxes like this one hold important, not-to-be forgotten information that is directly relevant to the surrounding text.

Tips, hints, tricks, and asides to the current discussion are offset and placed in italics like this.

As for styles in the text:

- We *italicize* new terms and important words when we introduce them.
- We show keyboard strokes like this: Ctrl+A.
- We show file names, URLs, and code within the text like so: `persistence.properties`.
- We present code in two different ways:

```
In code examples we highlight new and important code with a gray background.
The gray highlighting is not used for code that's less important in the present
context, or has been shown before.
```

Source Code

As you work through the examples in this book, you may choose either to type in all the code manually or to use the source code files that accompany the book. All of the source code used in this book is available for download at `http://www.wrox.com`. Once at the site, simply locate the book's title (either by using the Search box or by using one of the title lists) and click the Download Code link on the book's detail page to obtain all the source code for the book.

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1

An Introduction to ASP.NET 2.0 and the Wrox United Application

At the end of the twentieth century something unprecedented happened to computers. Previously relegated to the realm of the bedroom and dedicated hobbyists who never saw the light of day, the explosion of the Internet lead to computers acquiring a glamour, an aura of excitement that had never been associated with them before. Prior to the 1990s it was almost embarrassing to admit you worked with computers, and then suddenly everyone wanted one. Every business had to be attached to the Internet, and many families wanted their own web site. If you had to name one piece of technology that became synonymous with the explosion, it was undoubtedly the web browser. However, without anything to view on a web browser, it becomes virtually useless. You need information, and like mushrooms sprouting up in a woodland, hundreds of web sites on every imaginable subject were born.

The late '90s were a time of vast upheaval. Business empires were founded on the simplest ideas — a search engine (Google) or an online store for buying books (Amazon). Everyone wanted to know how to build a web site for themselves. HTML (HyperText Markup Language) enabled them to do that, but it was soon obvious that it only went so far. You could display pictures and text, but what happened if you wanted more than that? What happened if you wanted a site that was reactive, that received information from your users and was automatically updated without someone having to beaver away writing new web pages every time? What if you wanted to attach a database to the Internet, or you wanted to display a stock catalogue, or you wanted to personalize your site to everyone who visited it, or you just wanted it to look good for your family and friends who visited it?

The race was on and several competing technologies were created for doing this, including CGI, PHP, and Java. Microsoft's own entry into the race was ASP and what made it particularly attractive was that it was simpler to pick up and learn than most of its rivals, but it also had some exciting features — the ability to store details of users as they moved through pages on a web site, and controls such as calendars and ad rotators that you could just stick into your pages like HTML tags. ASP was a huge success. Microsoft went one further; it created the .NET Framework, and

ASP.NET became a "grown up" version of its ASP technology, using its mature programming languages VB.NET and C#. The leap forward in power was amazing, but Microsoft lost partial sight of one critical aim — simplicity. Web sites suddenly became things you needed expensive consultants to build and cutting-edge designers to visualize. It was out of the hands of those who so empowered the boom.

ASP.NET 2.0 is the big step back in this right direction. Microsoft recognized that one thing people who build web sites don't want to do is have to code. Code is dull; code is geeky. However, Microsoft also recognized that some people still have to code for a living. And more than that, these coders have to build the same things, over and over again. A login mechanism, a menu system, a shopping cart, a funky theme for your site's backdrop applied to every page — something every web site requires. Two guiding principles seem to be at work here: make it easier for the novice to use and reduce the amount of repetitive work the developer has to do. Claims for ASP.NET 2.0 boast "70% less code" is needed; ASP.NET 2.0 also comes with a multitude of controls to enable the developer to create login systems and menus in minutes.

Late in 2003 we saw the previews of the new version of Active Server Pages named ASP.NET 2.0. Everyone knew that these claims weren't just hyperbole and that the way developers create web applications was going to change fundamentally. Microsoft expanded the powerful features of earlier ASP versions while greatly reducing the effort to implement those features. The ease of implementation meant a reduction in the cost of developing complex sites. Or, put another way, there would now be a large expansion of the number of people that have the capability to build a complex site.

In addition to ASP.NET 2.0 comes a new, affordable tool for creating these web sites: Visual Web Developer Express. Microsoft's previous attempts at tools for helping create web sites have been clunky (Front Page) or have never really taken off (Visual Interdev), but this time they've got it right. Visual Web Developer will be part of the Visual Studio.NET suite, but a limited version named Visual Web Developer Express will be sold inexpensively (or given away). It'll allow you to drag and drop a site together within minutes, but it'll also be instantly recognizable to developers, and allows easy creation and management of your web pages.

This book leads you step-by-step through creating dynamic, data-driven, complex web sites using ASP.NET 2.0. To those ends this chapter explains the basic ideas and examines the completed sample site. You then spend time learning how to use Visual Web Developer Express (VWD) to build ASP.NET 2.0 sites.

Specifically, this chapter covers five topics:

- An introduction to ASP.NET 2.0
- Review of the Internet programming problems that ASP.NET 2.0 solves
- An explanation of how ASP.NET 2.0 fits in with other technologies
- A tour of the dynamic features of a site built with ASP.NET 2.0
- Understanding the tool you will use to build ASP.NET 2.0 (ASPX) pages — Visual Web Developer Express (VWD)

In previous books we've been pleased if our readers can create a single page by the end of the chapter, but ASP.NET 2.0 inspires much greater ambitions, and you will have the structure and outline of a working web site up by the end of the second chapter. Your Web site will be focused around a hapless soccer

(football) team named Wrox United and will be able to display their news and results, sell their merchandise, screen their footage, and will offer different views of the site depending on whether you are a customer or an administrator. And, as always, a list of gotchas and some exercises are included to help you review the concepts covered in this chapter.

The Site You Will Build

Go to `www.wroxunited.net` and have a good look at the site (the main page is shown in Figure 1-1). This site is built entirely in ASP.NET 2.0 and is the site you will build in the book. Likewise, it is the site that you will learn how to create a working miniature of in just two chapters.

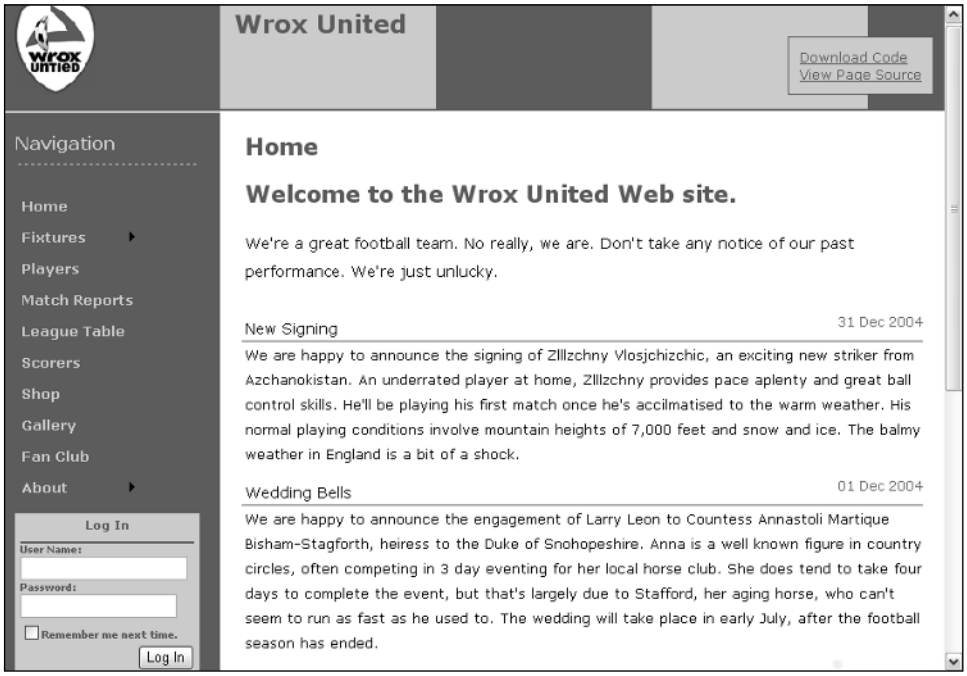


Figure 1-1

On the home page alone you can see a menu system, a login control, and some news items — these are all things that would have taken considerable time and code to create in any previous version of ASP or ASP.NET. If you take the example of a login mechanism, you'd have to think of accepting a user ID and password, checking that against an existing set of users and passwords, making sure the password wasn't corrupted in any way, and making sure that password was transmitted securely. So just to do something relatively trivial, you'd be talking an hour or two of your time at least and not much to show for it. Now this could take seconds.

Click the View Page Source link — it doesn't matter if you don't understand what you see yet — there are fewer than 10 lines of ASP.NET 2.0 code:

```
<%@ Page Language="VB" Trace="false" MasterPageFile="~/site.master"
AutoEventWireup="false" codefile="Default.aspx.vb" Inherits="_Default" %>
<%@ Register TagPrefix="wu" TagName="News" Src="News.ascx" %>

<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="server">

    <h2>Welcome to the Wrox United Web site.</h2>
    <p>We're a great football team. No really, we are. Don't take any notice
    of our past performance. We're just unlucky.</p>

    <wu:news id="News1" runat="server" ItemsToShow="5"></wu:news>

</asp:Content>
```

Step through the different links in the menu and see how league tables and fixture lists work, and see how few lines of code there are. Notice how the theme and style of the site remains consistent throughout, yet there is no evidence of how this is done. Welcome to ASP.NET 2.0. This is about to revolutionize how you build web sites from now on. You're going to look at some of the features behind the Wrox United site in more detail shortly, but first let's talk about what ASP.NET 2.0 offers.

ASP.NET 2.0 — A Powerful Tool to Build Dynamic Web Sites

The World Wide Web (WWW) on the Internet provides a wide expanse of connectivity. Virtually everyone that uses computers has access to the Net. But this pervasive reach was achieved by establishing very minimal standards. Information is transmitted in ASCII characters, without a built-in capability for machine-level code. The client requirements are very minimal — in fact the Internet itself does not have any standards for how a browser works, and thus multiple browsers for multiple operating systems (OS) and platforms exist. It is easy for us, in 2005, to forget that the Internet was designed to send simple static pages of text with images and links.

The story of the past fifteen years of Internet programming is an effort to provide sophistication and complexity to the user experience while not violating the WWW rules that demand extreme simplicity in page design. Users expect an experience that comes close to desktop applications such as word processing and database access. But such a level of complexity has not been easy to implement in the Web given its minimal configuration.

ASP.NET 2.0 fundamentally reduces the barriers for development of complex web sites. The ASP.NET development team at Microsoft looked at thousands of pages, sites, and scenarios to create a list of common objectives of site owners. The list included about twenty goals, including reading data, a unified login and authentication procedure, consistency in site appearance, and customization of pages for different browser platforms. The team then set to work to create bundles of code that would achieve each objective in the right way, with a minimum of developer effort and with Microsoft performing extensive tests of that code. This set of capabilities is available as *classes* (encapsulated and ready-to-use batches of code) in ASP.NET 2.0. The end result is simple — developers can very quickly put together (and easily maintain) a complex site by merely assembling the building blocks Microsoft has developed in ASP.NET 2.0. Instead of writing 50 or so lines of code (as in earlier versions of ASP), the designer can now simply

drag and drop a control to the page and answer some questions in a wizard. This control generates a small amount of code for your page and the server uses that code to build pages in HTML that are then sent to the browser. Because HTML is sent to the browser, there is no requirement for special capability on the browser beyond display of HTML and the execution of a single simple JavaScript script. Any browser that can display HTML can display ASP.NET 2.0 pages. This includes not only desktop browsers, but also PDAs, cell phones, and other devices.

Because all the code for these controls is run on the server before a web browser ever gets a hold of a page, these controls are known as *server-side controls*. The next section looks at what some of these server-side controls can do.

Simple Solutions for Common Web Site Tasks

Microsoft's survey of sites in earlier versions of ASP created a list of common objectives that site programmers were implementing. Some objectives were easy to achieve but time-consuming, whereas others were too complex for all but the most sophisticated developers. Overall, the programmers' solutions varied from brilliant to dysfunctional. Not only were the observed solutions sometimes poor, but they also represented a tremendous waste of time, because thousands of programmers spent time planning, writing, and testing code that had the same purpose. This section goes through eleven of the objectives for which ASP.NET 2.0 offers built-in solutions. As you will see in Chapter 3 and beyond, these solutions are in the form of ASP.NET 2.0 server-side controls that contain code to execute settings and behaviors. By simply placing one of these controls on a page, the designer gets all of the behavior that would have been hand-coded in the past.

Consistency and Personalization

Web designers tend to desire two conflicting design features. On the one hand they want a consistent look to the entire site. But conversely, they desire the capability of users to customize the site to the user's taste in colors, font size, and other features. ASP.NET 2.0 offers a `MasterPage` control that allows a site to be consistent in the layout of its headers, menus, and links. Within that consistent layout a designer can add a control that allows users to pick one of several themes to apply to all pages.

Navigation

Every site requires tools for navigation, generally in three forms. Users need a menu. They also need to be able to see where they are currently located in a site. And last, they want to be able to easily navigate up or down a level. ASP.NET 2.0 supports an XML file called a SiteMap. ASP.NET 2.0 controls can then render menus and other navigation aids based on the site map and the name of the current page.

Login, Security, and Roles

Many sites need a login system that can check a potential user's ID and password against a list and then authorize or deny entry. Although basic implementations are not difficult, only a small percentage of programmers are successful in creating a system that conforms to best security practices. ASP.NET 2.0

offers a few controls that create and implement a logon better than most of us can program by hand. Beyond simple site entry, the system offers password reminders and a system to create new users. A user can also be assigned a *role* that determines what pages and features will be available for that user to view. For example, all users can view the employee phonebook, but only users with the role of Manager can view pages to change information about employees.

Connection to Data

Although most dynamic web sites are connected to data, few designers are successful in implementing the full suite of features that users desire. In sites built with older ASP versions Microsoft observed many problems in efficiency and security. Furthermore, even modest objectives required scores of lines of code. ASP.NET 2.0 provides a rich suite of data features through two groups of controls for working with data. *Data source* controls offer the behavior of connecting to sources of data. *Data-bound* controls take that information and render it into HTML. The several data source controls can connect to almost any source of data, and the data-bound controls offer the user tables, lists, trees, and other presentations. Working together, these controls offer the user the capability to page through data, as well as to sort and edit data.

Code

Almost every web site requires customized code because it is impossible for ASP or any other web site technology to anticipate the needs of all businesses. ASP.NET 2.0 supports more than 20 different languages. Regardless of the language the programmer uses, the code is translated into a single intermediate language prior to execution. ASP.NET 2.0 controls are executed on the server, but the programmer also has the option of writing code (for example Java or other client-side script) in a block to go out for execution on the client.

Componentization

Web sites are easier to develop and maintain if various parts can be created independently of each other. Traditional ASP relied on large pages containing content, HTML, ASP controls, and scripts of code. ASP.NET 2.0 provides more efficient models and structures to divide the site into logical parts. For example, code is normally kept in separate files from the presentation layer (the text and HTML tags). Furthermore, Visual Web Developer offers wizards to easily create objects to provide data resources.

Web Services

Enterprises offer information and services on their own sites. For example, from its worldwide headquarters, `www.Ford.com` can give you a list of colors and price quotes. But in the past few years we have seen a demand for those services to be available to other sites. For example, a local Ford dealer may want to offer the list of colors and prices at `www.YourLocalFordDealer.com`. Web Services allow a *consumer* site (the local dealer) to obtain information from a *provider* site (Ford headquarters). The local Ford dealer can display real-time data using Web Services provided by the Ford corporate site, but keep the user on the page of the local site. ASP.NET 2.0 offers a complete Web Services solution that conforms to the specifications of SOAP (Simple Object Access Protocol, a way to ask for data from a Web Service) and XML (Extensible Markup Language, a format for data).

Performance and Caching

After the designer writes a page on the development machine it is compiled into the single uniform language of .NET 2.0 called the Microsoft Intermediate Language (MSIL). Then it is copied to the deployment machine. The first time it is requested the page undergoes a further compilation into the Common Language Runtime (CLR), which optimizes the page for the hardware that will serve it. This two-step process achieves the dual aims of consistency for software and optimization for hardware. Both steps have undergone intensive performance analysis from the .NET 2.0 team. The great aspect for beginners is that all of this compilation occurs automatically.

ASP.NET 2.0 easily enables *caching* of pages so that subsequent requests are served faster. When cached, the final version of a page is stored in the server's RAM so that it can be immediately sent on the next request rather than having the server rebuild the page. Furthermore, the designer can specify that only parts of pages can be cached, a process known as *fragment caching*. Fragment caching accelerates the service of non-changing portions of a page while still allowing the dynamic fragments to be custom generated. If you are using Microsoft SQL Server 7 or higher you also have the option of *data invalidation caching* for portions of the page that are data-dependent but less variable (perhaps a list of employees or your retail outlets). Data invalidation caching will keep a page in cache until it gets a message from SQL Server that the underlying data has changed. You cache a set of data with a designation to receive a SQL data changed notice. SQL Server will notify .NET when the data has changed, which triggers ASP.NET 2.0 to perform a reread.

Errors and Exception Handling

Any web site, indeed any system, needs to respond to errors. ASP.NET 2.0 provides a system to respond to errors. The response can be in code or it can be a redirect to an error page. The error page can be unique to the error or it can be a single error page for the entire site. The .NET 2.0 Framework also allows multiple levels error handling. If an error occurs in a data read it can be handled at the level of the data source. If it is not handled, the error bubbles up to the next level and can be handled there. Unhandled errors continue to bubble up through layers with the designer having the option to resolve the problem at the most effective level.

Deployment

In the past, sites deployed to Windows or Linux required a series of setup steps that registered and configured the site on the host machine. The ASP.NET 2.0 team set a goal of XCOPY deployment, naming it after an old DOS command that performed a simple copy of a folder and all of its subfolders. A simple XCOPY deploys your site from the development machine to the deployment host. All registrations and machine-level customizations occur automatically when the first request hits the site.

Development Tools

Although not part of ASP.NET 2.0, Microsoft has spent considerable effort improving tools for building ASP pages, namely the Visual Studio, Visual Web Developer, and Visual Web Developer Express products. These IDEs (Integrated Development Environments) allow drag-and-drop building of pages. Most common actions are either automatic or guided with wizards. In cases where typing is required, the IDE provides intelligent completion of most phrases. This book uses the freely downloadable VWD Express.

Where Does ASP.NET 2.0 Fit with Other Technology?

Many people have questions about how ASP.NET 2.0 fits in with all of the other web-related terms (most of them acronyms). We will clarify this now — where does ASP.NET 2.0 fit with other software that is running on the server? What is its role, and what are the roles of the other pieces of technology? ASP.NET 2.0 is part of the .NET 2.0 Framework. The .NET Framework is a brand of Microsoft that sets software standards for Internet connectivity using Web Services and XML. Many Microsoft products conform to the .NET standard, including various server software, data management systems, and desktop applications. ASP.NET 2.0 is the subset of .NET 2.0 that offers software for generating dynamic web sites. The software is published in a set of *classes* holding various controls that execute their behavior on the web server. In our day-to-day designing of pages we work with these server-side controls. Because ASP.NET 2.0 is a subset of the .NET 2.0 Framework, in this book we sometimes uses features of ASP.NET 2.0 and sometimes uses features of the .NET 2.0 Framework. Use of these various features will be essentially seamless.

As a Microsoft product, ASP.NET 2.0 runs on Windows. For development, it will work on the desktop with Windows 2000 or later (including both XP Home and XP Pro). At deployment the normal OS is Windows Server 2003 or another Windows OS version designed for higher loads. Within Windows, ASP.NET 2.0 works with the Internet Information Server to read pages from disk and send them to requestors. Alternatively, on the development desktop, ASP.NET 2.0 can be tested with a lightweight web server named Cassini that is distributed with development tools such as VWD.

When a designer uses the ASP.NET 2.0 controls to connect with data, two more levels of interaction are introduced. The data controls use a technology named ActiveX Data Objects (ADO.NET), but fortunately the use of ADO.NET is behind the scenes for us. Those ADO.NET objects, in turn, interact with the source of data. The source of data can be Microsoft SQL Server (as used in this book) or almost any other source of data including relational databases such as Oracle or MySQL, and non-relational sources such as XML or text files.

Microsoft offers tools for several levels of developers to build ASP.NET 2.0 web sites. The most comprehensive product is Visual Studio 2005, aimed at professional developers. A low-cost, and only slightly less function version, is Visual Web Developer Express. Front Page can work, but it focuses more on static HTML pages and thus lacks the set of tools that makes designing the dynamic, data-intensive ASP.NET 2.0 pages such a pleasure. Creating pages in Notepad was long the preferred method of ASP developers and is still theoretically possible; however, the necessary management of web sites and web pages make this impractical, laborious, and far more prone to errors.

Enough of the theory; let's see ASP.NET 2.0 in action. During the course of this book you will build a complete web site for a hapless football (soccer) team named Wrox United. A completed example is hosted at `www.wroxunited.net`, which you explore in the next section to observe the range of features ASP.NET 2.0 supports. Then in the remainder of the book you will build the same site on your desktop. For this exercise you do not have to install software on your machine. The remainder of the book, however, relies on your completion of the setup outlined in Appendix B.

Exploring the Wrox United Application

This section explores the site as built by the authors and that you will build, and which is hosted at `www.wroxunited.net`. Open your browser and direct it to that address.

- **MasterPages and Site map (discussed in Chapter 2):** Click through several pages to observe the uniform layout across the top and left side of the page. This design consistency derives from an easy-to-implement feature called MasterPages. Second, note the maroon box in the lower-right of each page that indicates your current page and its relationship to parent pages back to the home page. This feature was created with the ASP.NET 2.0 Site Map and Navigation controls.
- **Server-Side controls (discussed in Chapter 3):** Go to the Players page. All of the data comes from two server-side controls — a data source control to connect to the database and a data-bound control to display the information. Most of the behavior of ASP.NET 2.0 pages is encapsulated in server-side controls. These include links like the shopping cart at the bottom-left, images such as the logo at top-left, and text boxes such as the logon section at the lower-left.
- **Login and Security system (discussed in Chapter 4):** On the home page, log in as User Name `Lou` and Password `lou@123`. Then log out. Authentication systems can require a tremendous amount of work to create and even then frequently contain security holes. ASP.NET 2.0 offers a very simple system based on several server-side controls including the login and password verification schemes, and a system to e-mail a clue for forgotten passwords.
- **Events (discussed in Chapter 6):** Browse to the Shop page, click an item and add it to your cart (of course, this is not a real shopping site, just a demo). An event occurred as you clicked the Add to Cart button and that event was handled by custom code that created an order and added the item to the order.
- **Data Reads (discussed in Chapter 7):** Browse to the Players page where the names and joining dates are read from a SQL Server Express database. Many kinds of information on the site are held in data stores that are read by ASP.NET 2.0 server-side controls on the page. Browse back to the home page and observe the menu. Even these menu choices are read from an XML file that holds a map of the site.
- **Data Writes (discussed in Chapter 8):** Browse to Shop, click car sticker and click Add to Cart. You have just written a value to a database. The behavior of writing your order to the database was implemented by two ASP.NET 2.0 server-side controls. The designer of the site did not have to do any custom code.
- **Code behind the controls (discussed in Chapter 9):** From the home page click Shopping Cart at the lower-left of the page. We have written custom code that executes when the page is loaded that checks if there are currently any items in the shopping cart and renders a page appropriate for the cart contents: either empty or a list of contents. Although the capabilities of the ASP.NET 2.0 server-side controls are impressive, they cannot cover every possible case. An ASP.NET 2.0 site offers numerous places that a designer can add custom code.
- **Components (discussed in Chapter 10):** Browse to the Fixtures page. Although the data is stored in a SQL Server database, the ASP.NET 2.0 page does not read it directly. There is a component that reads that data and then sends it on to the ASP.NET 2.0 page. That component can be reused by other web sites or by Windows applications that run on a local network without the Internet.

- **Roles (discussed in Chapter 11):** If you had administrative rights you could log in and see different screens. Once you have installed the site on your local machine you will experiment with this feature in Chapter 4. ASP.NET 2.0 goes beyond just logging in visitors. They can be authorized to have sets of privileges called *roles*. The public site does not allow non-authors to log in as administrators, so no need to take action at this point.
- **E-Commerce (discussed in Chapter 13):** From the menu go to Shop, and click a few items to add to your cart. Now on the bottom of the menu click Shopping Cart and view its contents. The most complex part of the site is the shopping cart. ASP.NET 2.0 does not have a pre-built e-commerce solution, but because so much behavior is built into the ASP.NET 2.0 controls, designers can develop features such as e-commerce much more quickly than in the past.
- **Performance (discussed in Chapter 14)**
- **Errors and exception handling (discussed in Chapter 15)**
- **Deployment (discussed in Chapter 16):** At this point we will not walk through a deployment. However, keep in mind that for ASP.NET 2.0 the transfer for a site from a development machine to a deployment machine is generally only a few steps that copy the databases to the data server and then do a simple file copy of the site folder and its subfolders to the new server.

This walk-through gave you a taste of what you will learn to create in this book. Most of the features explored were implemented with very little code that we wrote. The behavior was performed by code that Microsoft baked into a set of server-side controls that are the components of ASP.NET 2.0. We merely placed these controls on pages and set various properties.

Getting Started with Your Wrox United Site

Having observed the finished site as publicly hosted, now is the time to begin creating the same site on your desktop. If you have not installed Visual Web Developer Express, SQL Express, the sample database, and the sample site (outlined in Appendix B) then do so now. Start by reading the overview at the beginning of the appendix and then work your way through each step. You can be sure of your installation by performing the check at the end of each section.

This chapter and the next chapter set up the basic framework of the site as you learn how to use VWD and establish some design parameters for the site. Because VWD offers drag-and-drop solutions to most tasks, you will be able to create the entire site with a minimum of typing. In the cases where some typing is necessary you can cut and paste from text files in this book's download at `www.wrox.com`. All pages are in the download in their final form, but we strongly believe that creating ASPX pages yourself is a better way to learn ASP than merely copying completed pages from our reference set.

VWD Express — A Development Environment

A fundamental difference between most animals and humans is the ability to use tools. In the early days of programming the tools to write programs were very primitive. Today we enjoy the benefits of very sophisticated tools for software development. Engineers have taken almost every area of human weakness (primarily related to the capacity of memory and the brain's interface to the world) and created

compensating tools. These tools are pulled together into a type of software called an Integrated Development Environment (IDE). The IDE used in this text is Visual Web Developer Express (VWD).

VWD contains a number of development tools. First is an editor in which you can build a web page. This editor is enhanced with IntelliSense, a tool that finishes typing commands and offers appropriate choices for the developer. In addition, a toolbar contains icons that can be dragged to the editor and will automatically type a block of code into the editor. Another way to automatically get code into a page is with the many wizards that pop up when attempting a more complex task. VWD also contains a mini File Manager to organize ASPX and associated files and folders. Similarly, there is a Data Explorer that offers navigation through the data sources of the web site. A suite of troubleshooting tools is also included. Finally, VWD ships from Microsoft with a web server for testing named Cassini, which is covered in the next section. If you go beyond the scope of this book you can discover tools for more complex scenarios including the management of code versions among a team of developers.

Introducing Cassini

Earlier, Cassini was mentioned as the lightweight web server that comes with VWD. Both Cassini and IIS (included with the .NET Framework) can serve all ASPX and associated pages, so at deployment there is no need to make changes to your site. But a number of differences exist between the servers.

The two servers use different security models. IIS is a service and every service in Windows requires a user. The special user for IIS is named ASPNET. Cassini runs as an application that uses the currently logged-in Windows user. That makes Cassini easier to install because there is no need to create a specific ASPNET account in Windows. In fact, the installation of Cassini is transparent when VWD is installed.

Cassini has three downsides. First, it is a tool for designers to test pages on their development machine and thus it does not scale to more than one user. Second, because of the simplifications to the user model, Cassini cannot support a robust security scheme. Cassini should only run in a closed environment or behind a robust firewall. Third, when you run a page in Cassini it locks the page back in VWD. In order to unlock the page you must close the browser, which can be inconvenient when making and testing many changes to a site. Therefore, many developers use IIS even on their development machines so they do not have to close a page in the browser before working on it in VWD. The downside is that you have to configure your development machine to provide IIS, set up the appropriate authorizations, establish security controls, and create a virtual root. You learn how to set this up in Appendix B. If you don't want to go through the IIS setup you can still use Cassini and just close the browser between modifications.

VWD's Solution Explorer

An ASP.NET 2.0 web site is stored as a family of files. You need to be able to organize these files, including the tasks of viewing their names and relationships, copying, creating, and deleting. They can be viewed and manipulated in Windows Explorer. But it is inconvenient to switch between VWD and Windows Explorer, so VWD includes an explorer-like tool called the Solution Explorer, shown in Figure 1-2. The Solution Explorer is displayed by default on the right of the screen, or you can redisplay it by pressing Ctrl+Alt+L. Think of it as a Windows Explorer that considers your web root to be the highest level and does not require you to switch out of VWD. Note that the Toolbox may be placed behind the Solution Explorer, as in the case of Figure 1-2.

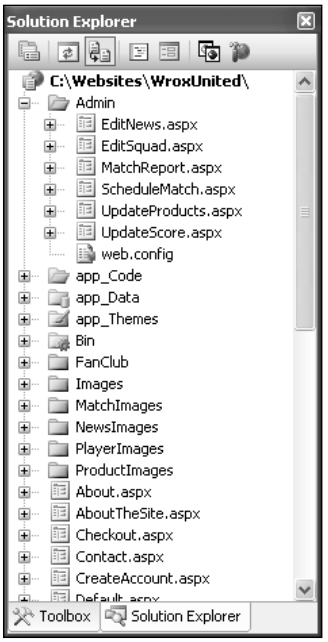


Figure 1-2

The layout of Solution Explorer is instantly familiar to anyone who uses Windows Explorer. Click the plus and minus icons to expand or contract folders. The icons in the toolbar start from the left with a tool that switches from the Solution Explorer to a view of properties (more on that later in this chapter). The double horizontal arrows perform a refresh. The double file icon automatically hides or expands nested sub-files. The next two icons open the selected files to display either their user interface (design) or their code. The double browser icon is used to copy the entire site to the deployment machine. The right-most icon, with the hammer, opens a Web Administrator tool to manage features of the site.

At the bottom of the Solution Explorer may be a small task bar that shows tabs for the Solution Explorer, Toolbox, Data Explorer, and/or Properties windows. To conserve monitor real estate these four tools are frequently stacked and the tabs offer quick switching. For example, in Figure 1-2, the Toolbox is also open (albeit hidden behind the Solution Explorer) and clicking the Toolbox tab would hide the Solution Explorer behind it. They are not strictly part of the Solution Explorer, but rather the pane that holds the four stacked tools.

In the main pane of the Solution Explorer is the list of files that make up your site. At the top is the root, generally in `C:\websites\MyWebSiteName`. In the case of WroxUnited we have used C:\BegASPNET2\WroxUnited. The files are displayed in their subfolders. Using the same techniques as Windows Explorer, you can expand, collapse, cut, copy, and paste files among folders. Solution Explorer recognizes the implied link between an .ASPX file and its .ASPX.VB or .ASPX.CS file (more on these in Chapters 6 and 9). If you copy the .ASPX file the code file will move with it.

You can also right-click a folder and select Add Existing Item. The resulting dialog box allows you to navigate anywhere on your computer and network (including FTP sites) to bring in files. For example,

when you begin to build your project there are times you will be asked to use an image or text file from this book's download at `www.wrox.com`. You can use Solution Explorer to add the item to your web site from your download folder.

ASP.NET 2.0 sites do not contain, during development, a special system of file registration. The files, including ASPX pages, code files, data files, and images are all contained in a normal Windows folder and subfolder structure. If you do not have VWD open, you can cut, copy, and paste your site files directly from Windows Explorer.

The Solution Explorer, like the Toolbar, Data Explorer, and Properties window discussed in the next section, can be placed on the page in one of two modes: *floating* or *dockable*. Floating allows the window to be placed anywhere on the screen, similar to a normal window of a base size (not maximized). Dockable will automatically place the window in one of five locations: top, bottom, left, right, or stacked on another window. Change the mode by selecting one of the windows, and click through Window ➪ Floating or dockable in the menu. In dockable mode you will see, when you drag the window's title bar, some translucent positioners (see Figure 1-3). Drag the title bar onto one of these positioners, and the window will automatically size and place itself in the correct dock.

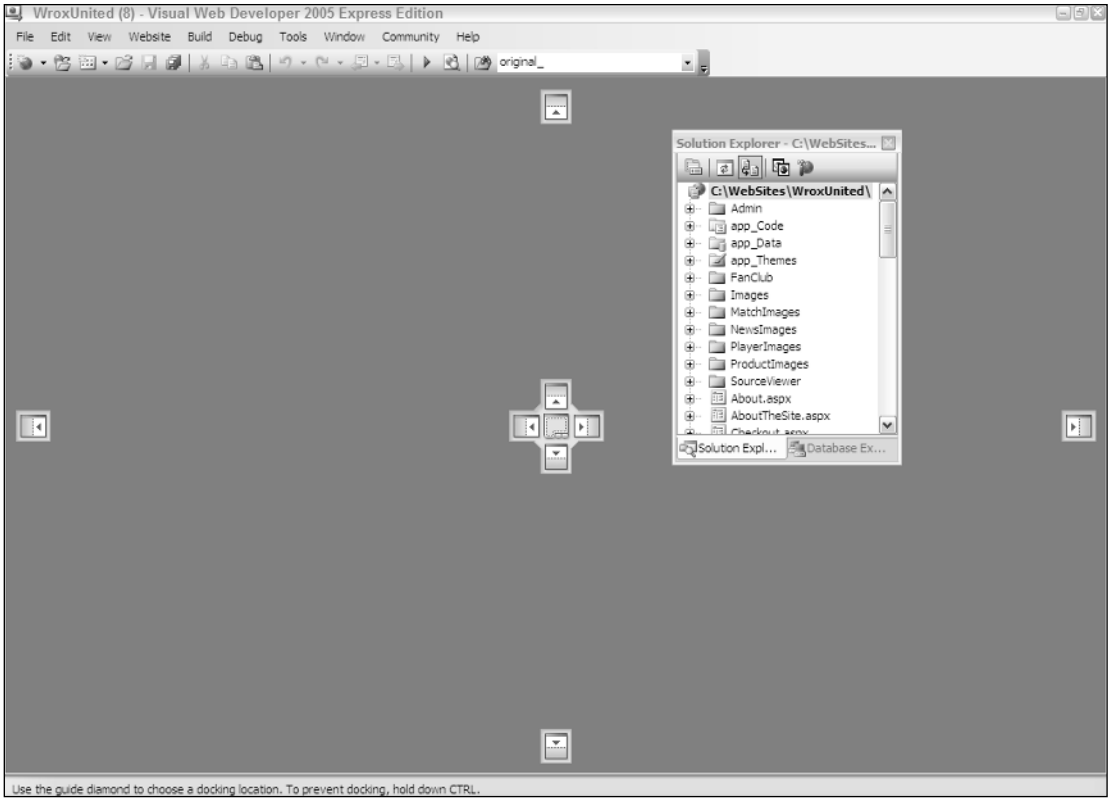


Figure 1-3

Having learned to modify the VWD Express IDE, you can now move on to the techniques of creating web sites and pages within those sites.

Creating, Opening, and Using Web Sites and Pages with VWD

To create a new site you only have to open VWD and click Menu ➪ File ➪ New Site. From the wizard, select an ASP.NET Web Site. Assuming you will create a local copy for development, set the location to File System and browse to the path. Normally this would be `C:\Websites\MyWebsiteName` (our practice site allows backward compatibility with earlier books by using `C:\BegASPNET2\WroxUnited`). You can pick either Visual Basic or C# as your language. Visual Basic is the default for VWD and the samples in the book. VWD will automatically create for you a folder, a default page, and a subfolder for data.

ASP.NET 2.0 introduces a very simple model for file organization and code registration for a web site. All files for the site are stored in a folder and its subfolder. At the time of deployment, that entire group is copied from the development machine to the host. Therefore, you are not required to create a virtual root as in former versions of ASP. Deployment is further simplified by VWD: If you select Menu ➪ Website ➪ Copy Website, VWD opens an FTP screen that you can use to send new or updated files to your host.

To edit an existing site, choose Menu ➪ File ➪ Open Web Site. If you are working locally you can browse to the folder. On the left side of the screen, VWD presents a menu with options to work directly on pages via FTP or through a local IIS installation.

Once the web site is created pages can be added. We usually start by adding some folders to organize the pages. Right-click an existing folder and click the option to add a folder. Special ASP.NET folders, such as those for Code, Themes, and Web References, have their own menu option.

To add a page, right-click a folder and click Add New Item. A wizard presents many choices. For now, you simply need to create a Web Form, but take a look at the other options to get a feel for the capability of VWD and ASP.NET 2.0. Give your new page a name and set its language. Later chapters discuss the two checkboxes. Having introduced you to creating web sites and pages, the following Try It Out puts that knowledge to use, asking you to create the Wrox United site and a couple of practice pages.

The Sample Code Directories

To make things easy, each chapter has its own code, and there are two directories for each chapter, held under one of two higher-level directories. There is a Begin directory, which contains the samples ready for you to work through – it's the samples without any changes. The End directory contains the samples with the Try It Outs completed, so you can use these as a reference as you are working through the examples, or to cut and paste code if the example directs you to do this.

These Begin and End directories appear under a Chapters directory, with each chapter having its own directory. So the starting set of samples for this chapter is under Chapters\Begin\Chapter01, while the finished code for this chapter is under Chapters\End\Chapter01. Some chapters work on the main WroxUnited application, and will therefore contain a copy of the WroxUnited directory, while others have non-WroxUnited samples. The reasons for this is that for some techniques it is easier to see them in smaller, easier to digest samples, than in a fully working application. All of the techniques however, are used in the main application.

Having separate directories, some with complete copies of WroxUited, does mean that the samples are quite large, but the advantage is that each chapter is kept separate from the others, and allows you to work through chapters without mixing up which code came from which chapter.

As well as the code for the chapters, there is a WroxUnited application that contains the final application. This may differ slightly from the samples, but only in that the data may be more complete, and some of the pages look a little nicer.

Try It Out Creating the Wrox United Site and Two Practice Pages

1. Open VWD. Choose Menu ➪ File ➪ New Web Site. Select ASP.NET Web Site located in the File System at `C:\BegASPNET2\Chapters\Begin\`; you can use the Browse button to navigate to this directory, and when you have, type Chapter01 on the end, so that the new Web site is located at `C:\BegASPNET2\Chapters\Begin\Chapter01`. Make sure the Language list is set to Visual Basic. Click OK. You should see your folder on the right side of the screen in the Solution Explorer. If not, choose View ➪ Solution Explorer. Note that VWD automatically builds three items: a folder named `App_Data`, a page named `Default.aspx`, and (if you expand `Default.aspx`) a file named `Default.aspx.vb`, which will hold code for the default page.
2. In the center of VWD you will see a space for editing pages with the `Default.aspx` page opened. Note in the bottom-left a choice of Design and Source. Click each in turn to observe the code and the results of the code. When in Design View, click the page and type the simple text **Home Page**. Press Ctrl+S to save.
3. Create a folder for images by going to your Solution Explorer and right-clicking the root of your site (this will probably show as `C:\...\Chapter01`, as the Solution Explorer hides part of the path) and then clicking Add Folder of the regular type. Name the nascent folder Images.
4. You can manipulate your site's files and folders outside of VWD. Open Windows Explorer and navigate to `C:\BegASPNET2\Chapters\Begin\Chapter01` to see the same set of folders and files as you see in VWD's Solution Explorer.
5. Returning to VWD, right-click the nascent Images folder and click Add an Existing Item. Browse to the folder where you stored the download for this book, probably named `C:\ BegASPNET2\WroxUnited`. Open the Images folder and select all the images. Click Add to actually copy those images from the download folder to your site's image folder.
6. Staying in VWD, now create your first page, the history of Wrox United. Right-click the site's root (`C...\Chapter01`at the top of the Solution Explorer) and select Add New Item from the menu. Select the Web Form template and give it the name History. Accept the other default settings. Click Add, and switch to Design View. Rather than typing text on the page you can copy a short history of the team from a file included in the download. Switch to Windows Explorer and navigate to your `C:\BegASPNET2\Chapters\End\Chapter01` folder. Look for the file named `History.txt`, open it, and select the paragraphs. Switch back to VWD and paste the text into the page. Click the diskette icon of the toolbar to save.
7. Repeat Step 6 for a Mishaps page, whose contents come from `Mishaps.txt`.

How It Works

In this exercise you created your site and the first few pages. By using the menu choices in VWD to create a site, you automatically get some standard folders and files. You could have followed the Microsoft recommendation of storing the site in the `C:\Websites` directory, but you can also put your site in an

alternate folder as we have done at C:\BegASPNET2\ – we did this to keep the book samples separate from any other Web sites you create. As you saw with the Images folder, it is easy to add subfolders to the root to organize your files.

When you created a page in VWD you were offered a few dozen templates. You selected Web Form as the standard plain ASP.NET 2.0 web page. By using cut and paste you have no problems bringing in text from other files.

You also learned that there is no requirement for a special file indexing or storage mechanism in VWD. The files sit in the folders organized by Windows on the hard drive. However, it is better to create and add files in VWD when possible to keep the Solution Explorer view and other VWD features immediately up to date with your changes.

Running a Page

Once a page is created it can be served to a user. Because the server actually executes code in the server-side controls to create the final HTML page, this serving of the page is also called *running* the page, as if you were running a program. VWD has a green triangle tool icon to initiate a run or you can press F5 or choose Menu ➪ Debug ➪ Run. VWD then performs several steps:

1. All pages in the site are compiled to the Microsoft Intermediate Language (MSIL) that is then stored with supporting files in an assembly. At this point development language differences (for example VB and C#) disappear because the result is in MSIL. However, there is no optimization for the hardware that will serve the page.
2. The assembly is Just In Time (JIT)–compiled from MSIL to Native Code that is optimized for the serving machine.
3. A lock is placed on the page that prevents changes in VWD Design View while the page is opened by Cassini.
4. VWD starts Cassini and your browser is opened with a request to Cassini for the page.

> **A common mistake for beginners is to attempt to change a page in VWD's Design View while it is still open in a browser served by Cassini.**

As your site gets larger, you'll find that the compilations take longer. You can press Ctrl+F5 to run a page with a compilation of only that page. In the following Try It Out, you practice running the History and Mishaps pages created in the previous Try It Out.

Try It Out Running a Page

1. In VWD's Solution Explorer, double-click the `History.aspx` file to open it (if it is not already open).
2. Click the Run icon (green arrow) on the toolbar. If there is a message to add a `Web.config` with a Debug, accept the suggestion. Note that your Browser opens and displays the History page.

3. In the Windows tray, the icon of a yellow page with a gear indicates that Cassini is running. Double-click it and you will see that it is pointing to your web site. Close your browser so Cassini unlocks the page.

4. Return to VWD and open the Mishaps page. This time, watch the lower-left corner of VWD as you start to run the page. You will see a message that the build has started and a brief display of an error list box. After seeing the Mishaps page in your browser, switch back to VWD. Note that the page (in Design View) is locked while it is served.

How It Works

This section focuses on running pages from VWD. You can start the run by clicking the green arrow. This action starts Cassini. It also opens your browser and sends a request to Cassini for the page. Once running, you can see the icon for the server in the Windows system tray.

Design Surface

The center of the VWD interface is occupied by the large Design Surface. This is the area where you will do most of your work of adding content to ASP.NET 2.0 pages. You can switch between Design View, which displays a simile of the final page in a browser-like display, or you can switch to Source View, which displays code in a text screen (see Figure 1-4). In general, the Design View is easier and faster for most work because it supports more drag-and-drop features. You can switch to Source View when you need to make those minor changes that are beyond the capability of the VWD drag-and-drop interface.

Figure 1-4

When you add a control to a page in Design View, a Common Tasks Menu may pop up. This mini menu contains the most frequently used setup features for the control. Not all controls have smart task panels, but if it is available it can be opened and closed using the small black triangle at the top corner (shown in Figure 1-5) of a control that is selected.

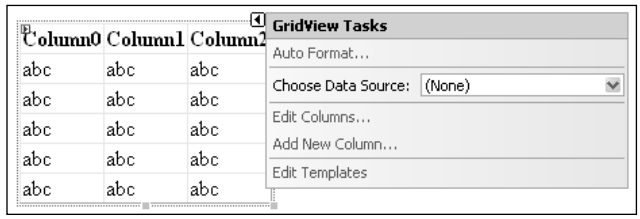


Figure 1-5

Several default settings can be changed in the Design Surface by opening the Tools menu and selecting Options. These options change the way the pages appear to you, as the programmer, when they are opened for editing in VWD. These are not the settings for the appearance of the page to the web site visitor. You can select to start pages in Design View or Source View, as well as the automatic opening of the smart task panel. Being able to revise the number of spaces for tabs and indents helps your projects conform to your company's specifications for web page code.

At the bottom edge of the Design Surface is a navigation tool that is useful in large and complex documents. You can read the navigation tags to find out where the insertion bar (cursor) is currently placed. The current setting will appear to be highlighted, as depicted in Figure 1-6. You can also click a tag and the entire tag will be selected in the Design Surface.

Figure 1-6

The designer is, in many ways, like your word processor. But VWD also offers the two alternatives to viewing a page (Design and Source) as well as enhancements for navigating through the page. The next section discusses how VWD helps you to add features to the page.

Toolbox

VWD offers the set of ASP.NET server-side controls in a Toolbox for easy drag and drop onto the page. Chapter 3 discusses in detail the various server-side controls and how they are used; here you will just get a feel for how to use the Toolbox in general. The Toolbox can be displayed by choosing Menu ➪ View ➪ Toolbox or by pressing Ctrl+Alt+X. Once displayed, the Toolbox can be moved to a new location on the screen by dragging its title bar. As you drag the Toolbox to different areas it will render a compass icon that allows you to drop the toolbar toward the top, bottom, left, or right, as well as on top of other windows. If you are trying to maximize the size of your design surface, you can stack your Solution Explorer and Toolbox on top of each other at one location on the screen.

The Toolbox is organized into several panels that group similar controls. The panels can be expanded to show their tools or collapsed to save space. There is some variation among installations, but a typical set of panels includes the following:

- **Standard** for the majority of ASP.NET 2.0 server-side controls.
- **Data** for data source and data-bound controls.
- **Validation** for controls that reject user input that does not meet your range of acceptable values.
- **Navigation** for menus and breadcrumbs.
- **Login** for the authentication controls.
- **WebParts** for larger components in sites that the user can rearrange or hide.
- **HTML** for generic (non-ASP) tags.
- **General** can be customized.

Figure 1-7 depicts the Toolbox as it will appear on your screen.

Figure 1-7

Clicking the plus icon expands a panel to show its list of available controls. Figure 1-8 shows the Login and Standard panels expanded.

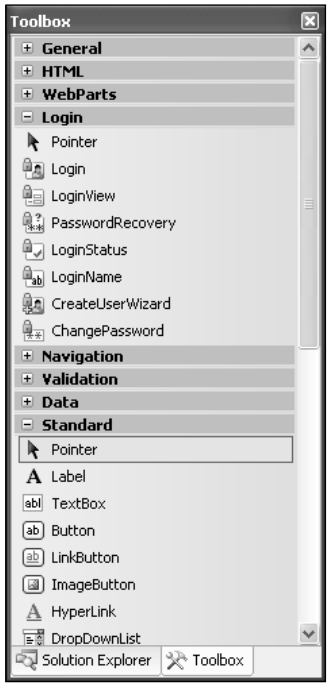


Figure 1-8

The General panel starts out empty. After you have created part of a page, you can select that page and drag it into the General panel to create your own reusable tool. This is useful if you want to duplicate a set of a couple controls with formatting onto several pages.

On the right side of the Toolbox title bar there is a pushpin icon, shown in Figure 1-9. When clicked, the pushpin turns horizontal, meaning that the Toolbox will automatically hide when not in use, leaving only its title bar exposed.

Figure 1-9

The appearance of the Toolbox changes as it is used. For example, the titles of each panel will change as they are selected.

When your mouse moves over the Toolbox title bar, the Toolbox will expand out for your employment, as shown in Figure 1-10.

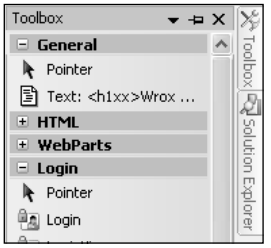


Figure 1-10

In this Try It Out you practice using the Design and Source Views and Toolbox features of VWD.

Try It Out — Using the Views and Toolbox

1. Continue working in VWD with your Mishaps page.
2. Switch to Design View. In the Toolbox, expand the HTML panel and scroll down to the bottom of the panel. Drag a Horizontal Rule from the Toolbox onto the page (anywhere between paragraphs).
3. Your next objective is to add a calendar to the bottom of the History page. Open the Standard panel of the Toolbox and find the ASP.NET calendar control. Drag it to the page. (Double-clicking performs the same operation.) Select the calendar with a single click and notice the small right-facing arrow in the top-right corner. Click it to expose the smart task panel. Click Auto Format, select a format, and click Apply. Observe how easy it is to modify many rendering criteria at once using VWD's dialog interface.
4. Open your History page in VWD. View it in DesignView. Move your insertion bar up to the first line to the tag that begins with `<%@ Page...>`. Note that the navigation guide (at the bottom of

the design panel) shows you that you are in the `<Page>` tag. Click the `<Page>` tag. You will see that the entire tag is selected in the design panel.

How It Works

As you saw, by adding a simple HTML Horizontal Rule, the Toolbox offers the ability to drag and drop elements to the page rather than typing out their tags. Even complex constructs like a calendar are added with just a drag and drop. Once on the page, you can modify an element by using the smart task panel.

Properties Window

An object, such as a web page, a `ListBox` server-side control, or a connection to a data source, has *properties*. Properties are settings that determine how the object appears and behaves. In earlier versions of ASP, many goals were achieved by writing lengthy and complex code. In ASP.NET 2.0, however, most of that code has been pre-written by Microsoft and encapsulated within the server-side controls. Properties determine how that behavior will be exercised. Properties can be very simple, such as BackColor, or very complex, such as EnablePaging. Likewise, the values assigned to a property can be as simple as BLUE or as complex as a multiple-line SQL statement. Properties values can be set by typing them directly into the Code View or by using the Properties window, which is shown in Figure 1-11.

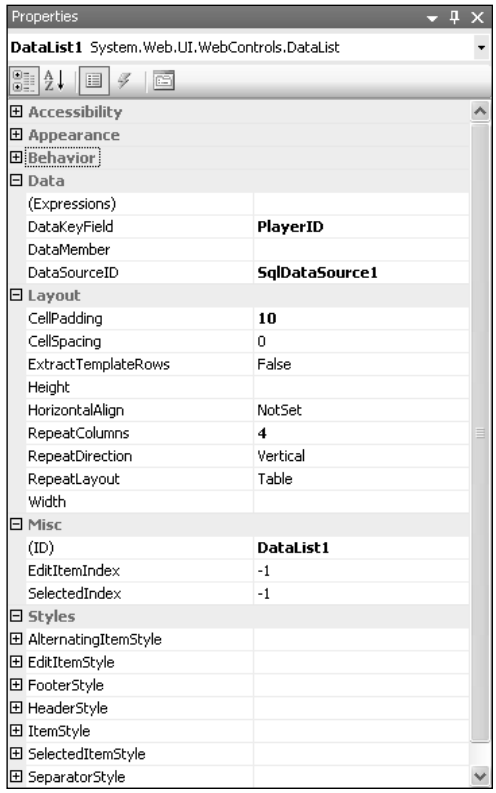


Figure 1-11

Display the Properties window by pressing F4 or by choosing Menu ➪ View ➪ Properties. The properties are organized into panels that can be collapsed or expanded (similar to the Toolbox). For example, in Figure 1-11 the top three panels are collapsed. At the top of the Properties window is a drop-down list containing the names of all of the controls on the page currently open. Below that are icons to arrange the list of properties categorically or alphabetically. The lightning icon will change the Properties window so that it displays events (a topic covered in Chapter 6) rather than properties. The body of the window displays property names on the left and their current values on the right. At the bottom sits a box that gives some help on the currently selected property.

The fundamental technique used to change properties is to select an object, usually a control, and then find the property of interest and set it. You can select the object with a single click on the object in Design View or by locating the insertion bar in the object in Source View. Alternatively, you can select an object from a drop-down list at the top of the Properties window. One common mistake arises when you attempt to change the properties but have not first actually selected the object you want to change. You end up changing an object that was still selected from earlier work.

You have several options for setting the value of a property. If the property has a limited number of allowed values (such as true and false), you can double-click the property name to toggle through the values. If there are more than a few options, but still a finite amount, the values will be in a drop-down list. Some properties have many options, and their value box offers an ellipses button that takes you to a dialog box. Last, some properties can accept strings, so their values are set in text boxes. It is always better to select or to toggle a value rather than type it. Once a value has been changed, you must press Enter or Tab or click another property in order to set the value. At that time the Design View will render the change.

You can also set property values by typing into the Source View. Locate the insertion bar within a tag and press the space bar to display an IntelliSense list of all the properties that can be inserted at the location of the insertion bar. Type the first letter or two then an equals sign. IntelliSense will then display all of the legal values (if the list is finite), and again type the first letter or two of the value you desire. Finish by typing a space. Note that there will be no value list if the range of possible property values is not finite. For example, if the value is a SQL statement you will have to type the statement without IntelliSense.

Error List Window

When problems arise you have two major paths for obtaining clues about the problem. First is an error report on the page delivered to the browser, and second is the Error List window within VWD.

ASP.NET 2.0 will give an error report (shown in Figure 1-12) on the page sent to the browser if the following shaded line is in your `Web.config` file:

```
   <system.web>
             <compilation debug="true">
              </compilation>
```

Note that the first time you run (F5) a page you will get a default of <compilation debug=”true” strict=”false” explicit=”true”/>.

Because the default is `true`, you will have debug turned on if there is no specific attribute. So `debug=true` for the following case as well where there are no changes to the default. Of course, having it literally set to `true` helps other programmers on your team that may be looking through your settings:

```
<system.web>
        <compilation></compilation>
```

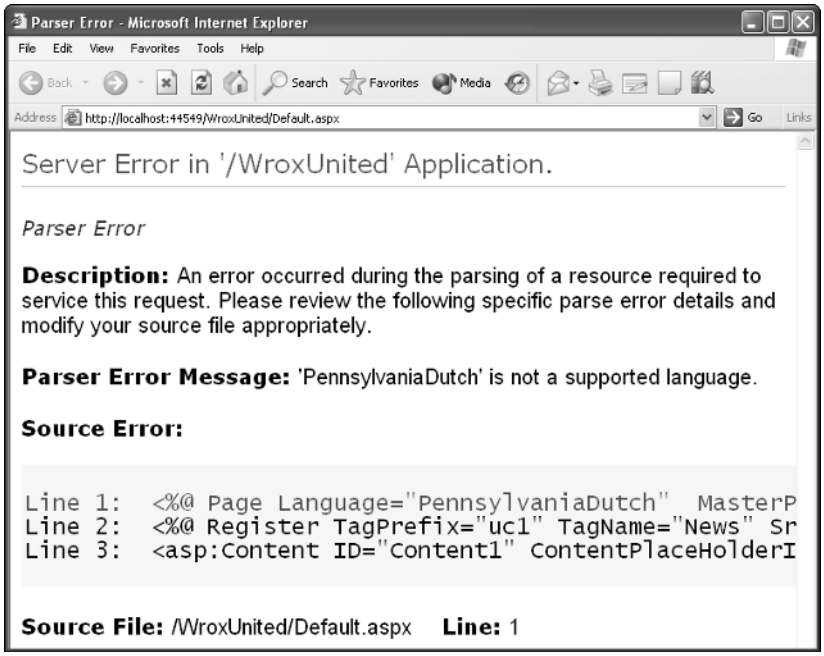


Figure 1-12

A fatal error on the page produces a characteristic white and yellow page on your browser with an error message. Just below the yellow block is the name of the offending file and the line containing the failure. As with all errors, the error may actually be related to the line number displayed, but this should give you a good clue. Note that when you deploy a site the `debug` command in `Web.config` should be set to `false` to improve performance and to reduce information given to hackers. Error handling is covered in greater depth in Chapter 15.

The second way to identify errors comes from within VWD itself via the Error List window, depicted in Figure 1-13. By default, the window is hidden until you run a page. You can force it to be displayed by choosing Menu ➪ View ➪ Error List. The window displays all of the errors encountered during the conversion of the page into the MSIL.

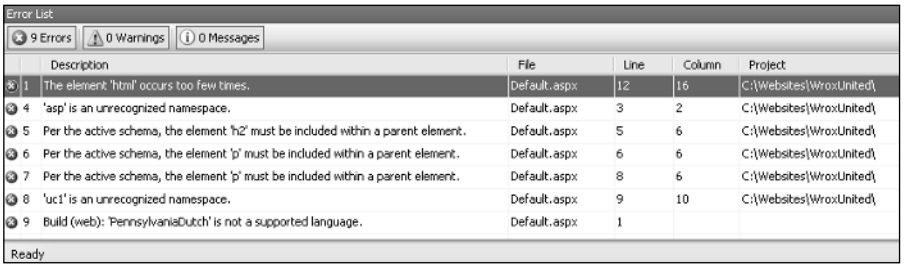


Figure 1-13

Note that the top of the Error List window has three clickable icons: Errors, Warnings, and Messages, which display different lists of items created when the page was built. Hiding a type of item does not remove it from the list; rather, doing so only hides the item so the list is shorter. The second column from the left identifies the order in which the errors occurred.

Errors cause the page as a whole, or some portion of it, to fail. This includes, for example, references to objects that do not exist.

Warnings are problems that could be solved by VWD while building the page (for example, the lack of a closing tag).

Messages are sets of texts that the programmer can include in the code to appear when IIS is building the page.

When viewing the list of items you can sort by clicking a column heading. If you hold Shift you can click a second column for tiebreakers (to determine the order for records with the same value in the primary column). You can also resize the columns by dragging their dividers, or re-order them by dragging the column name left or right. Double-clicking an item allows you to open the offending file and jump the cursor to the offending line.

In this Try It Out you practice changing properties of an image control on the History page. Then you create some errors and observe the results.

Try It Out — Using the Properties and Error Lists Windows

1. Open the History page in Design View. In the Solutions window, open the Images folder and drag the jpeg named logo-yellow to the top of the History page. VWD will automatically create an image with its source set to the jpeg.
2. Click the image once to select it, and then switch to the Properties window (or open it with F4). Change the height from 447 to 100 and press Enter to set the value. As you can see, changes are immediately visible in the design panel.
3. Now modify properties from Source View. Find the `<img>` control and within it the property (attribute) for height. Change it from 100 to 300. Click the green arrow (or press F5) to run the page to see the result.

4. Close your browser and return to Source View. Locate your insertion bar in the `<img>` tag immediately after the closing quote of `height="300"` and press the space bar. This opens the IntelliSense list with all of the properties that are suitable at this point in your page. Press the t key and then the i key to move down the list to the Title property. Press the equal (=) key to close the IntelliSense and type in **"Wrox Logo In Yellow"** including the start and end quotes. Run the page, and in your browser note that when you mouse over the image you see the title you created. Close the browser.

5. Next, introduce a non-fatal error. Open the History page in Source View and find the `<h1>` tag near the top of the page. Change the `<h1>` tag to `<H1xx>` and run the page. The browser opens and you can see that the text "Wrox United — a potted history" fails to render in heading-one style. Close the browser and switch back to VWD to observe the Errors List window. If not already visible, choose Menu ➪ View ➪ Error List to view the Errors List window. Note that two errors were entered in the list. First was a note that "h1xx" on line 3 is not supported. Second, the closing tag of `</h1>` on line 4 no longer matches an opening tag.

6. Your last experiment is to introduce a fatal error. In Source View go to the top of the page and change the first line from `Language = "VB"` to `Language="Esperanto"` and run the page.

7. You will deal with solving many kinds of errors in each chapter of this book. For now, return your page to its original form by deleting the `<img>` tag, restoring the goofy `<h1xx>` to the proper `<h1>`, and changing the language back to VB.

8. Save the page.

How It Works

You experimented with three ways to change a property. First you worked in Design View and changed a property by typing its new value into the Properties window. Next you made a change by hand-typing a new value into the source code. Last, you used IntelliSense to guide you through adding a property to an existing control.

You observed the results of two types of errors: fatal and non-fatal. In the first case, ASP.NET 2.0 could still render the page even though the faulty tag of `<h1xx>` left your text as default, not heading one. Although the page rendered, back in VWD an error message was logged on to the Error List window. You introduced a more serious error when you changed the language value to a non-supported language. ASP.NET 2.0 could not overcome this error and so you see two results: In the browser you got the error page with troubleshooting information, and back in VWD you got entries to the error list.

VWD's Database Explorer

When you begin to work with data (in Chapter 7 and following) you can use tools in VWD to gain knowledge about your data sources. This information includes the exact names of tables and columns. In fact, as you see later in this book, you can drag columns to the designer and VWD will do all the work of setting up the proper controls to display data from those columns. For now, understand that in the Solution Explorer you can double-click the name of an Access MDB to open that file in Access (assuming Access is installed). For SQL Server databases (as used in this book) you can use a tool named the Database Explorer to do even more exploration of a database and change its data and properties. These features are discussed in detail in Appendix D.

Summary

Microsoft has revised large parts of ASP.NET in version 2.0. The overall biggest benefit is that tasks, which formerly required custom coding, can now be implemented by dragging pre-built controls to the page. These pre-built controls include tools for logging on users, navigation, connecting to stores of data, displaying data, creating a consistent look to the site, and offering customization options to the user. The result is both faster and more robust development of dynamic web pages. On top of this Microsoft has made version 2.0 easier to deploy and faster in performance. As with earlier versions of ASP, the execution of code (that is, the building of dynamic pages) occurs on the server and only standard HTML is sent to the browser. Thus, ASP.NET 2.0 is compatible with all browsers.

Three tools are available from Microsoft for creating ASP.NET 2.0 pages. The one used in this book, Visual Web Developer Express (VWD). VWD displays the organization of pages on your site, and helps you to build new pages or modify existing pages. VWD also comes with a lightweight web server named Cassini for testing your pages. After building a page you can click Run and VWD will start Cassini, start your browser, build the page, and serve it to the browser. This chapter also covered the following topics:

- VWD offers many options for the way that you view and work with pages during their development. Tabs allow switching between Design View (which displays a good facsimile of how the browser will render the page) and Source View (which shows the tags and code that generate the page).
- When creating a new site or adding pages, VWD offers wizards and templates that walk you through the most common setups. In this chapter you looked at how to create a new page based on one of several dozen templates, followed by working with the Toolbox. This source of pre-built objects is a focus of building pages in all the exercises of this book. To organize the large Toolbox, the tools are divided into groups.
- Another window displays properties of whichever object is currently selected. You can, for example, select a text box and see its size, background color, and dozens of other properties. The remainder of this book goes into the details of many properties of objects that ASP.NET 2.0 supports on a page.
- When a page is built as a result of the VWD Run command, you get some feedback on how the process fared. Fatal errors are listed, as well as warnings about potential problems with the page. Double-clicking any of those errors will lead you to the offending line in the site.

This first chapter focused on an introduction to ASP.NET 2.0 and how to build your first pages using VWD. Chapter 2 moves on to understanding some of the ASP.NET 2.0 features that govern the look and feel of all the pages on a site.

Exercises

1. Explain the differences among the .NET 2.0 Framework, ASP.NET 2.0, VWD, and IIS.
2. List some differences between Cassini and IIS.
3. When you drag the title bar of the toolbar it will only go to certain locations and certain sizes. How can you put the title bar where you want it?

4. How can you copy a .jpg file in `C:\MyPhotos` into your site for display on a page?
5. You want to add a subfolder to your site, but Folder is not one of the items listed in Add Items. Why?
6. Microsoft has written extensive code to make it easier for programmers to create Web pages. How does a programmer actually use that code?
7. Why are there no tools in the General panel of the Toolbox?

2

Site Design

When you start to develop a web site, you'll often have a good idea of what the site needs to be able to do; for example, a blog site needs the ability to store blog entries by categories, for adding comments to blog entries and an administration section, at the very least. Alternatively, consider a simple retail store that wants to enter the realm of e-business by having a web site that enables customers to browse and buy their products. Each and every site needs to be carefully thought about and designed before you can start work, and only then can you start putting code together to implement a site.

Before jumping into the discussion and implementation of specific techniques, we should discuss the development of good site design with an eye toward the features supported by the ASP.NET 2.0 server-side controls. After all, a well-designed site is easier to create, easier to use, and easier (and cheaper) to maintain.

In this chapter, you learn about the following concepts:

- How to start the design process for a site, and consider all the requirements for the site before you start coding.
- Using Master and Content pages to implement a consistent look and feel to a site using this great new ASP.NET 2.0 feature.
- Constructing a site map that defines which pages exist on a site, and how these pages relate to each other hierarchically.
- Storing central configuration data and code that is used by all pages on a site using the `Web.config` and `Global.asax` files.

At the end of the chapter are some exercises to help you to gain a bit more familiarity with the concepts learned in this chapter.

General Design Objectives

Designing a fully functional web application is a big task. If you're developing your own site, you may have thought long and hard about what you want your site to be about, so you know what it is you're trying to do before you start. However, if you are developing a site for a customer, you must make sure you are careful and thorough about how you agree on a design for a site. In a professional development environment, this process normally includes the following steps:

- Develop a functional model that describes exactly how the site should function. What happens when the user clicks the Log In button? What features are available when a user wants to view a product? These questions, and many others, need to be answered before you start work, so you don't end up developing something that the customer doesn't want!
- Identify which technologies you have available to use in the implementation of the site. Many hosting packages have different levels of support for databases, and limitations on the overall size of a site, so make sure you talk about this early on and make sure you can use all the technologies you would like to use.
- Develop a technical specification that describes how you will implement the required functionality. For example, on a blog site, how will you make sure that when the user clicks the button to post a new blog entry, the text that has been entered is saved in the database? Be as thorough as you can, because you may not be the one who has to maintain the site later.

This may sound like quite a lot of work, but even for smaller businesses or sole trading contractors, following this process will help you to maintain a happy relationship with your customer, and potentially secure future work with either that customer or any of their friends or business contacts.

Once you move from the business side of things into the implementation phase, you start to think about how to create the application, and how to actually design the site in line with what the customer wants. Creating a web application requires more than just correct use of the ASP.NET 2.0 server-side controls, because the process of actually designing and laying out the pages of the site is just as important.

Note that the term *design* can have two meanings. The first is the selection of colors and layout, which are typically created by a design artist for the site. The second definition includes the intellectual construction and coordination of the parts of the site. This includes the plans for the architecture of the information; in your case you want to store as much information as possible in a relational database. This chapter concentrates on the second definition. The next chapter considers how to design each page in a site, using a healthy mix of HTML and ASP.NET controls.

The Wrox United sample site has several site-wide design objectives that are implemented in this chapter:

- Facilitate troubleshooting as much as possible during the development, so that it's a simple process to track down errors.
- Set site-wide standards for coping with errors after deployment.
- Create a consistent look for all pages.

Additional general design objectives are covered later in the book, including an interface for a login system to identify members (Chapter 4), applying consistent styling and themes to a site (Chapter 5), and sourcing as much information as possible on databases or XML data files (Chapters 7 and 8).

Master and Content Pages

A site benefits from a consistent look and feel, and you'll rarely find sites on the Internet that deviate from having a generic site layout, which generally includes the following:

- A common header and menu system for the entire site
- A bar on the left side of the page offering some page navigation options
- A footer providing copyright information and a secondary menu for contacting the webmaster

These elements will be present on every page and they not only provide essential features, but the consistent layout of these elements signal to users that they are still in the same site. Although this appearance can be built with include files in HTML, ASP.NET 2.0 provides more robust tools with the Master page and Content page system.

A Master page defines the layout to be used by all pages based on the Master. It's the overall parent that controls your layout, specifying how big your header will be on every page, where your navigation features will be placed, and the text to display in the footer on every page — a bit like a cookie cutter for each page. The Master page contains some of the content available to each page on the site, so standard copyright footer text can be defined here, along with positioning the main site logo at the top of the page. Once the standard features of the Master are defined, you then add some *placeholders* — named regions on a page that define where content that varies from page to page will be positioned.

A Content page is a page based on a Master, and is where you add the content for each page on a site that varies from page to page. The Content page contains text, HTML, and controls within `<asp:content>` tags. When the Content page is requested, its content is combined with a copy of the Master page, with the specific content defined in the Content page placed within the specified placeholder on the Master page. Then the whole package is delivered to the browser, as shown in Figure 2-1.

Fortunately, the heavy lifting for this architecture is performed by ASP.NET 2.0; you only have to create the Master and Content pages as laid out in the next two sections.

Creating a Master Page

A Master page is created in VWD's Solution Explorer by right-clicking the root of the site, selecting Add Item, and designating the type as a Master Page. By default, the name for a new Master page is `MasterPage.master` and is located in the root of the site. The Master page has three parts.

First are some basic page tags and designations (such as the designation of a Master, `DOCTYPE`, `xmlns`, `html`, and `head` tags) that are required by any rendered page. This content is entered only once in the Master page, to reduce repetition. The `DOCTYPE` and `xmlns` refer to the place the server can look up the definitions of tags used by the page. Note that these tags will not appear in the Content pages:

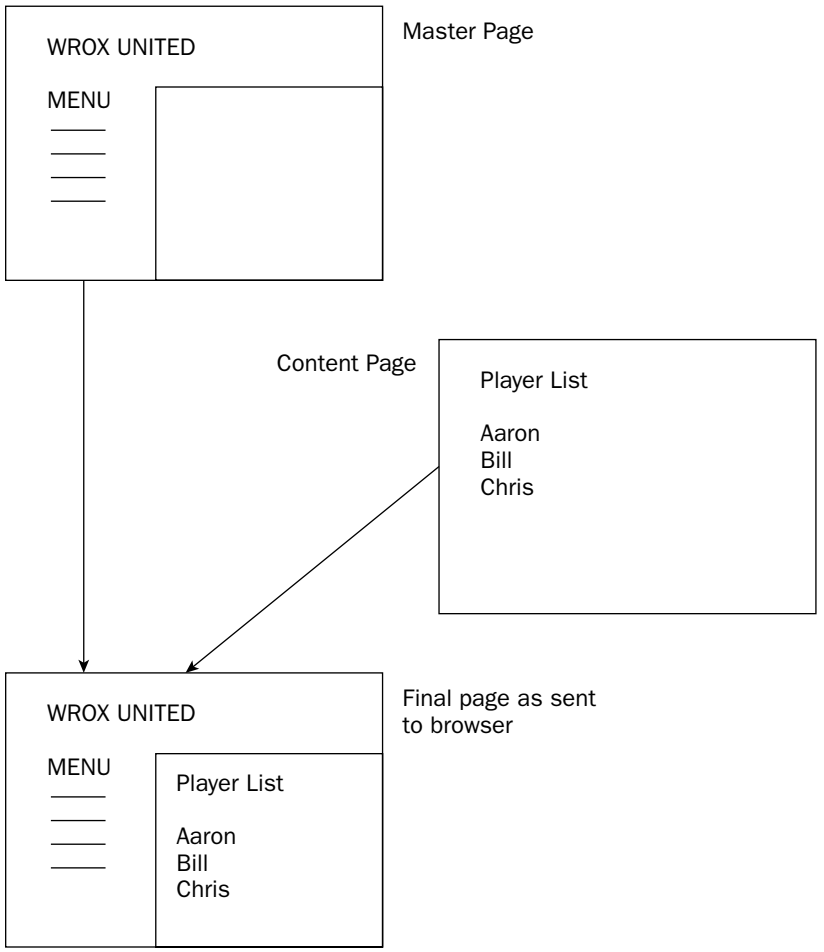


Figure 2-1

```
<%@ master language="VB" %>

<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<html xmlns="http://www.w3.org/1999/xhtml">

<head id="PageHead" runat="server">
  <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
  <meta http-equiv="Content-Language" content="en-uk" />
  <title>Wrox United</title>
  <link rel="stylesheet" type="text/css" href="site.css" runat="server" />
</head>
```

The second part of the Master page is a place for scripts that will be run on all pages (for example, `Page_Load` code, which runs each time a page is loaded), for example:

```
<script runat="server">
  Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs)
    ' ...
  End Sub
</script>
```

Third, the Master page includes some HTML for layout, and the start/end tags `<asp:content ... ContentPlaceHolderID="xxx>` and `</asp:content>` tags. The material from the Content page will be placed between these tags. For example:

```
<body>
  <form id="mainForm" runat="server">
    <div id="header">...</div>
    <div id="sidebar">...</div>
    <div id="content">
      <asp:contentplaceholder id="mainContent" runat="server" />
    </div>
    <div id="footer">
      <p class="left">
        All content copyright &copy; Wrox Press and its subsidiaries 2004.</p>
    </div>
  </form>
</body>
</html>
```

In summary, each Master page must include the following elements:

- Basic HTML and XML typing tags
- `<%@ master ... %>` on the first line
- An `<asp:ContentPlaceHolder>` tag with an ID

The Master page is now available as a container to hold other pages. You create those Content pages in the next section.

Creating Content Pages

As with most of ASP.NET 2.0, VWD saves you typing. Starting in the Solution Explorer, right-click the root and select Add New Item. Generally, you will pick a Web Form; there is no special template for a Content page. Notice at the bottom of the dialog box the option to Select master page (see Figure 2-2). When this box is checked and you click Add, you will be led to an additional dialog that asks which Master page to use for the new Content page.

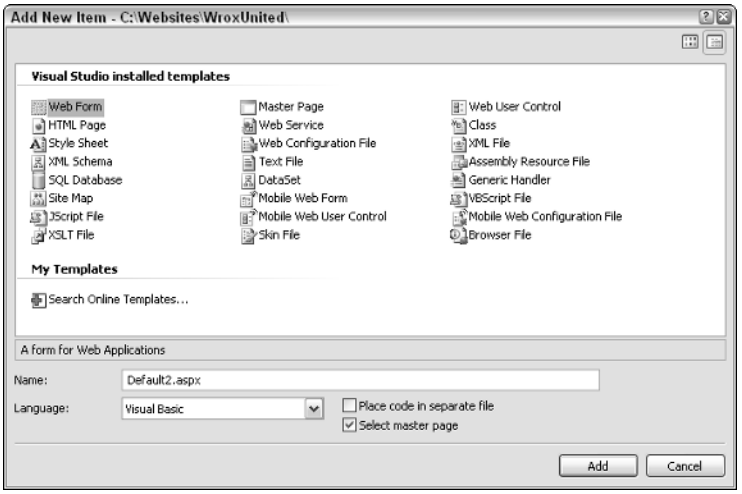


Figure 2-2

The second dialog box (shown in Figure 2-3) allows you to pick which Master page to use. Select the Master page (usually named `MasterPage.master`) and click OK.

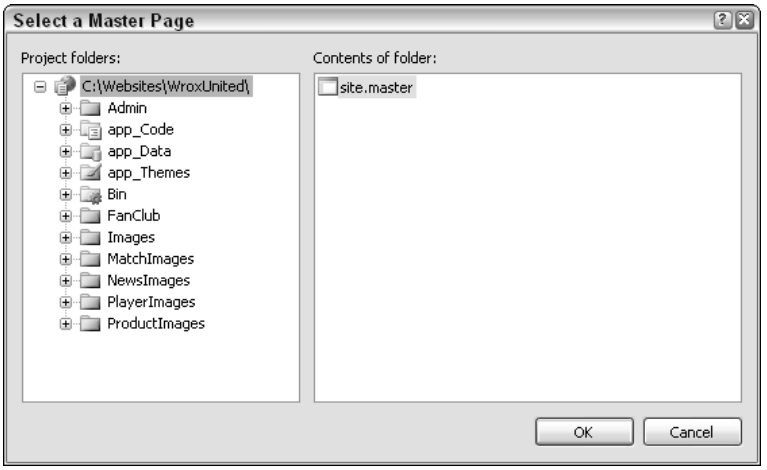


Figure 2-3

VWD sets two values in the Content page. They are not shown in Design View, but switching to Source View reveals them, as displayed in the code below. First, the Master page to use will be stated in the first directive. Second, VWD will include an `<asp:content>` control with a property that designates the ID of the placeholder in the Master page. A Master page may have many places where Content pages can be inserted. This designator identifies which placeholder to fill with this particular page.

```
<%@ Page Language="VB" MasterPageFile="MyMasterPage.master" %>
<asp:Content ID="Content1"
ContentPlaceHolderID="Content Place Holder ID in Master Page"
Runat="Server">

... content goes here

</asp:Content>
```

To summarize, the Content page exhibits three features as follows:

- Lack of the HTML `<!DOCTYPE HTML . . . >` and XML `<html xmlns=. . .>` typing tags
- `<%@ page MasterPageFile= . . . %>` on the first line to instruct ASP.NET 2.0 which Master page to use
- An `<asp:content>` tag

The theory is not difficult and the typing is done automatically by VWD. In the following sample, you see Master and Content pages working together.

A Sample of Master and Content Pages

Almost all of the exercises in this book can be carried out in Design View (without working directly in code). But it is interesting to take a look at how VWD builds pages by switching to Source View. The following code listing shows an example of a Master page (named `research.master`) for a corporation and a Content page called "mission statement." The first shaded line designates the Master page, and the second shaded area is a control that defines a content placeholder, where the content developed on a Content page will be inserted:

```
<%@ Master Language="VB" %>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server"> <title>CorporateMaster</title></head>
<body>
Corporation Name
    <form id="form1" runat="server">
    <div>
        <asp:contentplaceholder
              id="ContentPlaceMissionStatement"
                runat="server">
        </asp:contentplaceholder>
    </div>
    </form>
</body>
</html>
```

Following is the Content page for this example. The highlighted section designates the Master page and the control that delineates the material to be put in the Master page. The ID of the `ContentPlaceHolder` must match the ID of the `ContentPlaceHolder` in the Master page. The following listing is complete; there are no additional tags or attributes at the top of the page:

```
<%@ Page Language="VB" MasterPageFile="~/research.master" Title="Untitled Page" %>

<asp:Content ID="Content1"
  ContentPlaceHolderID="ContentPlaceHolderMissionStatement"
  Runat="Server">

Our Mission Statement is to provide value to the customer.

</asp:Content>
```

Note that a Content page must have a very minimal set of tags. The Content page does not have tags such as `<!DOCTYPE >` or `<html xmlns="http://www.w3.org/1999/xhtml" >`. Nor does the Content page contain `<head>` information. This data will be provided by the Master page.

Using Cascading Style Sheets in a Master Page

A Master page is a good location to declare a link to a Cascading Style Sheet (CSS). CSS is a feature of HTML, not ASP.NET 2.0, so the topic isn't covered in depth in this book. However, CSS is discussed as related to themes in Chapter 5. There is also a brief reference for HTML and CSS in Appendix E. In short, a CSS contains formatting for various styles to be applied to pages and controls, so that when a page is rendered, the elements on a page, the style of the text, buttons, links, and so on, appear formatted according to the style definition in the CSS. This saves the designer from having to include (and maintain) many individual style format tags for frequently used designs. A CSS also speeds page loading because the CSS is loaded just once by the browser, and then reused directly from the client-side cache for each subsequent page that uses that style sheet. On a Master page, you should include the following kind of link (highlighted with a gray background) in the `<head>` section to link a page with a CSS:

```
<head id="PageHead" runat="server">
    <title>Wrox United</title>
    <link rel="stylesheet" type="text/css" href="MySite.css" runat="server" />
</head>
```

In the following Try It Out, you get the chance to create the Master page for the Wrox United site. You will be adding content and features in the exercises of each chapter of this book. At this point you will simply create the shell of the Master page. You will add many additional parts to the Master page later in the book, so if it seems a bit incomplete now, hang in there!

Try It Out Creating a Master Page and Importing a CSS

1. Open the sample site for this chapter, located at C:\BegASPNET2\Chapters\Begin\Chapter02. You will start by importing a CSS file the authors have created for you. Right-click the root of the site and select Add Existing Item, as shown in Figure 2-4.

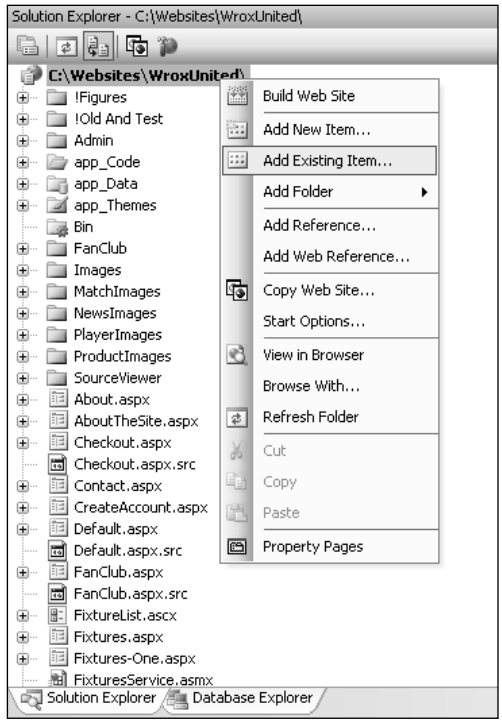


Figure 2-4

2. Navigate to the folder where you downloaded the files for this book (C:\BegASPNET2\WroxUnited), select `site.css`, and click Add. CSS is an HTML topic (not ASP.NET), but if you want to open the file you can observe styles set for the HTML of the body, such as `<h1>`, `<h2>`, and so forth. There is no need for you to modify this file. Observe that you now have a `site.css` file in the list of files displayed in the Solution Explorer. If you opened the CSS file, close it now.

3. Again, right-click the root, but this time select Add New Item and use the Master Page template. Name the page `site.master`. Ensure that the checkbox for Select master page is not checked (that option is only for Content pages). After VWD creates the page you can observe it in Design View, although it is empty at this point. Notice in Source View that VWD has added several tags and controls for you (see the following code). The first tag is a designation that this will be a Master page and the second tag is the normal document type designation. Following that sits a place to insert scripts and then an XMLNS value. Observe that in the `<body>` VWD created a `contentplaceholder`:

```
<%@ master language="VB" debug="true" %>
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">

<script runat="server">
</script>
```

```
<html xmlns="http://www.w3.org/1999/xhtml">

<head id="PageHead" runat="server"> ... </head>

<body>
  <form id="Form1" runat="server">
    <div>
      <asp:contentplaceholder id="mainContent" runat="server" />
    <div>
  </form>
</body>
</html>
```

4. You want to change the name of the form from the generic VWD names to something more applicable to your situation. Switch to Source View and change the `<form id="form1" runat="server">` to `<form id="MainForm" runat="server">`.

5. Switch back to Design View to set the style sheet. At the top of the Properties box, drop down the list of controls and select Document. At the bottom of the properties list, find Style Sheet (see Figure 2-5), click its ellipses, and browse to `site.css`. Click OK.

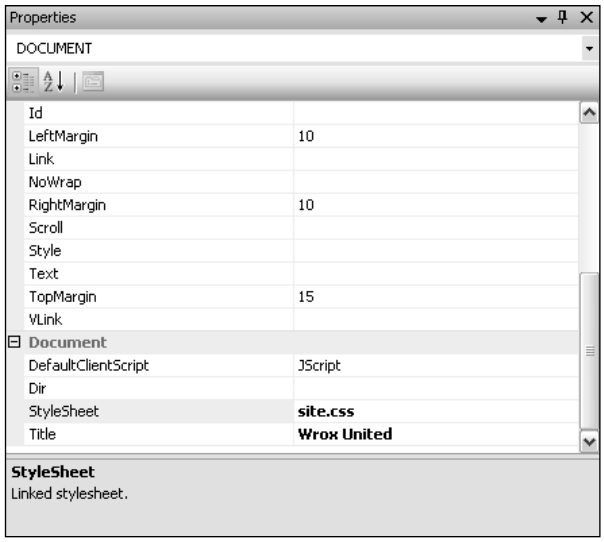


Figure 2-5

6. Adding `<div>` tags divides the page for easier formatting. Your Master page will use four `<div>` sections within the `<form>`. Some of these will then contain additional `<div>` tags within them (lower-level `<div>`). The first `<div>` is automatically created by VWD; the others you will add by hand. A `<div>` can be dragged onto a page from the HTML section of the toolbar, but it is difficult to get it located properly in Design View. You will use Source View to get exact placement.

7. Switch to Source View and find the default `<div>` within the form. Select from the beginning of the `<div>` tag to the end of the `</div>` tag, and note that the Properties window now shows properties for the `<div>`. Set the `id` property to `content`.

8. Staying in Source View, add another `<div>` by dragging the control from the HTML section of the toolbar to a position above the `<div id="content">`, but still within the `<form>`. Set its `id` property to `header`.

9. Add two more `<div>` tag sets within the form. Give the first one below header an ID of `sidebar` and give the lowest one an `id` of `footer`.

10. Staying in Source View, now create lower-level `<div>` tags, which will reside inside of the `<div>` you created earlier. In the `header <div>`, drag in a `<div>` and give it an `id` of `logo`. Follow the `logo <div>` with some simple text for display, shown here:

```
<form id="mainForm" runat="server">

  <div id="header">
    <div id="logo"></div>
    <h1>Wrox United</h1>
  </div>
```

11. In the `sidebar <div>` add the text `Navigation`, as shown in the following code:

```
  <div id="sidebar">
    <h3>Navigation</h3>
  </div>
```

12. You will add controls to the `content <div>` in the next few chapters, but for now, add a lower-level `<div id=>` with an `id` of `itemcontent`:

```
  <div id="content">
    <div class="itemContent">
      <asp:contentplaceholder id="mainContent" runat="server" />
    </div>
  </div>
```

13. In the `footer <div>` add two notices of copyright:

```
  <div id="footer">
    <p class="left">
      All images and content copyright &copy; Wrox Press and its subsidiaries 2004.
    </p>
    <p class="right">
      Website designed by
        <a href="http://www.frogboxdesign.co.uk" title="croak">Frog Box Design</a>
    </p>
  </div>
</form>
```

How It Works

You started by simply importing to your site a CSS that the authors created for you and included in the download for this book. (Actually, the authors are lame at design. We originally thought red, pink, and orange went well together, so we asked a designer at Frog Box Design to make the design palatable.) Because CSS is an HTML topic, the structure of the style sheet is not discussed here (see Appendix E for some details).

The more important objective, however, is to use VWD to help you create a Master page with the three basic components. By using the Master page template you got the basic HTML and XML typing tags. VWD also added for you the `<%@ master . . . %>` on the first line. Finally, VWD provided a single `<div>` with an `<asp:ContentPlaceHolder>` tag. Every placeholder tag must have an ID, so you changed the ID so that it made sense in your context.

You then did some basic modifying of the Master page to support features you will add later in the book. All of these are actually HTML features, not ASP.NET 2.0. First, you used VWD IntelliSense to add a link to the CSS sheet you imported. Then you created several more `<div>` tags to organize the page into header, sidebar, content, and footer sections.

The following Try It Out complements the previous exercise in that you will now create a Content page to fill the placeholder of the `site.master`. Because of its simplicity, the "about the site" page is a good starting point.

Try It Out — Create Content Pages

1. In VWD and with Wrox United open, right-click the root of the site. Select Add New Item and select the template type of Web Form. Name it `About.aspx` and make sure that both Select a master page and Place code in separate file are checked as in Figure 2-6, even though there will be no code. (If you don't set code in a separate file, the framework tags for code will be in the .aspx file. It's better to stay consistent with the rest of the site and keep the container tags and the code in a separate file.)

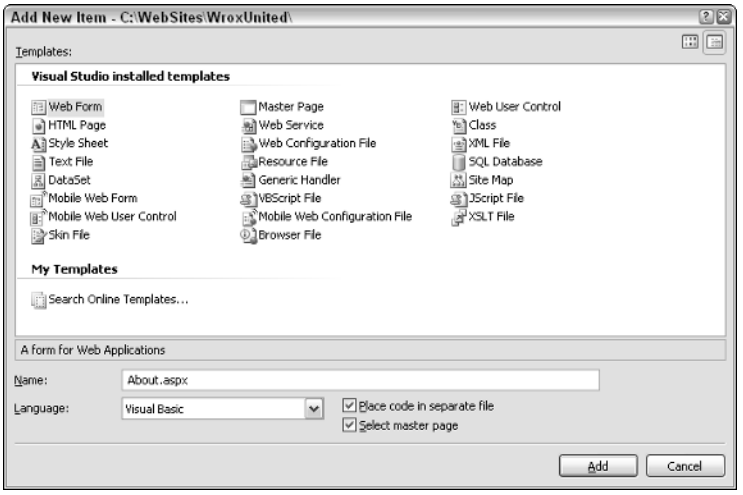


Figure 2-6

2. In the second dialog, select `site.master` for the Master page and click OK, as in Figure 2-7.

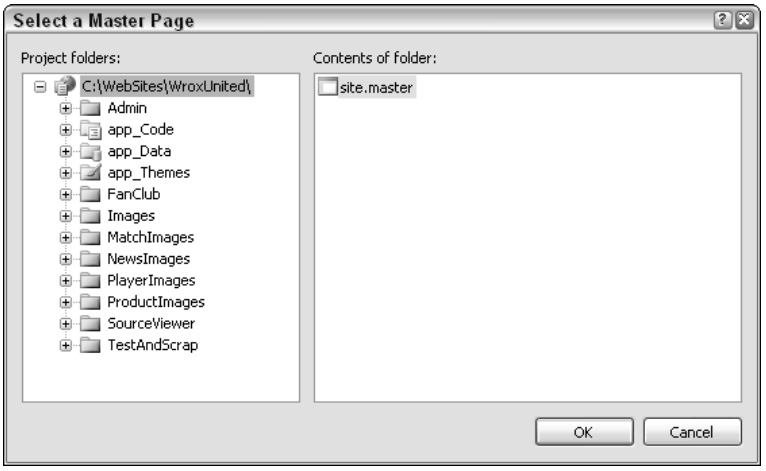


Figure 2-7

3. In Design View, type in a few lines, such as the following:

```
The site was initially written by Dave, while design & graphics were done by Lou.
Conformance is XHTML 1.0 Transitional and CSS 2.1.
```

4. As an aside, you can experience that VWD helps you with non-ASP tags, such as a hyperlink. Staying in Design View, look on the Toolbox's Standard panel for the `Hyperlink` control and drag one to the end of the first sentence in the preceding code. In the properties box set the text to `Frog Box Design` and the `NavigationURL` property to `www.frogboxdesign.co.uk`. VWD will automatically take care of all the typing to create the link.

5. Look at the page in Design View and note that the Master page contributes the framework, and the Content page only has the text you typed. Switch to Source View and note that the About page designates its Master page and that its content will go into the `MainContent` placeholder.

How It Works

The general steps to create a page start with selecting the parent folder in the Solution Explorer. In many cases this is the root of the web site `C:\BegASPNET2\WroxUnited`, but in some cases it can be a lower folder such as the location of `FanClub.aspx` in the folder `C:\ BegASPNET2\WroxUnited\FanClub`.

Observe how a Content page has the three features to work with the `site.master` page. The initial tag `<%@ Page... >` must contain the `MasterPageFile` attribute. Because you might move the files into a different folder structure, you refer to the Master page's location with an initial tilde (~) that indicates that it will be in the root of the site. Second, the material of the Content page is held within an ASP.NET server-side control named `asp:Content` with a `ContentPlaceHolderID` attribute that points to one of the locations for content in the Master page. Third, because the HTML and XMLNS tags will be brought in with the Master page, you omit them from all the Content pages.

Additional Capabilities of Master Pages

Although not implemented in Wrox United, several additional features are available that you can use with Master and Content pages. Multiple levels of Master pages can contribute to a final page. One of several Master pages can be served depending on the requesting browser. And a Master page can support several content placeholders.

Multiple Levels of Master Pages

Although the technique is not used on Wrox United, your pages can inherit multiple levels of Master pages. This feature provides a way to display standard content from several levels of hierarchy. For example, a Content page named `Publication.aspx` can establish its Master as `Research.master`, which can in turn declare its Master as `Corporate.master`. The final rendering will be of `Research.aspx` surrounded by `Research.master`, and all of that surrounded by `Corporate.master`. One problem is that the space remaining for content reduces at each level. VWD does not contain automatic tools to create multiple levels of Masters. In fact, if you have multiple levels you can only open those pages in Source View.

To create pages with multiple levels of Masters you must include in the middle-level page tags that both indicate its Master page (up a level) and its content placeholders (for the lower level). Recall that a Master page must have `<%@ master ... %>` on the first line, and that a lower-level or Content page must have `<%@ page masterPageFile= %>` on its first line. In the case of a middle page that is both a Content and Master page, the tag must start with `<%@ master ...` and also contain `...masterPageFile= %>`.

Also recall that a Master page contains an `<asp:ContentPlaceHolder>` tag whereas the Content page has an `<asp:content>` tag. In the case of a middle layer there must be an `<asp:content>` holding the ID of the Master's `<ContentPlaceHolder>` tag. Then within that tag there is an `<asp:ContentPlaceHolder>` tag that will be used by the next level down.

The following example illustrates a Corporate Master page, then a Research department Master page, and finally a `Publication.aspx` page that holds the content. The Corporate page is shown in the following code. Note that its content placeholder is defined in the shaded lines:

```
<%@ Master Language="VB" %>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
  <title>CorporateMaster</title>
</head>
<body>
Corporation Name
  <form id="form1" runat="server">
    <div>
      <asp:contentplaceholder
                id="ContentPlaceHolderCorporate"
                runat="server">
      </asp:contentplaceholder>
    </div>
  </form>
</body>
</html>
```

The Research department Master page is illustrated by the following code. This page is the most complex, because it is a Content page for the Corporate page, and a Master page for the Publication page. Notice the use of `Master` and `MasterPageFile=` on the first line that establishes this as content for the Corporate Master page. Then observe that the `<asp:ContentPlaceHolder>` will house other pages as content (in this case the Publication page). The content placeholder must sit wholly within the `<asp:content>` tags:

```
<%@ Master MasterPageFile="~/Corporate.master"  Language="VB" %>

<asp:Content runat="server"
  ContentPlaceHolderID="ContentPlaceHolderCorporate">

Research Department

    <asp:contentplaceholder
        id="ContentPlaceHolderResearch"
        runat="server">
    </asp:contentplaceholder>

</asp:Content>
```

Code for the `Publication.aspx` page (designed with content only) is shown in the following code. Here you only need to designate a Master page. This page, which sits at the lowest level, is not a Master page:

```
<%@ Page Language="VB" MasterPageFile="~/Research.master" Title="Untitled Page" %>

<asp:Content ID="Content1"
  ContentPlaceHolderID="ContentPlaceHolderResearch"
  Runat="Server">

Publication text

</asp:Content>
```

Master Pages Support Multiple Content Placeholders

The examples so far have used a single `<asp:ContentPlaceHolder>` in the Master page and a single `<asp:content>` tag in the Content page. ASP.NET 2.0 supports multiple content placeholders. However, each must have its own ID, as in the following example:

```
<%@ Master Language="VB" %>

<html><body>
<form id="form1" runat="server">
  <asp:contentplaceholder runat="server" id="TopContent" />
  <asp:contentplaceholder runat="server" id="MiddleContent" />
  <asp:contentplaceholder runat="server" id="BottomContent" />
</form>
</body></html>
```

The content can then have `<asp:content>` tags that have `ContentPlaceHolderID` values equal to the ID values in the Master page:

```
<%@ Page Language="VB" MasterPageFile="~/research.master" Title="Untitled Page" %>

<asp:Content ID="Content1" ContentPlaceHolderID="TopContent" Runat="Server">
  Text to go in Top section
</asp:Content>

<asp:Content ID="Content1" ContentPlaceHolderID="MiddleContent" Runat="Server">
  Text to go in Middle section
</asp:Content>

<asp:Content ID="Content1" ContentPlaceHolderID="BottomContent" Runat="Server">
  Text to go in Bottom section
</asp:Content>
```

Dividing content into several `<asp:ContentPlaceHolder>` tags helps with the layout of the Master page.

Creating a Site Map

To enable navigation features of ASP.NET 2.0 you need to have a standard way to describe each of the pages of the site. This standard should not only include the names of all of the site's pages, but also a sense of their hierarchy. For example, the page of a player's statistics would be a sub-page of the general players list, and that would be a sub-page of the home page:

```
Home
- Players
-- Player Statistics
```

Defining this sort of hierarchy is an important part of site design, because you want to know (before you start coding) what pages need to be developed, which links will be relevant to users on different pages, and where the user is likely to want to go after viewing a specific page. Drawing up a site tree, like the simple one shown above, is the first step you need to take. Then you can move to the next stage and define this hierarchy in code.

ASP.NET 2.0 holds this information in an XML file named `web.sitemap`. You can use this file as the source of data for menu and navigation controls, which are discussed in Chapter 3.

> **What Microsoft offers in ASP.NET 2.0 is a way to *use* site data in menus and navigation controls if that data is stored according to the `web.sitemap` standards. VWD includes a template with the tags for a `web.sitemap` file. But as of this writing there is no tool to scan the site and generate the actual data that goes into those tags. Third parties will surely fill this gap, but for now you must type the information into the `web.sitemap` file.**

The site map must be an XML file with the exact name `web.sitemap` and located in the root of the web application. XML is a standard for holding data, somewhat like a database, but in a human-readable text form. Each item of data is held in a *node*, and in this case a node would represent one page of the site with data for the page URL, title, and description. An XML file holds the nodes in a tree-like structure so ASP.NET 2.0 will know which pages are to be considered children of a parent page. For example, a page

of *Corporate Departments* would be a parent to children pages with details on *Sales*, *Research*, and *Accounting*. The first tags in the file are standard for XML files to identify the version and the XMLNS, as shown in the following code:

```
<?xml version="1.0" encoding="utf-8" ?>
<siteMap xmlns="http://schemas.microsoft.com/AspNet/SiteMap-File-1.0" >
```

These first two lines are automatically typed for you when you use VWD to add an item to the root from the template site map. The node names are simple: `<siteMap>` containing `<siteMapNode>` tags. Each tag represents a web page and can include the following attributes (all attributes of the `<SiteMapNode>` tag are strings):

- **Title:** Describes the page (this is not linked to the `<Title>` tag in the header of the page, although it could have the same value).
- **URL:** The location of the page described in this node.
- **Description:** A description of the page.

Note that a URL can contain *querystring* data, which is additional information defined at the end of the URL string of a page, which is sent as part of a request to display a page. For example, a general reference to a page would be similar to the first line in the following code, whereas a reference to a page with some data (for example, the month to display on the calendar) would be similar to the third line:

```
url="Calendar.aspx"

url="Calendar.aspx?Month=May"
```

The hierarchy (parent/child relationships) of pages listed in the site map is established by including a child node within its parent's open and close tags. Notice in the following code how the two sub-pages (Members and Calendar) occur within the open and close tags for the Home page (shown with a gray background). The indentation is only for the human eye; it does not affect the hierarchy. Note that the tags for the child pages (Members and Calendar) can use the single tag format of `<Tag... />`. But because the parent page (Home) has children (it contains other nodes) it must use the two-tag format of `<Tag>...</ Tag>`:

```
<siteMap>
  <siteMapNode title="Home" url="Default.aspx" description="Home page for MySite">
    <siteMapNode title="Members" url="Members.aspx" description="All Members" />
    <siteMapNode title="Calendar" url="Calendar.aspx" description="Club Events" />
  </siteMapNode>
</siteMap>
```

To create two child pages within Calendar (grandchildren to the Home page) you take two steps. First convert the Calendar `<SiteMapNode>` to the two-tag format and then add the two child tags as shown in the following highlighted code. Remember, as stated in the preceding note box, you must do all of this by hand-typing in the Source View of the `web.sitemap` file. VWD offers neither a tool to perform an automatic scan and build, nor a way to drag and drop from the Solution Explorer into the `web.sitemap` file.

```
<siteMap>
  <siteMapNode title="Home" url="Default.aspx" description="Home page for MySite">
    <siteMapNode title="Members" url="Members.aspx" description="All Members" />
```

```
      <siteMapNode title="Calendar" url="Calendar.aspx" description="Club Events">
         <siteMapNode title="Calendar of Racing Events"
                  url="Calendar\Racing.aspx" description="Racing Events" />
         <siteMapNode title="Calendar of Social Events"
                  url="Calendar\Social.aspx" description="Social Events" />
      </siteMapNode>
   </siteMapNode>
</siteMap>
```

Note that there is another attribute that you can specify on a `<SiteMapNode>` element; the `roles` attribute. As you learn in Chapter 11, this attribute is used in the Wrox United sitemap file. There may be some situations where you will want to allow a user to know of the existence of a page, even if the user is denied access to the page. In this way, you can offer a link to a user, but when he clicks that link, he is prompted to log in as a user with sufficient privileges before he can view the page.

In the next Try It Out you create a `web.sitemap` for Wrox United. You won't be able to see the results of your hard work until you reach the next chapter, where you learn the concept of navigation controls, but this stage is a way of putting your paper-based design for the structure of a site into code, so it's important to get it right.

Try It Out Create a Site Map

1. Right-click the root of the site in Solution Explorer and select Add New Item. Choose the template named Site Map and name it `web.sitemap`. Note that VWD added the first two tags automatically and gave you the framework for three nodes. The first is the highest level (Home) and the next two are children.

2. Modify the first `<siteMapNode>` to represent your Home page with the following code:

```
<siteMapNode title="Home" url="Default.aspx" description="Wrox United Home Page">
```

3. Modify the next `<siteMapNode>` (the first child) as follows:

```
<siteMapNode title="Fixtures" url="Fixtures.aspx" description="Match Fixtures">
```

4. Copy an entire blank `<siteMapNode>` to the clipboard so you can paste it without having to retype the tag.

5. Create two children to Fixtures, as highlighted here:

```
   <siteMapNode title="Fixtures" url="Fixtures.aspx" description="Match Fixtures">
      <siteMapNode title="Future Fixtures"
                   url="Fixtures.aspx?type=future"
                   description="Who we're going to be playing" />
      <siteMapNode title="Past Fixtures"
                   url="Fixtures.aspx?type=past"
                   description="Who we've already played" />
   </siteMapNode>
```

   As you can see, there are two sub-nodes within the Fixtures section of the site that enable you to view details of both future and past fixtures.

6. There are quite a few more nodes to specify to complete this example, so to save you some time, we've included the rest of the nodes in a file called `web.sitemap.remainder` in the chapter directory (C:\BegASPNet2\Chapters\begin\Chapter02). All you have to do is open this file in Notepad, copy the entire contents of the file, and paste the contents into your version of the file right at the bottom. Alternatively, feel free to just import our `web.sitemap` file into your site.

7. At this point there is no a good test for your `web.sitemap` file because the controls that display the data aren't discussed until Chapter 3, but having an understanding of this foundation is very important because you can use it to add navigation features to a site.

How It Works

In this exercise you undertook the tasks to create a site map file. Recall that VWD does not include a tool to automatically create this file, but does include a simple template to pre-type some tags to get started. ASP.NET 2.0 will only utilize this file when named `web.sitemap`, so try to avoid any temptation to change the name.

You added a new item of the site map template and switched to Source View. VWD adds the initial tags and the tags for the first node. But you then have to manually type in all of the data and begin copying and pasting tags for all of the rest of the pages and their data. Obviously, the third party that writes a program to automate this task will enjoy good sales!

General Guidelines for Site Design

Prior to designing any web site you benefit from reviewing the principles of a good site design. In this book, you should keep in mind three general concepts:

- Endeavor to separate the presentation from the information. For example, you will design the title, layout, and format of a page (the presentation). On that page you will put a control that is configured to get and display information (such as the list of players for the team). By dividing these goals you are able to make updates to each without impacting the other. For example, when a new player is added to the team, the information about the player will be entered into the site's database, and the page will automatically display the new list of players on the team without having to modify the presentation layer.
- Strive for a consistent look and feel throughout the site. By keeping the same colors, logo, and arrangement on the screen you develop a sense of presence. The loyal followers immediately feel at home with the team colors. Return visitors will be able to use the same set of learned behaviors for using the site.
- Make the site as easy to navigate as possible. First, a menu bar on all pages provides easy jumps form one part of the site to another. You will also use ASP.NET 2.0 tools to indicate where the currently viewed page is located in the site.

Standard Files for ASP.NET 2.0 Applications

ASP.NET 2.0 uses two files, common to every ASP.NET site, to hold configuration information and code that applies to the entire site. These are the `Web.config` and `Global.asax` files, respectively.

- `Web.config` contains configuration settings for a site; for example, for specifying a standard customized error page to display to end users if anything on the site breaks.
- `Global.asax` contains code that handles events raised by any page on the entire site; for example, code that is run each time a user first accesses the site (the start of a session).

Web.config Holds Settings for the Entire Site

`Web.config` stores values that apply to the entire site. Structured as an XML file and located in the root, nodes hold information in three major areas:

- Application settings for feature availability used in development versus deployment
- Connection strings that hold values used when reading or writing from a data source.
- System.Web and System.Net settings that hold all else.

System.Web settings is then broken into several sub-catagories, including the following (not all are used in WroxUnited).

- HTTP Modules that point the page to other pages for execution of code
- Debugging routines that should be turned on at the time of compilation.
- Authentication Technique
- Role Manager turned on or off
- Anonymous Identification permitted or not
- Error handling settings.
- SiteMap file data used for navigation and menus
- Profile data that is used for identifying users.
- E-mail settings for the Simplified Mail Transfer Protocol (SMTP) (not used in WroxUnited)
- Definition of NameSpaces that identify the location of objects within larger objects (not used in WroxUnited)

System.net holds just one setting for our purposes, a series of values for sending Email.

You can amend the contents of this file in two ways; the first is to edit it by hand in VWD, which, thankfully, is not too tricky to do. The alternative is to use the ASP.NET Web Site Administration Tool, which you can launch from within VWD. You can go to the main VWD menu and select Website➪ASP.NET Configuration. A series of dialog boxes will allow you to set values that VWD will change in `Web.config` without directly opening the file. You can have a look at this tool later on in the last Try It Out in this chapter.

The following explanation of the structure of a `Web.config` file takes a look at parts of the Wrox United `Web.config` file, looking at sections from the top of the file and working down. If you open the file, you can see that the structure (with opening and closing tags, each with attributes, and sometimes with child nodes) is the same as for any other XML file. Application-wide configuration settings are made by adding appropriate nodes and attributes. Text within the special `<!-- -->` characters is treated as a comment, which you can add to the file to help other users understand what each part of the file is used for.

When VWD creates a `Web.config` *file it includes many comments that provide advice for the settings of each section. A list of all of the values is contained in a text file located at* `C:\Windows\Microsoft .NET\Framework\v2.xxx\CONFIG\Web.config.Comments`.

Here's the start of the Wrox United `Web.config` file as you can view in the download. Feel free to import it into your site in place of the default Web.Config.:

```
<?xml version="1.0"?>
<!-- Note: As an alternative to hand editing this file you can use the web admin
     tool to configure settings for your application. Use the Website->Asp.Net
     Configuration option in Visual Studio.
     A full list of settings and comments can be found in machine.config.comments
     usually located in \Windows\Microsoft.Net\Frameworks\v2.x\Config -->

<configuration xmlns="http://schemas.microsoft.com/.NetConfiguration/v2.0">
```

Three lines of code here are added by default to all new `Web.config` files. The first line contains the XML declaration, specifying that the `Web.config` file follows the XML standard. The next section is a large comment that reminds you that you can use the administration tool, instead of hand-editing the code. The last item to note is the root node for the file; the `<configuration>` node will contain all child nodes that contain settings relating to the content stored on the site.

The next section contains a custom application setting that can be useful to change the way the sample application runs for different environments as follows. The large section between <!— and --> is a note to programmers from VWD and not part of the actual settings.

```
  <!--
    Mode defines certain feature availability:
      Full: No restrictions
      Real: Runs as if a real site, without the view code and download links
  -->
  <appSettings>
    <add key="mode" value="Full" />
  </appSettings>
```

The next section, the connection string section, holds sets of information about data sources. This string generally includes authentication information that you can use to connect your code to the data stored in your database. Connection strings are discussed in detail in Chapter 7. For now simply notice that within the connection strings section you have one or more tags that add strings:

```
  <!--
        define the connection string to the database
  -->
  <connectionStrings>
     <add name="WroxUnited"
          connectionString="Data Source=.\SQLEXPRESS;
                            AttachDbFilename=|DataDirectory|WroxUnited.mdf;
                            Integrated Security=True;User Instance=True"/>
  </connectionStrings>
```

Note that the `connectionString` attribute wraps here because of page width limitations. This line of code should remain on one line in your code.

After the connection strings the remainder of the settings are found within the `<system.web>` tag. They can be in any order; here the httpModules setting is covered first. This value allows the site to handle user selected themes centrally, without requiring code in pages. Themes are covered in Chapter 5, and while the HttpModule isn't covered in detail in this text, the code is well commented.

```
    <system.web>
      <httpModules>
        <add name="Page" type="Wrox.Web.GlobalEvents.ThemeModule" />
      </httpModules>
```

Next within System.Web is the compilation value. When set to `true` (as illustrated in the following code), ASP.NET 2.0 will provide output to the page describing any problems that were found during the build of the page. This feature is useful when developing the site but should be set to `false` prior to deployment:

```
    <system.web>
      <compilation debug="true">
      </compilation>
```

Wrox United declares site-wide values for three security settings: authentication, roles, and profiles. Chapters 4 and 11 discuss these functions in detail. The section of `Web.config` in the following code gives you a preview of what you will learn to write. Notice how the settings establish the page to use for log-on (`Default.aspx`) and then turn on the Role Manager. You then have a set of tags that create the Member type of role. Again, these are explained in detail in Chapters 4 and 11. The following code listing saves space by not listing the VWD programmers help comments. Also, there is a break in the WroxUnited web.config between the second and third settings in which are other settings.

```
      <authentication mode="Forms">
        <forms loginUrl="Default.aspx"></forms>
      </authentication>

      <roleManager enabled="true"/>
      <anonymousIdentification enabled="true"/>
```

```
...
```

```
      <profile enabled="true">
        <properties>
          <add name="MemberName"/>
          <add name="Name"/>
           ...
          <add name="Cart" serializeAs="Binary" type="Wrox.Commerce.ShoppingCart"
               allowAnonymous="true"/>
        </properties>
      </profile>
```

The next section to look at concerns handling errors that can (and will) affect the day-to-day running of your site. Chapter 15 discusses error handling in detail, but as an introduction, ASP.NET can be set to redirect the user to a custom error page if there is a problem. The file to display in the case of an error is declared in the `Web.config` `defaultRedirect` setting as follows:

```
<!-- The <customErrors> section enables configuration of what to do if/when an
unhandled error occurs during the execution of a request.  Specifically, it enables
```

```
developers to configure html error pages to be displayed in place of a error stack
trace. -->

          <customErrors mode="RemoteOnly">
          <error statusCode="404" redirect="missingPage.aspx"/>
          </customErrors>
```

So, for example, if your database server was the victim of a power cut, your users don't need to know the details, but they'd like to be reassured, along the lines of "Sorry, there is a fault — we're working hard to fix the problem. Normal service will resume shortly." Whereas local administrators would like to know what the problem is so that they can get it back up and running as quickly as possible! The `RemoteOnly` attribute in this example means that remote users see the friendly message, whereas the administrator will see all the details of any error.

The last setting of System.Web identifies the file that will hold the site map, an index to all of the pages and their relationships to each other (as we will study in chapter 2). ASP.NET 2.0 also requires the identification of what Provider, or reading tool, to use for the site map.

```
      <!-- Redefine the Site Map Provider, to add the security trimming attribute,
which is off by default -->
      <siteMap defaultProvider="AspXmlSiteMapProvider" enabled="true">
        <providers>
          <clear/>
          <add name="AspXmlSiteMapProvider"
               type="System.Web.XmlSiteMapProvider,
System.Web,
Version=2.0.3600.0,
Culture=neutral,
PublicKeyToken=b03f5f7f11d50a3a"
siteMapFile="web.sitemap"
securityTrimmingEnabled="true"/>
        </providers>
      </siteMap>
```

The last group of settings is in system.net. Although not explicitly used in the WroxUnited application, it could be used so that automated e-mails can be sent to a user when he has forgotten his password, and requests that the password be sent in an e-mail. Regardless of how the e-mail is created, you must declare the SMTP (Simplified Mail Transfer Protocol) in `Web.config` as follows:

```
    <system.net>
      <mailSettings>
        <!-- these settings define the mail server settings from: the user name from
which the email is sent - this is the application that is sending the message host:
the name of your mail server userName: the name the application will use to log
into the mail server password: the password for the above user name
        -->
        <smtp from="admin@your-domain.com">
          <network host="your-mail-server-name"
                   userName="your-user-name"
                   password="your-password" />
        </smtp>
      </mailSettings>
    </system.net>
```

Finally, as with all XML files, each opening tag must have a closing tag and so you finish up the file with the following:

```
    </system.web>
</configuration>
```

`Web.config`, as you have seen, holds site-wide settings to which all other pages can refer. This saves you from having to repeatedly specify the same pieces of information in every page that needs it, and you have one place to go to change settings.

Later on in the book, you'll be adding lots more capabilities to all your site pages, including adding code to deal with various events that happen on each page. But, in the same way that you don't want to specify the same settings in every page, if you need to have the same behavior repeated on multiple pages, you'll need a way to share that code. There was no executable code in `Web.config` — for that you need another site-wide file — the `Global.asax` file.

Global.asax Holds Code for the Entire Site

Whereas `Web.config` holds values, `Global.asax` holds code. `Global.asax`, like `Web.config`, resides in the root of the site. Writing code is discussed in detail in Chapter 9, but for now you can get an overview of `Global.asax`.

The code in `Global.asax` executes in one of three cases. First is the case of the application as a whole starting or stopping. Second is when each user starts or stops using the site. Third is in response to special events taking place that could happen on any page, such as a user logging in or an error occurring. Each of these is known as an event. When each of these events occurs, ASP.NET lets `Global.asax` know, and by editing `Global.asax`, you can put code into it that will be executed in response to the events.

You'll be using `Global.asax` to share code across all the pages of the Wrox United web site later on in the book.

Editing Site Configuration Through a Web Browser

Now, it's perhaps a little daunting looking at the complex XML syntax of `Web.config` and the code in `Global.asax`. Editing these files to make changes to the overall configuration and behavior of your application requires a good understanding of the files' syntax rules, and sure typing to avoid introducing little errors. Conveniently, though, ASP.NET 2.0 provides a graphical tool that lets you modify many of the settings you could manually enter in `Web.config`, through the Web Site Properties dialog.

You can bring up the Web Site Administration Tool by clicking the ASP.NET Configuration button just at the top of the Solution Explorer, as shown in Figure 2-8.

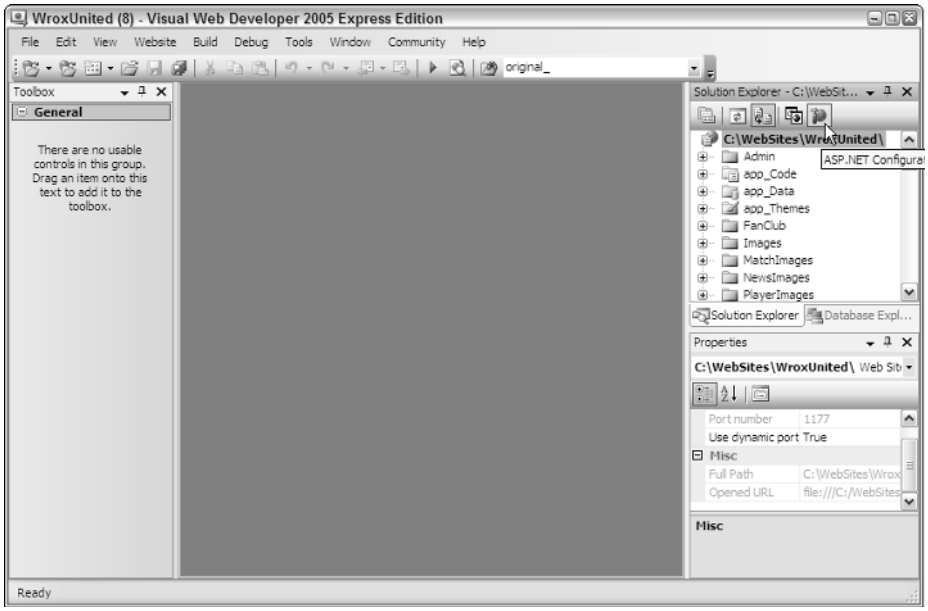


Figure 2-8

In Figure 2-9, you can see the Properties window that this opens up.

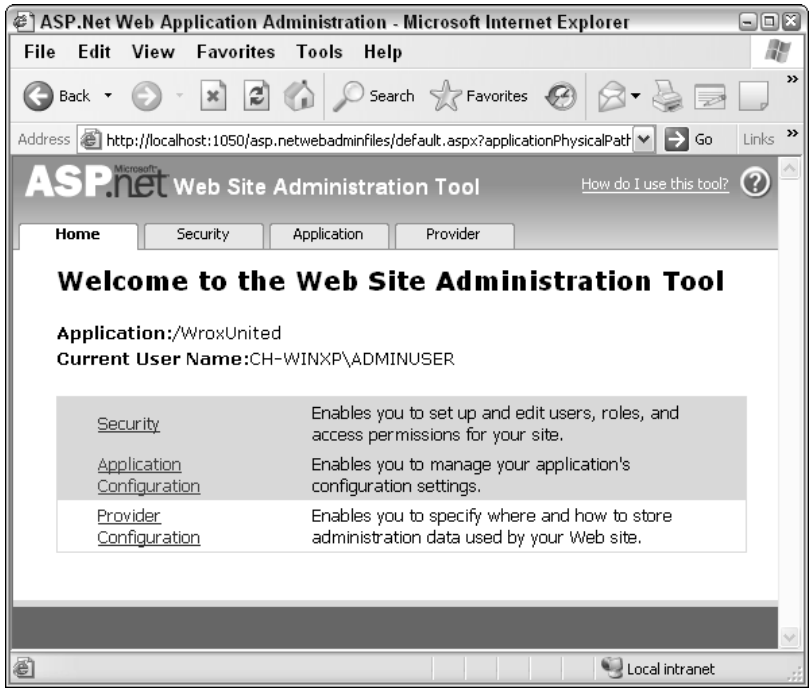


Figure 2-9

As you can see, VWD has actually opened up a web browser showing a web site that is built into ASP.NET, called the ASP.NET Administration Tool, through which you can edit the settings of your web application. You'll be using this administration tool in depth later on in the book, but for now, you can explore the Application Configuration section of the tool. Figure 2-10 shows what options are presented to you by this page.

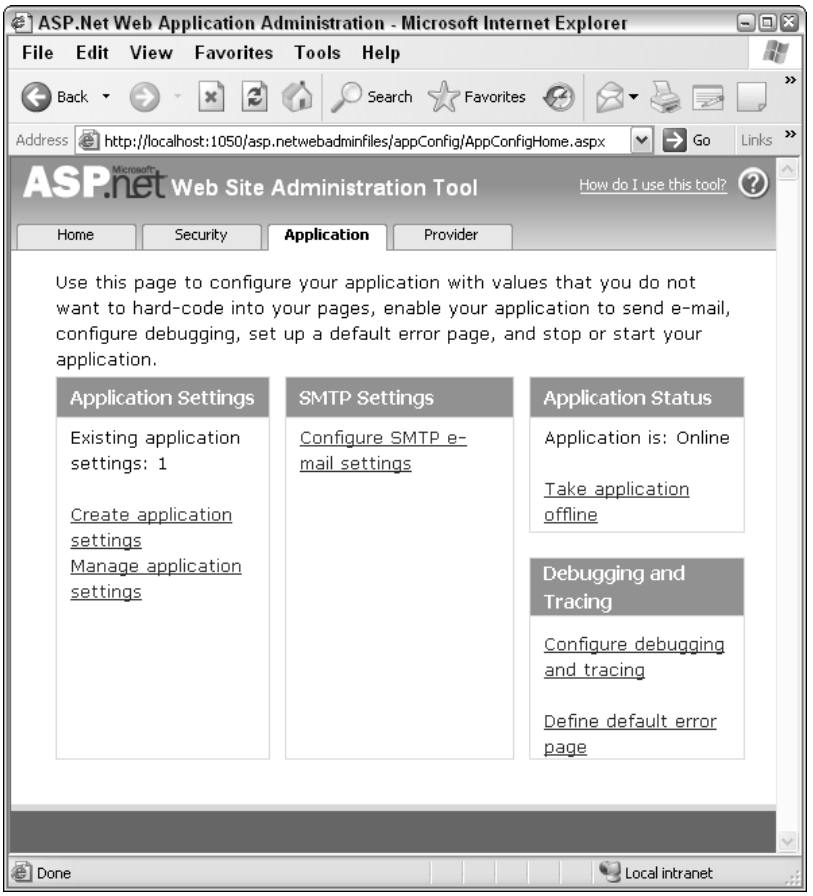


Figure 2-10

Although you can't administer everything that you looked at earlier, some of the key sections from `Web.config` are represented here. You have the ability to edit application settings (the contents of the `<appSettings>` element you looked at earlier), e-mail settings (the `<smtpMail>` section you saw in the `Web.config` file), and debugging and error handling (the `<compilation>` and `<customErrors>` sections you examined before).

In this Try It Out, you see how the ASP.NET Administration Tool edits the `Web.config` file for you.

Try It Out — Changing Settings with the Administration Tool

1. Working in VWD's Solution Explorer, import into your site missingPage.aspx from the download files (C:\BegASPNET2\WroxUnited).
2. Open up the Web Site Administration Tool by clicking the icon on the Solution Explorer.
3. Navigate to the Application Configuration page, and click Define Default Error Page.
4. Select "Specify a URL to use as the default error page," and select `MissingPage.aspx` as the page to redirect users to when an error occurs.
5. Click the Save button.
6. Return to VWD, and open up the `Web.config` file.
7. Scroll down until you find the `<customErrors>` section of the configuration, and notice that the value of the `defaultRedirect` attribute has been changed to the path of the page you chose in the administration tool:

```
<customErrors mode="RemoteOnly" defaultRedirect="MissingPage.aspx">
</customErrors>
```

How It Works

The administration tool is just a friendlier way to edit some of the settings present in `Web.config`, including the default error page. When you change the application's error handling setting through the administration web tool, it edits `Web.config` for you — without your having to get your hands dirty editing XML data!

Troubleshooting Site Design Errors

Now that you have a good idea of what goes into site design, here are the most common errors you might run into when using Master pages, and the other facilities you've looked at in this chapter:

- The reference to the Master page is misspelled in a Content page. This will prevent ASP.NET from being able to find the Master page template for a page. To avoid this, whenever possible, use the VWD checkbox in the template dialog to create the master reference.
- A mismatch between the ID of the content placeholder in the Master page and the `ContentPlaceHolder` ID property of the `content` tag in the Content page will prevent your page from displaying. Double-check that they match up.
- Typos in the `Web.config` or `Global.asax` files. These files are very strict about their syntax, and errors in them can be hard to track down. You can get around having to edit `Web.config` by using the ASP.NET Administration Tool, so you can be sure you haven't introduced typographical errors into the file.

Summary

Web sites are easy to create, use, and maintain if they are well designed. ASP.NET 2.0 offers several tools to organize the design of the site.

In this chapter, you learned that Master and Content pages create a consistent look and feel to the site. Master pages provide the consistent sections of the pages along with a position for the material contained in the Content page. Whenever possible, create the Master and Content pages using the Add New Item choice after right-clicking the root of the site in the Solution Explorer. A Master page must have the normal HTML and XML typing tags, `<%@ master . . . %>` on the first line, and an `<asp:ContentPlaceHolder>` tag with an ID. Content pages must not have the basic HTML and XML typing tags, must have `<%@ page masterPageFile= %>` on the first line, and must at some point use an `<asp:content>` tag to contain the material to be displayed. A Master page `<head>` can contain the link to a CSS if you are using one. Additionally, this chapter covered the following topics:

- Your site can implement multiple levels of Master pages. You can also create several Master pages to be served depending on the requesting browser. Furthermore, a Master page can support several `<ContentPlaceHolder>` tags provided that each has its own ID.
- Site maps contain a description of each file and its relationship to surrounding files. This XML file can then be read by ASP.NET 2.0 server-side controls to create navigation aids. VWD does not have a way to automatically create a site map, but the XML structure is not hard to understand because each page is a SiteMapNode.
- Two files hold information for an entire application. `Web.config` holds settings such as connection strings used with a data source, debugging routines for compilation, security settings, values for handling errors, among other settings. `Global.asax` holds code for the entire site, including code to run when the application as a whole starts or stops. Additional code blocks can run when each user starts or stops using the site. `Global.asax` also houses code that can run on any page.

In the next chapter you learn about the various server-side controls and how to use them to build proper pages. You will construct the Wrox United home page and fill in some of the Master page you created in this chapter.

Exercises

1. Describe the functional difference between the `Web.config` file and `Global.asax`.
2. What files discussed in this chapter are in XML format?
3. Take a look at the code for a Content page. Why does it lack directives and tags?

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head ></head>
```

4. What values must match between a set of Master and Content pages?

3

Page Design

Successful web sites are generally easy to use, intuitive, and clearly presented. It's your job (possibly with the help of a friendly designer) to ensure that the sites you develop are not just functional, but can be presented in a meaningful manner. Once you have a basic site outline structure in place, you need to make decisions about how to present the information and user interface elements.

ASP.NET, in conjunction with VWD, has some great tools for designing and laying out pages. Recall that you've already created a few pages with simple content simply by dragging and dropping from the Toolbox in VWD. Designing an entire site is obviously going to involve a whole lot more dragging and dropping, but there are ways of making this process less painful.

This chapter looks at the following topics:

- Creating and laying out static pages
- HTML and the HTML viewer in VWD
- Server controls and dynamic content
- Configuring controls in Design View
- The controls available in the web control library
- Adding dynamic navigation controls to a page, and getting them to work without writing a single line of code

If you have experience programming in HTML, some of this chapter may cover familiar territory, but the toolset available for working with HTML in VWD is quite advanced, so it's worth sticking around and enjoying a light refresher.

Static Page Design

The term *static* refers purely to the fact that the page shown in Figure 3-1, like many others on the Internet, is view-only (imagine an HTML page with nothing but text, or just a series of images) — you don't always want to have every page in a site include a form for submitting information, or react to user input. Static pages contain, by definition, content that doesn't change (or that rarely

needs to be updated). Imagine you had a personal web site that contained an "About Me" page — you might want to change the content from time to time (if you move, change jobs, or get married), but on the whole, you're not likely to want to change that page more than a couple of times a year.

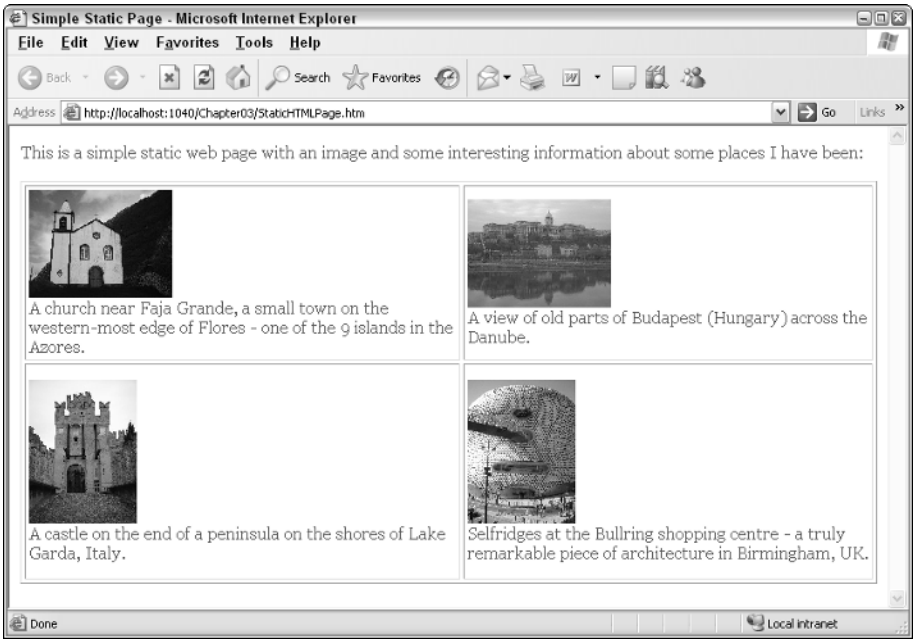


Figure 3-1

Static pages remind me of the Web circa 1995 — most of the sites I'd view at the time would be simple, plain sites, and the joy of just playing with HTML tables for layout was enough to keep me occupied for a few afternoons. Time for a quick Try It Out — you're going to create a really simple page and see what this page looks like in HTML view, looking at how HTML elements are structured.

Try It Out — Creating a Static Page

Fire up VWD and get started! This is a light run-through — you don't have to do much at this stage, just follow the steps and feel comfortable with the techniques.

1. First, it will help if you download the base code for this chapter from `www.wrox.com`. Make sure you place the base code folder in the following location: `C:\BegASPNET2\Chapters\Begin\Chapter03`.
2. Open up VWD and select Open Web Site from the main menu. In the dialog that appears, select the Chapter03 folder and click Open (see Figure 3-2).
3. In the Solution Explorer on the right (shown in Figure 3-3), right-click the Chapter03 site and select Add New Item.
4. The Add New Item dialog appears, where you need to select a new HTML page called `StaticHTMLPage.htm`, and click Add (see Figure 3-4).

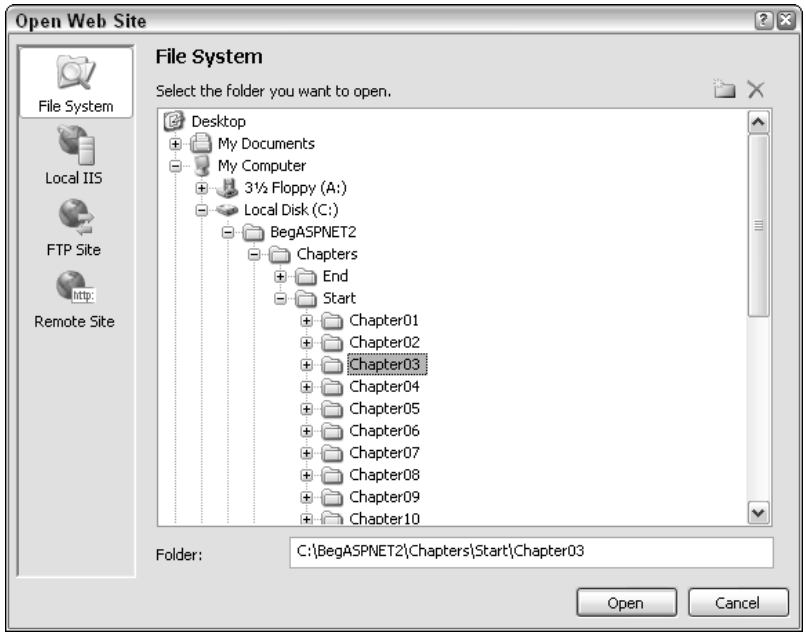


Figure 3-2

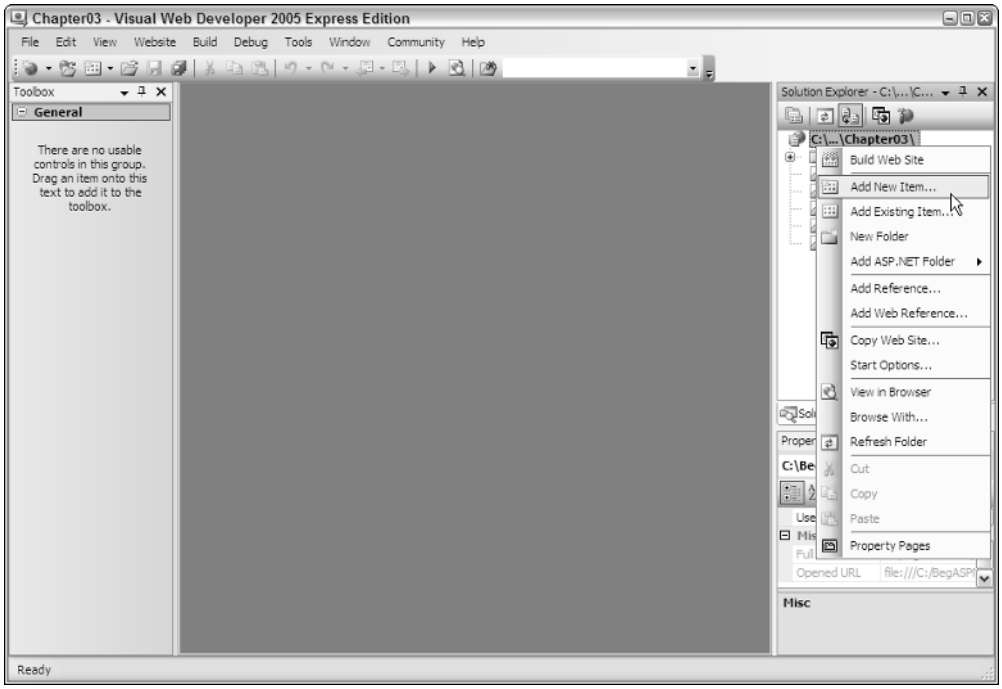


Figure 3-3

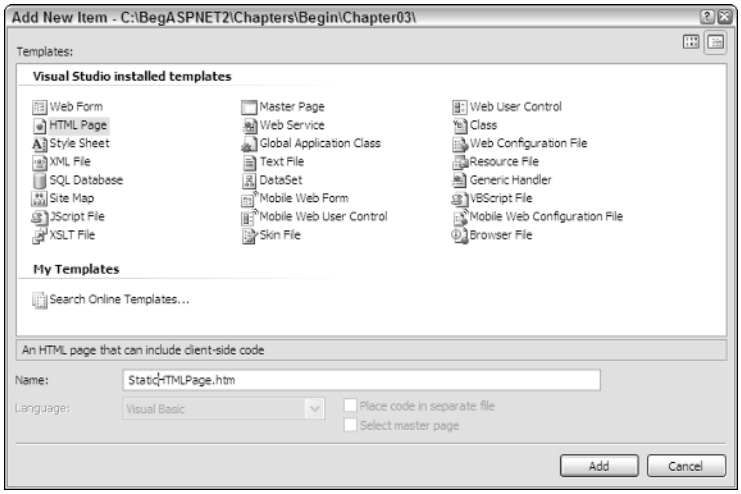


Figure 3-4

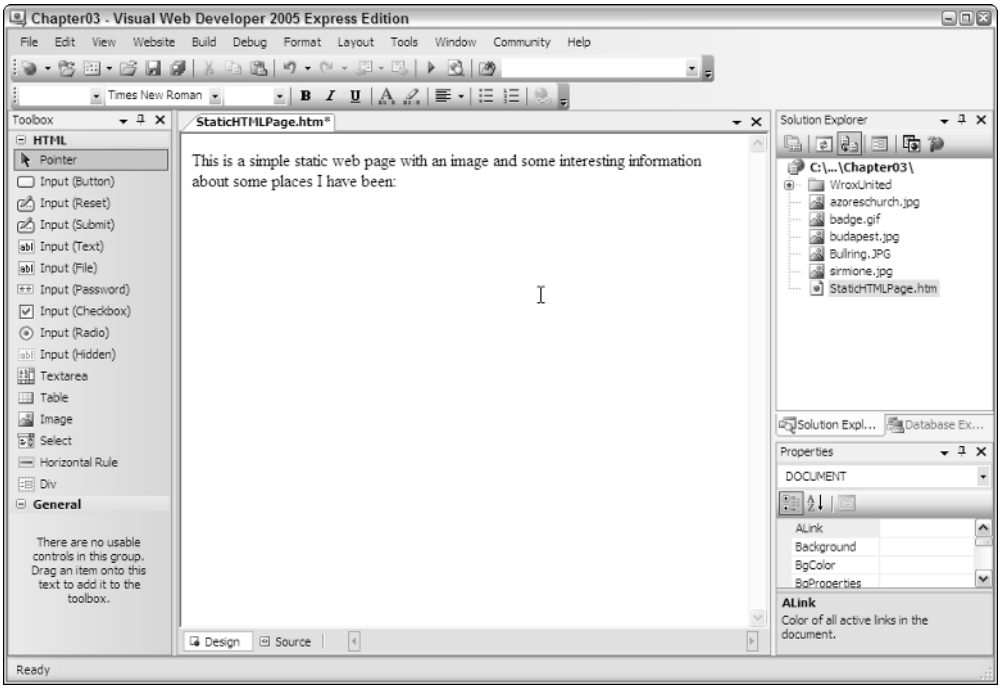


Figure 3-5

5. Switch to Design View and type in some text, as depicted in Figure 3-5.

   Don't worry about the actual text — this is a simple example, and you don't have to publish this on the Web!

6. Next, from the toolbar select Layout ➪ Insert Table to add a table to the page. Give it two rows, two columns, and borders and padding if you like, all of which appear in Figure 3-6.

7. Once you have a table, you can add content within each cell. Try adding some text to a cell, then drag an image tag from the HTML section of the Toolbox on the left of VWD onto the page, as shown in Figure 3-7.

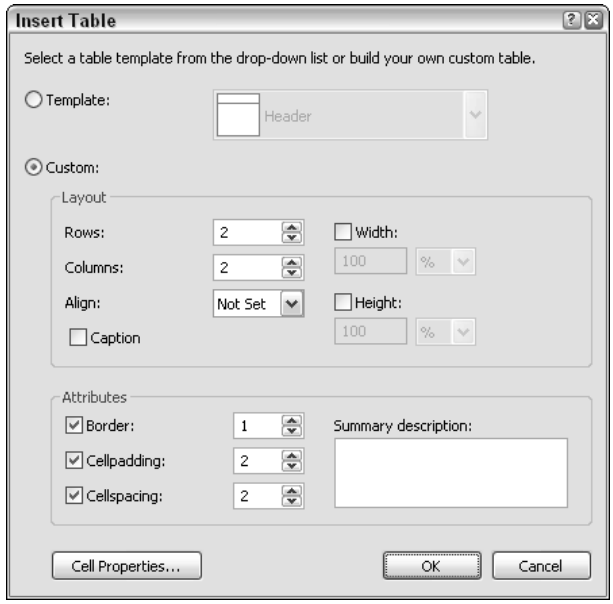


Figure 3-6

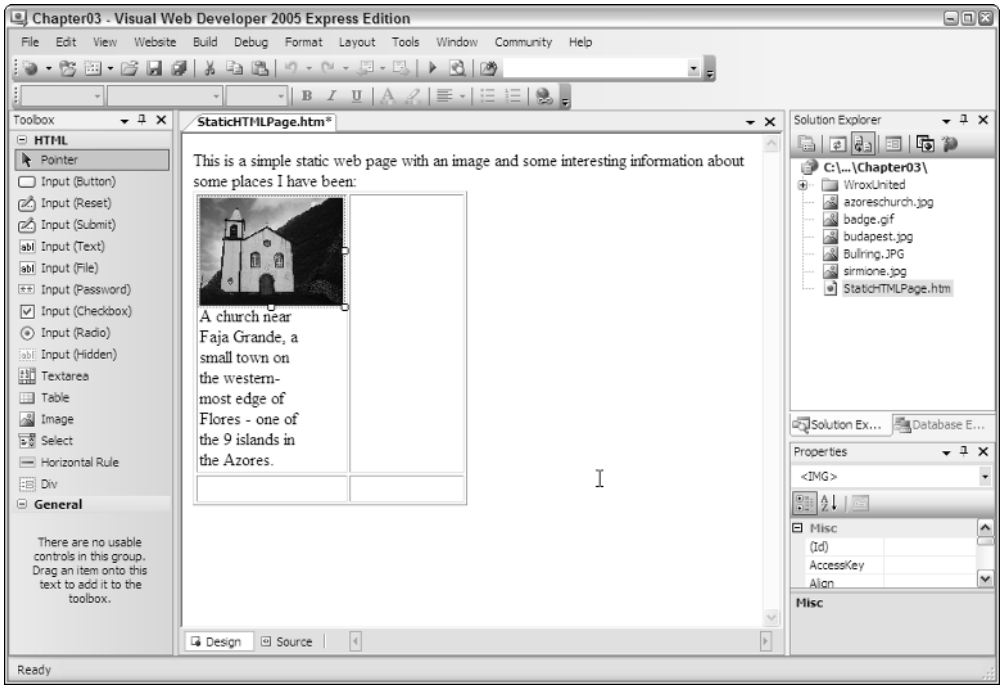


Figure 3-7

Once you have a table in the designer, you can click the <table> button at the bottom of the screen to select only that element on the page (see Figure 3-8) — you can then modify the padding and border attributes on the table by changing the values in the Properties box on the right.

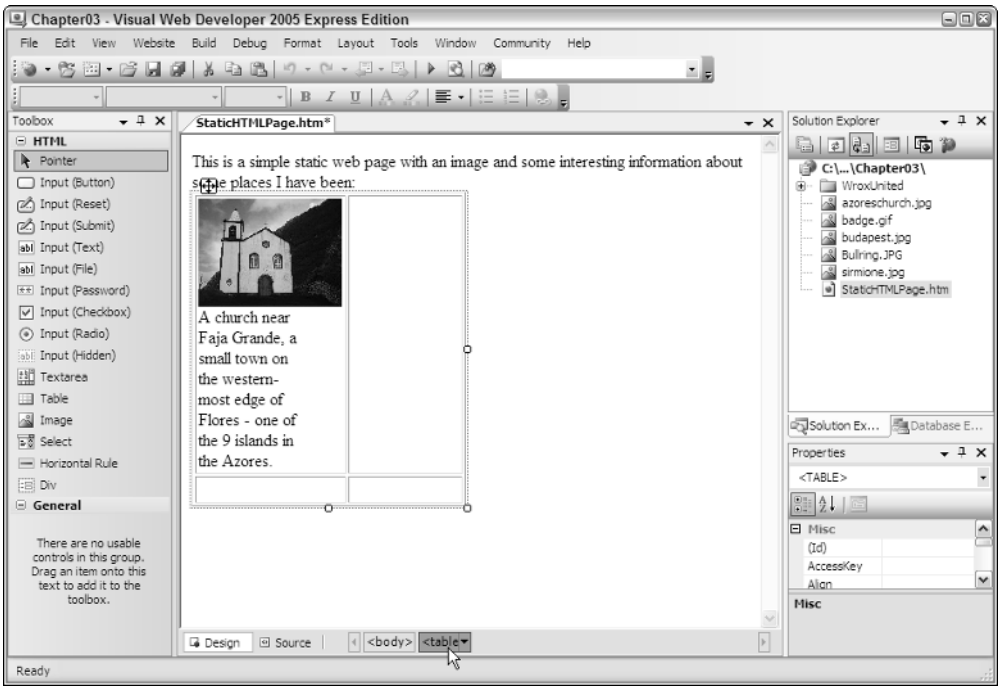


Figure 3-8

8. Click the Source button at the bottom of the screen and you can see the HTML that's generated for you (see Figure 3-9). With some small tweaks, you can add a small amount of styling and some links to your images.

9. To turn the nascent page into the finished example, I added some more text and images to my version. Here's the code for the version of the finished page that you can download from www.wrox.com — notice the <style> attribute on the <body> tag:

```
<body style="color: darkolivegreen; font-family: georgia">
  This is a simple static web page with an image and some interesting information
  about some places I have been:<br />
  <br />
  <table cellspacing="3" cellpadding="3" border="1">
    <tr>
      <td>
        <img src="azoreschurch.jpg" height="100" /><br />
        A church near Faja Grande, a small town on the western-most edge
        of Flores - one of the 9 islands in the Azores.</td>
```

```
      <td>
        <img src="budapest.jpg" height="100" /><br />
        A view of old parts of Budapest (Hungary) across the Danube.</td>
    </tr>
    <tr>
      <td style="height: 192px">
        <img src="sirmione.jpg" width="100" /><br />
        A castle on the end of a peninsula on the shores of Lake Garda, Italy.</td>
      <td style="height: 192px">
        <img src="bullring.jpg" width="100" /><br />
        Selfridges at the Bullring shopping centre - a truly remarkable piece of
        architecture in Birmingham, UK.<br /></td>
    </tr>
  </table>
</body>
```

Having finished adding content to the page, you can view the page by pressing Ctrl+F5. The result is a page that looks like Figure 3-10 (which is the same as Figure 3-1).

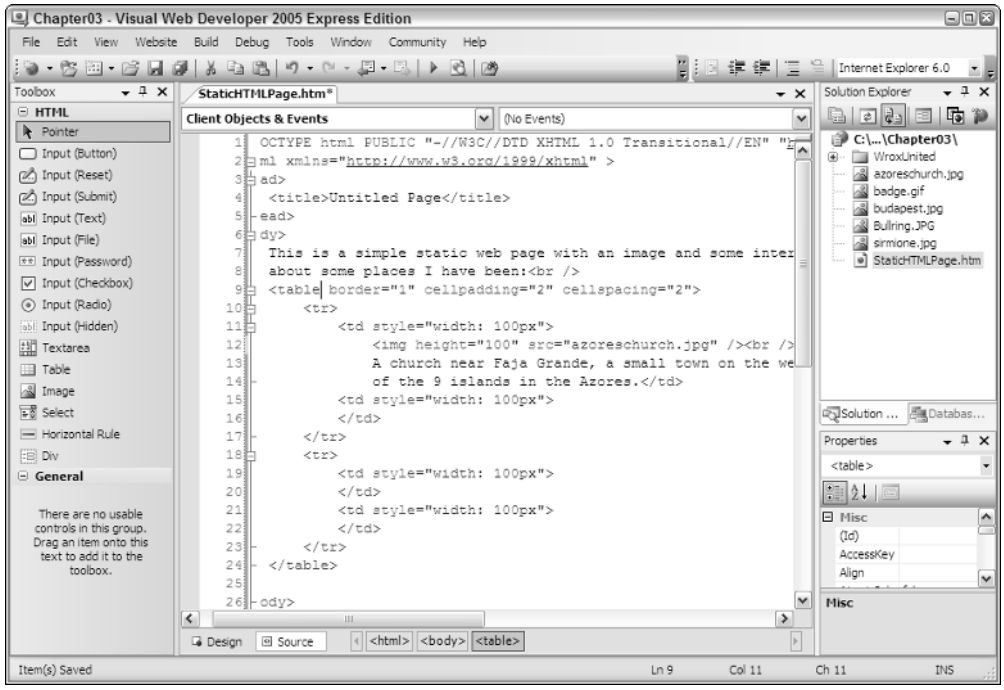


Figure 3-9

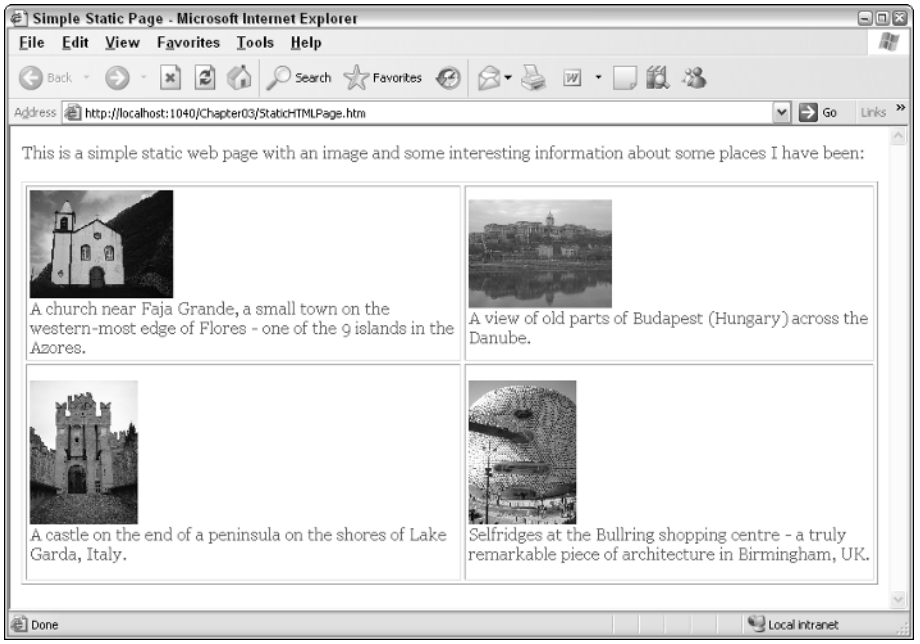


Figure 3-10

How It Works

As you carry on through this chapter, you'll become increasingly familiar with the technique of adding layout elements in the design window, and making some changes either in the Properties pane on the right, or by modifying the code manually. Static elements such as the ones used in this example (simple text within a body tag, tables, and images) are used throughout both static and dynamic pages, and understanding how to add and integrate these elements is all part of building dynamic web applications.

In this example, you gained a bit of practice in working with simple HTML layout of a page. For example, the elements on the page were laid out in a simple HTML table, and within each of the cells in the table were some text and some images:

```
<td>
  <img src="azoreschurch.jpg" height="100" /><br />
   A church near Faja Grande, a small town on the western-most edge of Flores - one
   of the 9 islands in the Azores.
</td>
```

The body tag in the rendered page has some simple styling attached to it that defines the color and font used for the text on the page:

```
<body style="color: darkolivegreen; font-family: georgia">
```

This attribute will apply to all of the elements within the opening and closing `<body>` tags, hence all of the content of the visible page.

Don't worry if a lot of this is new to you — the next section is designed as a crash course in HTML to help you get up to speed.

The World of HTML

If you are unfamiliar with HTML, here are some of the basic concepts you need to understand:

- An HTML file is human-readable text with a few extra brackets — when you browse a web page, your web browser will understand how to convert the bracketed bits into something that looks interesting.
- The bracketed bits are called *elements*, though strictly speaking, the element normally consists of two *tags* that open and close the element, and sometimes have textual or other HTML content between them. Some elements have only a single tag.
- Elements have *attributes* that give the browser extra information about how the element should appear on the page.

  Here's a simple HTML element:

```
<div id="divUserDetails"
style="width:300px;height:100px;float:left;background:darkred;color:white">
  These are my details, my favorite color, and my hobbies
</div>
```

  In this example, the `<div . . .>` and `</div>` parts are *tags* describing the `div` *element*, the `id=""` and `style=""` bits are *attributes*, and the text between the two tags is the content of the element.

- *Rendering* is the process of turning HTML code into visual elements, so the preceding code will render as shown in Figure 3-11.

Figure 3-11

The following table contains some of the HTML elements you're likely to run into.

Element	Description	Example Usage
`<img>`	An image tag. This tag places an image on a page.	`<img src="myimage.gif" />`
`<div>`	A paragraph-style block of text. Text contained in a `<div>` element can be positioned on a page using various attributes. For example, to place two `div` elements side-by-side, you could have one with a `float: left` style, and one with a `float: right` style.	`<div style="float:left">Left-hand content here</div><div style="float:right">Right-hand content here</div>`
`<span>`	A tag used to format characters of text, so you could surround a word in a sentence with a `<span>` tag and make the span have bold styling to highlight that word.	`<div>Some standard text with a <span style="font-weight:bold>bold</span> word in the middle</div>`
`<table>` `<tr>` `<td>`	A table element that contains rows (`<tr>`) and cells (`<td>`). Commonly used to position elements on a page, should ideally be used only for tabular data. According to accessibility guidelines, `<div>` elements should be used for layout and positioning, but a lot of sites still use tables because they are simpler to develop.	`<table border="1"> <tr> <td>The contents of a cell</td> </tr> </table>`
`<a>`	An anchor element. Defines a hyperlink on a page, enabling the developer to specify both the target content (in the `href` attribute) and the text to display to the user.	`Some text with a <a href=page.htm">hyperlink</a> in it"`
`<head>` `<body>`	The two main parts of an HTML page are the `<head>` and the `<body>`. The `<head>` is where the `<title>` element and `<link>` elements (along with a variety of metadata) are placed. The `<body>` contains the display elements.	`<html> <head> <title>Page Title</title> </head> <body> Contents of page </body> </html>`

Element	Description	Example Usage

`<form>`
`<input>`
	A form element. When creating a site that has a data entry form, the elements that are used to transmit data to the server must be contained within a `<form>` element. The HTML `<input>` element is quite versatile; with a `type` attribute of `text`, it appears as a text box on the screen. With a type of `submit`, it appears as a button that, when clicked, submits the form to the server.	`<form id="form1"`
		`runat="server">`
		` <input id="Text1"`
		`  type="text" />`
		` <input id="Submit1"`
		`  type="submit"`
		`  value="submit" />`
		`</form>`

`<title>`
`<link>`
	Within the `<head>` of the page, the `<title>` element controls the text in the title bar of the page. The `<link>` is most often used to link a page with a CSS style sheet.	`<head>`
		` <title>Page Title</title>`
		` <link rel="Stylesheet"`
		`  type="text/css"`
		`  href="MyCss.css" />`
		`</head>`

`<script>`	Can contain either client-side script (script run on the browser, normally written in JavaScript, or possibly VBScript), or server-side .NET code.	`<script`
		`language="JavaScript">`
		` alert('Hello World!');`
		`</script>`
		`<script runat="server">`
		` Protected Sub Page_Load( _`
		`  sender As Object, _`
		`  e As EventArgs)`
		`  ...`
		` End Sub`
		`</script>`

` ` `<hr />` ` `	Used to help to lay out a page, the ` ` tag adds a line break to a string of text, and the ` ` forcibly enters a non-breaking space character; hence two words (or elements) separated only by a ` ` character cannot be split apart over two lines. The `<hr />` element displays a horizontal line across the page.	`This is a string of text with a` `line break and` `a space.` `<hr />` `Two images separated by a` `space: ` `<img src="1.gif"> <img` `src="2.gif">`

A sample HTML page called `SampleHTMLElements.htm` that includes these simple examples is available in the code download for this chapter, and it appears as shown in Figure 3-12.

Gaining familiarity with the common elements in HTML is a necessity for any ASP.NET developer, and not only do you have to understand how to use these elements, you have to learn how to use them correctly, in adhering to the standards, and making sure that sites you develop are accessible by as many users as possible.

It's very easy to end up with HTML that's almost impossible to maintain, with tags and styling all over the place. Many older tools for constructing HTML pages would take pride in destroying your carefully crafted HTML code, and supposedly correct your code to follow the guidelines within the tool. Anyone who used older versions of FrontPage would have cursed many a time at the fact that simply opening an HTML page and closing it in FrontPage would permanently mangle your HTML code! Thankfully, VWD has one of the best HTML editors I've ever used.

Perhaps the best way to make your code clean and easy to maintain is to adhere to a common standard. The introduction of XHTML has brought many more guidelines to web development, and following these guidelines is a great way to improve your technique.

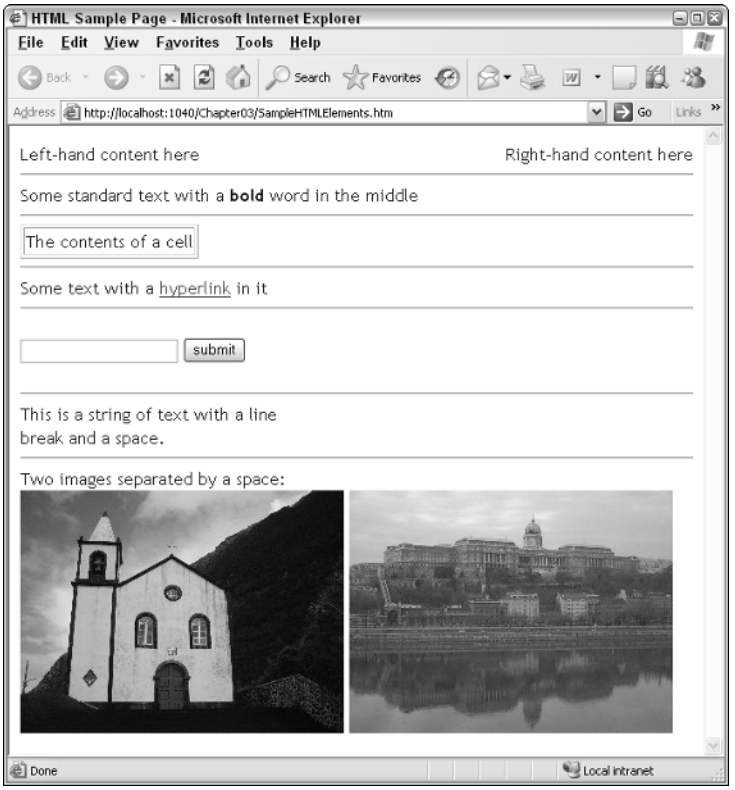


Figure 3-12

From HTML to XHTML Code

Although most people speak of HTML code, the fact is that if you write good HTML code, you're actually writing XHTML. XHTML is a set of rules that, if you follow them when you write HTML code, result in code that is more standards-compliant, and hence more likely to render as you want it to on a variety of different client browsers.

The core rules of XHTML are as follows:

- Always close your tags (so always have both a `<p>` and a `</p>` for a paragraph) or use self-closing tags (such as `<br />` instead of `<br>`).

- Tag and attribute names must be lowercase (so `<div id="myDiv">` is acceptable, but `<Div ID="myDiv">` is not) because XHTML is case-sensitive (so `<div>`, `<Div>`, and `<DIV>` are all different entities to XHTML).
- Attribute values must be enclosed within double quotes.

This is only a brief summary of XHTML; if you want to learn more about the rules, you should refer to the W3 site `www.w3.org/TR/xhtml1/` where you can learn all about the XHTML standard. Section 4 of that page deals specifically with the way XHTML differs from standard HTML.

In essence, the aim of XHTML is to provide a common set of guidelines for web developers and browser developers to both attempt to follow. With newer web browsers such as Firefox starting to gain ground on the Microsoft Internet Explorer–dominated landscape, it's important that all parties agree to support XHTML in all future iterations of their products to move away from the old problem of developing a site that worked just fine on Internet Explorer, but looked awful on Netscape.

The move toward XHTML as the standard language of the Web is gradual, and will likely never happen fully (with browsers likely to support older tags and markup for many years yet for backward compatibility), but you'll find that future maintenance of web sites that you write today will be much simpler if you follow the XHTML guidelines. You should be less likely to see your sites break when the next version of Internet Explorer or Firefox arrives.

Visual Web Developer has a great feature for helping you to develop standards-compliant web sites. If you open up `SampleHTMLElements.htm` in VWD you'll notice that there is a toolbar at the top of the page (see Figure 3-13) that lists Internet Explorer 6.0 as the target for the web page.

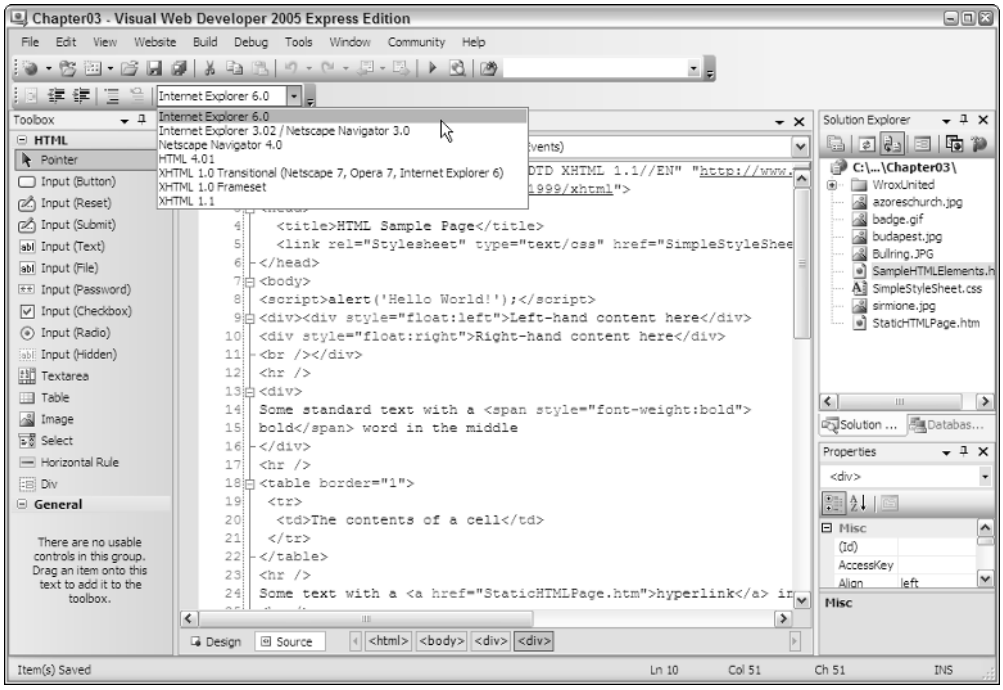


Figure 3-13

Now if you change the selection so that your page is supposed to target the XHTML 1.1 standard, you'll see plenty of red squiggly underlining, as shown in Figure 3-14.

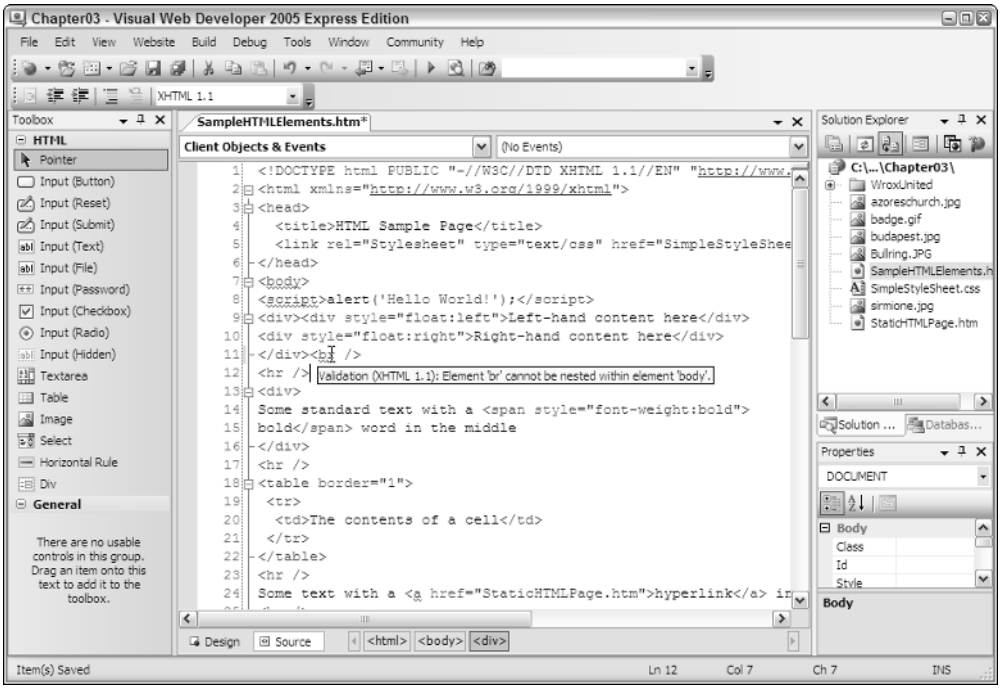


Figure 3-14

The highlighted error shown in Figure 3-14 refers to the fact that `<br />` tags are supposed to only appear within a block element, such as a `<div>`. If you changed the first part of the page to be enclosed within a `<div>` element, this error would be fixed, without any discernable change to the appearance of the page:

```
<div>
  <div style="float:left">Left-hand content here</div>
  <div style="float:right">Right-hand content here</div>
  <br />
</div>
```

The rules of XHTML are also followed in any code that ASP.NET generates dynamically. You haven't created much in the way of dynamic content so far, so let's move on to looking at how you can make pages a bit more exciting.

Dynamic Content

In order to move from the static world of HTML to the dynamic world of ASP.NET, it's important to know what is meant by dynamic content.

When you click a button on a form on a web page, you expect something to happen — and most of the time (if the page has been coded correctly), something does happen. You might submit an order form for a stack of CDs by clicking a button. You might also select an item on a menu on a page — take, for example, a menu from the Wrox United web site. Clicking the menu causes the menu contents to pop out (see Figure 3-15) and become selectable in a similar way to clicking your Start button.

Figure 3-15

Now notice that there's no lag between clicking the menu and clicking a different menu — the page responds just like your own system. Your browser's actually executing some local code in order to display these items. Click a button or a hyperlink on a form and the page will likely take longer to respond. Clicking buttons, hyperlinks, or other similar elements on a page causes your browser to start talking to the server, asking for something, or sending some data.

Dynamic Client Code and Dynamic Server Code

Hovering over the menu on the Wrox United web site will run some code on the page that is likely written in JavaScript, a programming language that most browsers can understand and run, and is used to provide quick responses to user input. The page won't flicker and refresh (unlike clicking a hyperlink) because the browser already knows what to display when you hover over the menu. This is an example of dynamic *client* code.

When a more complicated response is required (for example, when you submit an order on a shopping site or when you want to search for a specific item on a shopping site), the page submits information back to the web server for processing. The processing on the server is dynamic *server* code, and this is the code that you will learn to write over the course of this book.

Server-side code can be written in many different languages, not just ASP.NET with VB.NET, C#, or other .NET languages. You probably have heard of PHP and perhaps JSP (Java Server Pages) — these are just two examples of other languages used by developers to write server-side code. Each language has its strengths and weaknesses, but you'll be hard-pressed to find a server-side technology that's as easy to use and as powerful as ASP.NET.

When it comes to creating dynamic pages in ASP.NET, the fastest way to build a dynamic page is to drag server controls onto the page, set properties on those controls, and eventually write code to customize their functionality. This *drag-and-drop* architecture has improved greatly in the latest edition of ASP.NET, making it possible to create the structural framework for an entire site without having to write any code at all.

Introduction to Server Controls

When you look at the Visual Web Developer Toolbox, you'll notice several different sections, each containing a different set of tools. Many of these tools are *server controls*, and you'll be using these controls regularly when you develop ASP.NET applications.

> **A server control appears on the source code for an ASP.NET page as a tag; for example, `<asp:textbox ... />`. These tags are not standard HTML elements, so a browser will not be able to understand them if they appear on a page, however, when you request an ASP.NET page from a web server, these tags are converted into HTML elements dynamically, so the browser only receives HTML content that it can understand.**

This section starts by taking a look at some of the categories of controls available to you, and then discussing how they work.

The Server Control Toolbox

At first glance, the array of server controls in the Toolbox can be quite overwhelming. Not only do you have standard web page elements to choose from (such as radio buttons, hyperlinks, and drop-down lists), but other categories of controls are also available (shown minimized in Figure 3-16) that contain even more controls. The Toolbox will change appearance depending on which type of page is being edited, so Figure 3-16 is the standard appearance when working on ASP.NET pages.

The categories of controls available are as follows:

- **Standard:** Common controls that make up 90 percent of all pages.
- **Data:** Controls used to connect to data sources (databases or XML files).
- **Validation:** Controls that can be added to a page to validate user input (for example, to ensure that certain text boxes contain data or that data has been entered in the correct format).
- **Navigation:** Controls used to provide a simple and quick solution to making a site navigable (for example, dynamic menus and breadcrumbs of hyperlinks).
- **Login:** A set of controls that make it simple to move from a completely open site to one that has personalized areas.

- **WebParts:** Controls that make it possible to create Sharepoint-style sites with drag-and-droppable sections, known as Web Parts, which enable the user to rearrange their view of a site.
- **HTML:** Simple HTML elements.

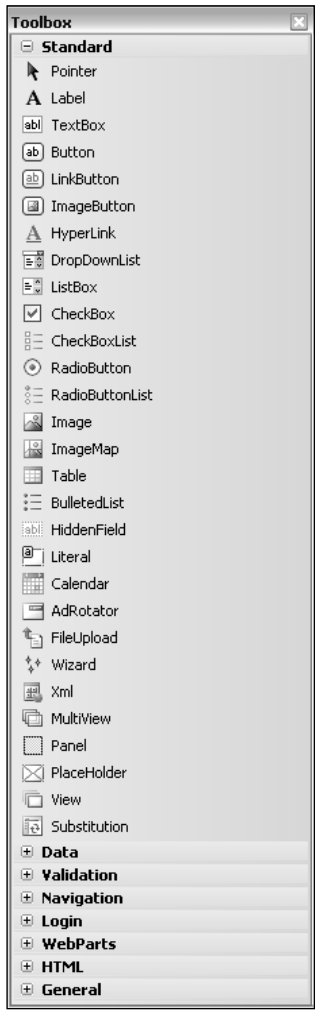


Figure 3-16

Throughout the rest of this book, you'll meet many of the controls in each category. Later in this chapter, you can play with some of the navigation controls when you build some menus for the Wrox United site.

What Are Server Controls?

Let's start from first principles — when you create a simple HTML page and save it to your local file system, you can view that page in your browser by double-clicking the file. This is fine if you're putting together a static HTML site and want to test the output, but there's no point in developing a web site that

users would have to download to view! That's why, when a web site is deployed, it is uploaded to a *web server*, which everyone can access via its URL (Uniform Resource Locator).

Now that the site is hosted on a web server, people can access the site from other machines and browse through the HTML pages. However, if the server has the right software installed, you can then do much more than offer static HTML pages. When you request an HTML page, the server looks up the file and sends it to you; when you request an ASP.NET page (a page with the file extension .aspx), the server looks up the file on its file system and reads the file, and then it performs some processing before sending the resulting page back to you. The "performs some processing" bit is the magic that makes ASP.NET work.

The extra processing that the server performs includes the capability to read an ASP.NET page and convert the server controls in that page into HTML that the browser can understand. Remember, your browser doesn't speak ASP.NET. A web browser is a simple thing that only speaks HTML and possibly JavaScript — it cannot process ASP.NET code. The *server* reads the ASP.NET code and processes it, *converting* anything that is ASP.NET-specific to HTML and (as long as the browser supports it) a bit of JavaScript, and sends the freshly generated HTML back to the browser.

The process of converting ASP.NET code to HTML is how server controls work; you can happily create pages that contain server controls when you are developing the source .aspx page, yet the browser that requests that page from the web server will only receive HTML and JavaScript (see Figure 3-17). This is a key concept to understand, and the process is discussed in more detail in Chapter 6.

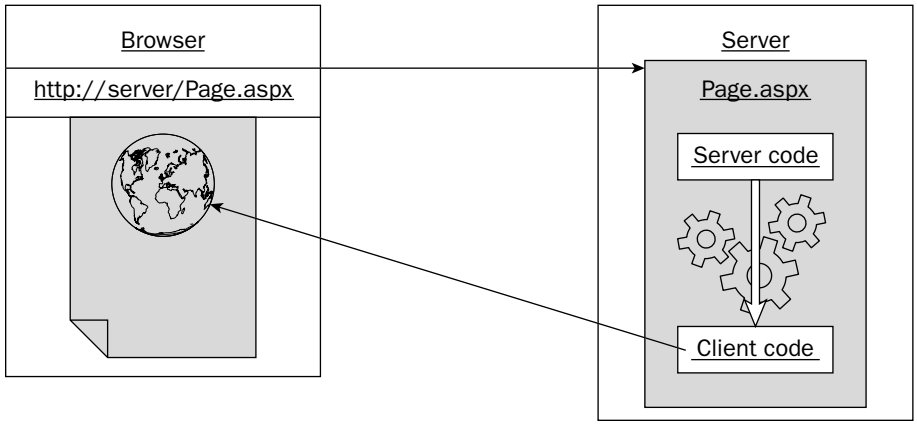


Figure 3-17

You can see how this works with the aid of a simple example. The following Try It Out is a really simple example to demonstrate the differences between the ASP.NET code and HTML code.

Try It Out Adding Server Controls in Design View

1. Start by reopening the Chapter03 web site.
2. Right-click the root of the web site and select Add New Item.

3. In the dialog that appears (shown in Figure 3-18), select Web Form, call the page `ServerControls.aspx`, and select your preferred language from the drop-down list and leave both of the checkboxes unchecked.

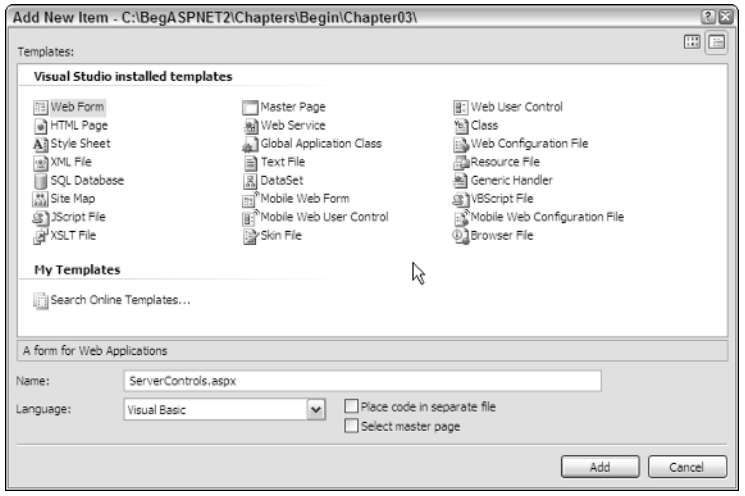


Figure 3-18

4. If you are not already in Design View, make sure you are switched into that mode and double-click a `TextBox` control from the Standard section of the control toolbox on the left (see Figure 3-19) to add it to the main body of the page.

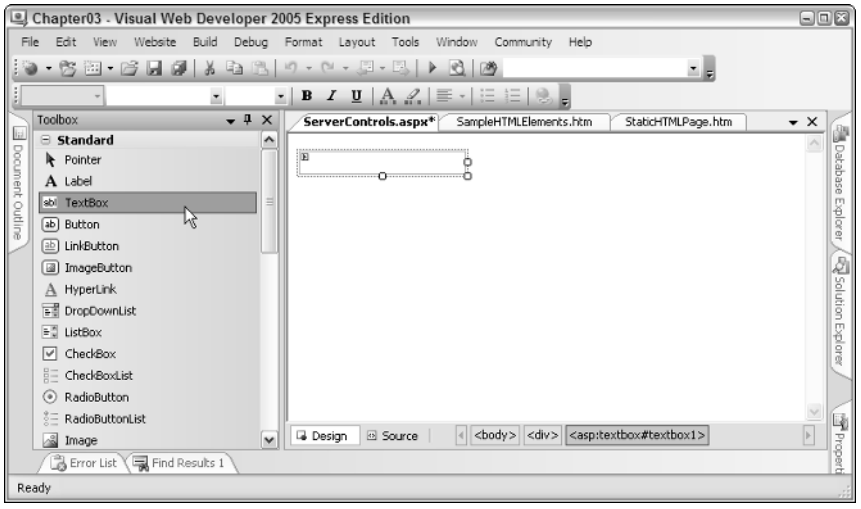


Figure 3-19

5. You're actually ready to view the page now, so click the run button on the toolbar (the green arrow with the tooltip Start Debugging).

   Your browser should fire up and display the page shown in Figure 3-20.

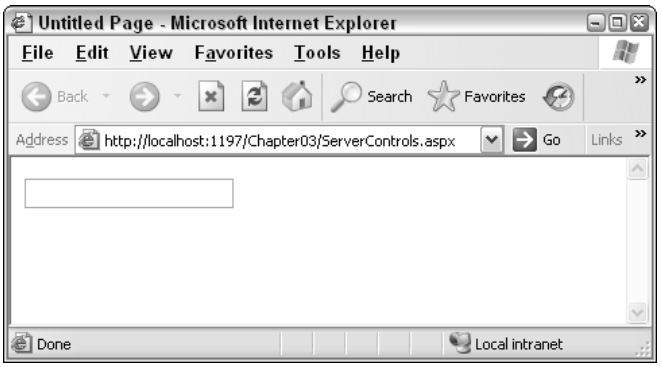


Figure 3-20

Note that the number displayed in the address bar (after the word localhost) is a fairly random number that will change each time you start debugging for the first time.

How It Works

In this example you've only added a single server control to an ASP.NET page and viewed the page in the browser. It's not exactly the most exciting example in the world, but the point is to see how server-side code is changed into client-side code.

First, click the View menu in the browser and select View Source — you should see the code shown in Figure 3-21 appear within Notepad.

Figure 3-21

This code is the client-side code — the rendered output of the page. Compare this with the original code; flick back to VWD and click the Source View of the page (see Figure 3-22).

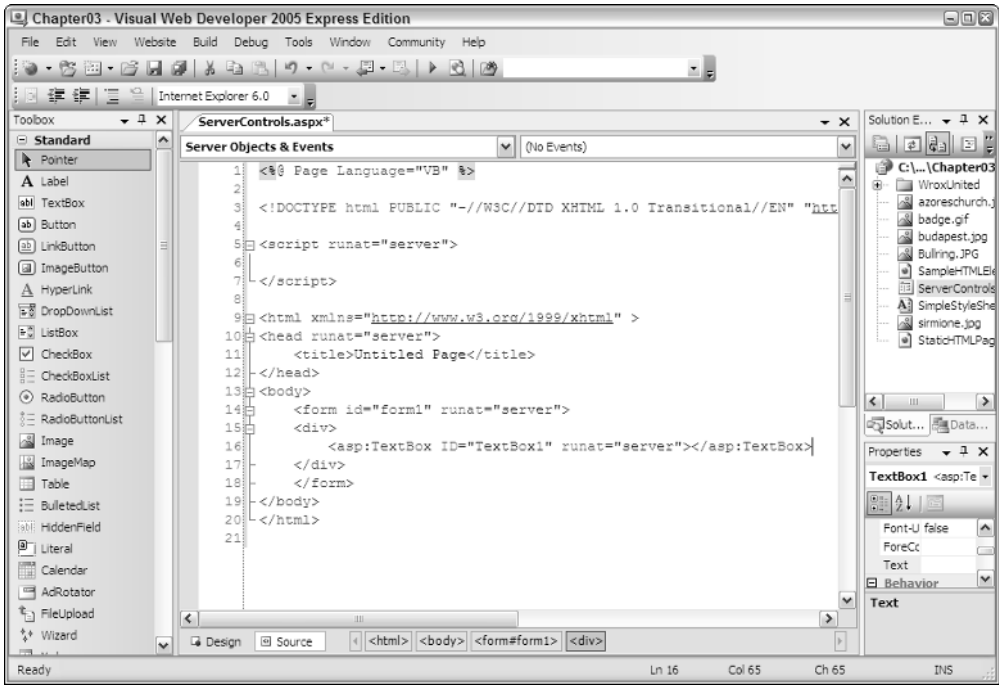


Figure 3-22

The lines you should pay attention to are the ones that describe the control with the ID of `TextBox1`. Here are those lines, as they appear in the original source code for the page:

```
<div>
  <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>

</div>
```

And here is the equivalent line in the rendered source code:

```
<div>
  <input name="TextBox1" type="text" id="TextBox1" />

</div>
```

Notice that the original `TextBox1` control has been converted from an ASP.NET control to an HTML element. The server received the request for the page and was able to glean, from the original request, that the browser could understand HTML, so the server spat out an HTML version of the control along with the rest of the page back to the browser. The browser then does the legwork in converting that HTML code to a viewable web page.

Source View in VWD

Visual Web Developer has two main modes when it comes to building and editing pages. The Design View is one that you've spent a little while working in now, and it's the Design View that we'll concentrate on using (where we can) in this book to avoid having to type too much code. However, Source View is really useful for hand-editing a page and fixing nagging problems, so it's worthwhile taking a look at this now and gaining some familiarity. Add another control to the page you were just working on; this time, in Source View.

Try It Out — Adding Server Controls in Source View

1. Head back into VWD and ensure that you are in Source View for the `ServerControls.aspx` page (click the link at the bottom of the window to switch between Design and Source views). In the code that appears on the screen, click the line immediately below the code representing the `TextBox` control that you added in the previous example.

```
<div>
  <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>

</div>
```

2. You have two options available to you when you add server controls in Source View; you can either type in the code by hand, or drag and drop the control from the Toolbox, much like the technique used in Design View. Do it the hard way first — start typing the following code:

```
<asp:Image
```

Before you even finish the word Image, you'll notice some handy tooltips popping up, as shown in Figure 3-23, trying to guess what you're hoping to type.

This is a feature available to VWD and Visual Studio known as IntelliSense, and it's designed to make your life as a developer a little easier. To accept a suggestion, you can scroll through the list with the arrow keys and then press either the Tab, Space, or Enter key, or click the suggestion with your mouse. To forcibly show any relevant IntelliSense, press Ctrl+Space and the popup will appear.

3. Continue to enter the code as follows:

```
<div>
  <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>
  <asp:Image ID="MyImage" runat="server" ImageUrl="~/azoreschurch.jpg" />
</div>
```

Notice that VWD presents you with a list of local images when you enter the `ImageUrl` property (see Figure 3-24).

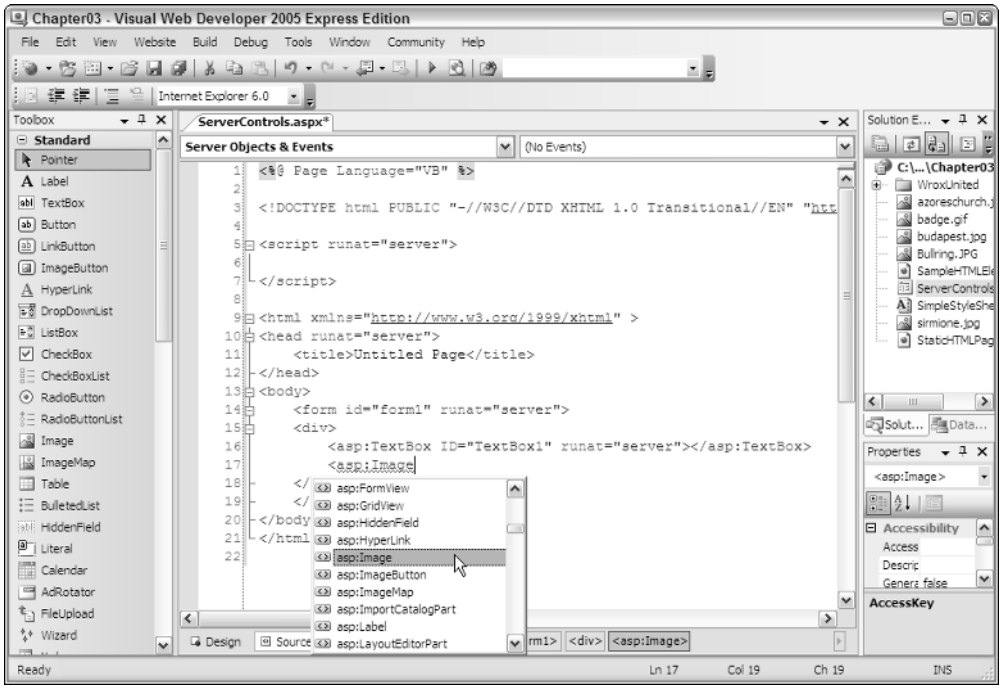


Figure 3-23

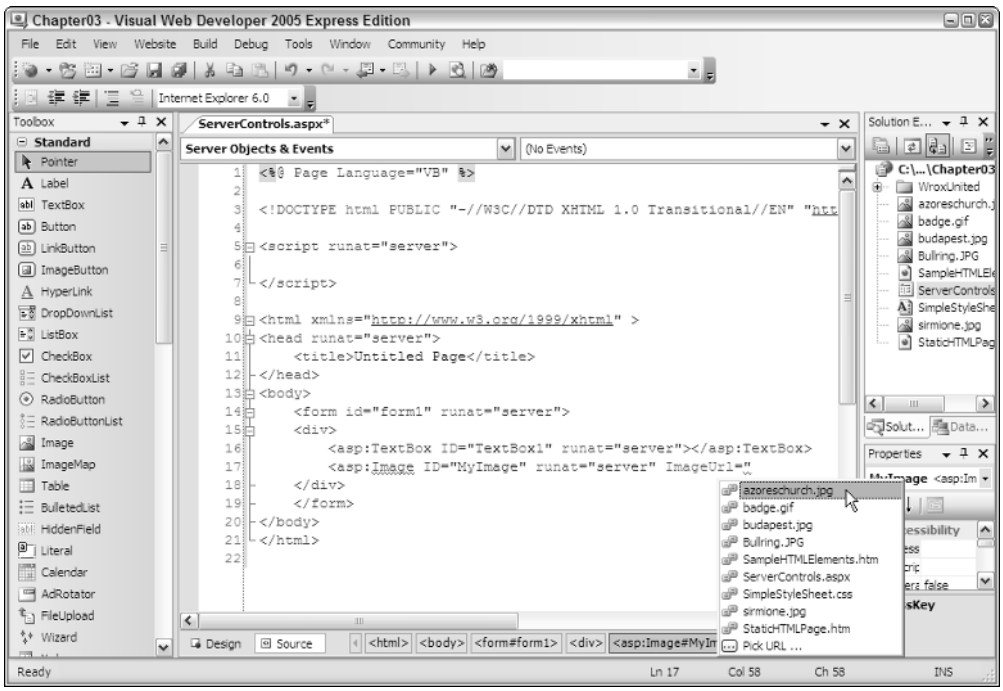


Figure 3-24

4. Add one more control to the page; this time, add it using the double-click technique. Add a blank line before the `</div>`, position your cursor in this line, and double-click the `Hyperlink` control (see Figure 3-25) in the Toolbox to add it to the page.

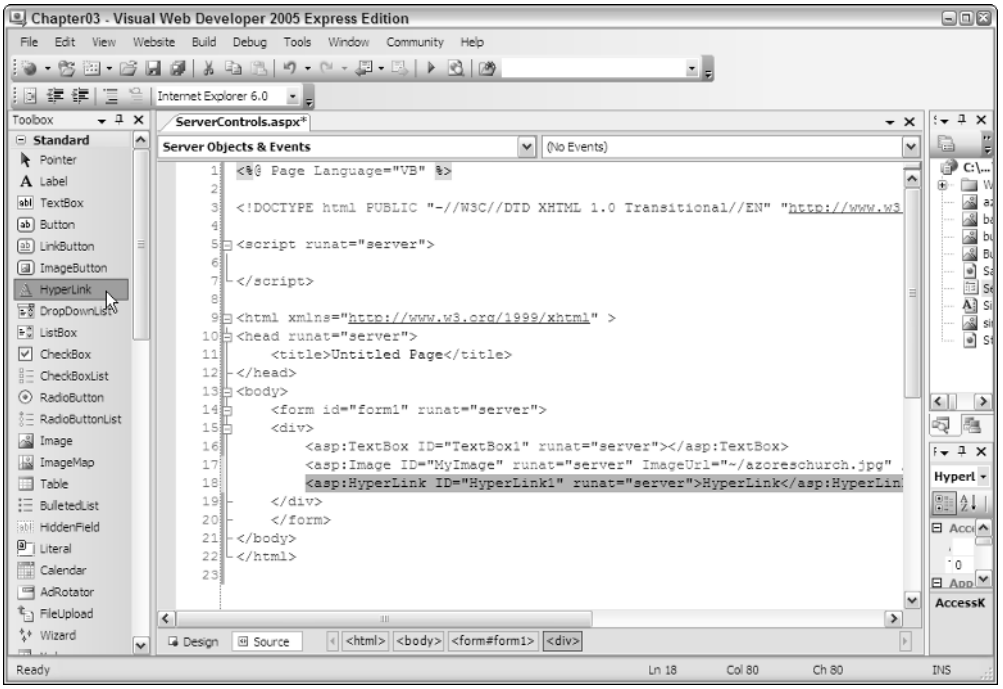


Figure 3-25

5. You'll still have to edit this control before you can run the page successfully, so position your cursor anywhere within the `Hyperlink's` definition and then cast your eye over to the Properties pane on the right (if it is hidden, as in Figure 3-25, you will need to pop it out from the side by hovering your mouse over the Properties tab at the right-hand edge of your screen, or select View ➪ Properties Window). Notice a property called `NavigateUrl` near the bottom of the list of properties — enter `http://www.wroxunited.net` as the value for this property and press Enter. Take a look at Figure 3-26 and you'll notice a new attribute of the hyperlink tag called `NavigateUrl` appear on the page with the value you entered.

6. At this stage, why not flick over to Design View and see how it looks — you'll notice all three controls on the page in one line. If you'd prefer them to appear one below the other, simply type `<br />` after each control to add an HTML line break character in Source View. You might also want to change the display text of the hyperlink control (the text immediately before the `</asp:HyperLink>` closing tag) to some text of your choosing.

```
<body>
  <form id="form1" runat="server">
    <div>
      <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox><br />
      <asp:Image ID="MyImage" runat="server" ImageUrl="~/azoreschurch.jpg" /><br />
      <asp:HyperLink ID="HyperLink1" runat="server"
```

```
            NavigateUrl="www.wroxunited.net">Visit Wrox United Online!
        </asp:HyperLink>
      </div>
    </form>
</body>
```

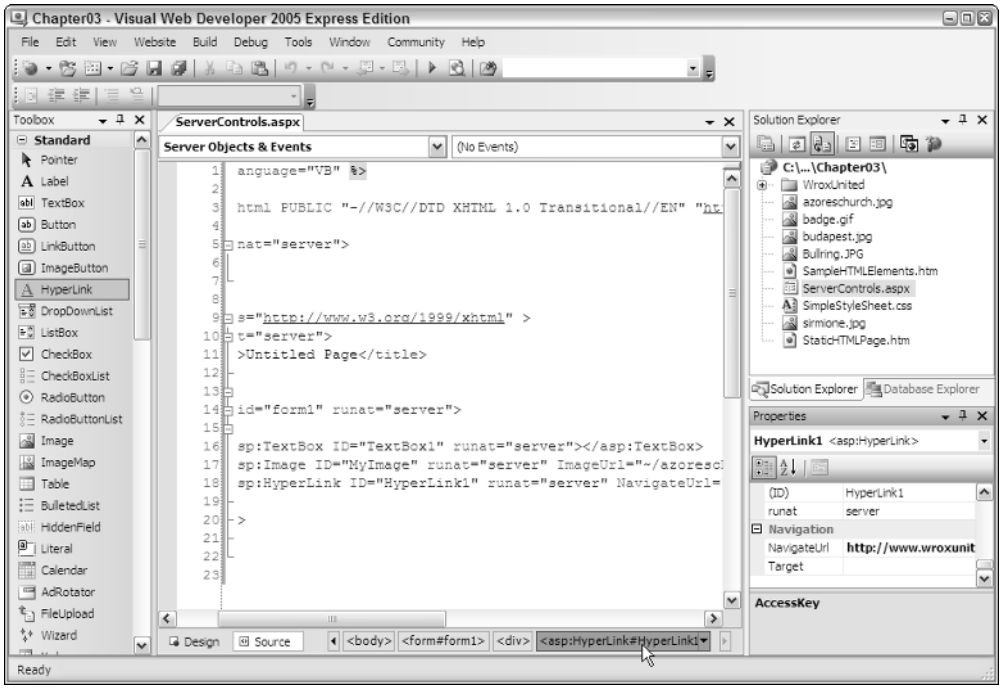


Figure 3-26

Notice the bar at the bottom of the screen next to the Design and Source buttons; there's an orange highlight on the element that is underneath the current cursor position (see Figure 3-26). This element hierarchy changes whenever you select different elements in either Design or Source View.

7. Now run the page again and view the results, which are depicted in Figure 3-27.

How It Works

In this example, you've gained a bit more familiarity with the drag-and-drop method of page design, and with using Source View to manually craft pages. You'll have noticed that VWD has lots of features that spring into action at different times to help you with this process.

Here's a walkthrough of the code that was generated in VWD. The main content region of the page was surrounded by a `<div>` control, and within this are the three controls added to the page:

```
<div>
  <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox><br />
  <asp:Image ID="MyImage" runat="server" ImageUrl="~/azoreschurch.jpg" /><br />
  <asp:HyperLink ID="HyperLink1" runat="server"
       NavigateUrl="www.wroxunited.net">Visit Wrox United Online!
  </asp:HyperLink>
</div>
```

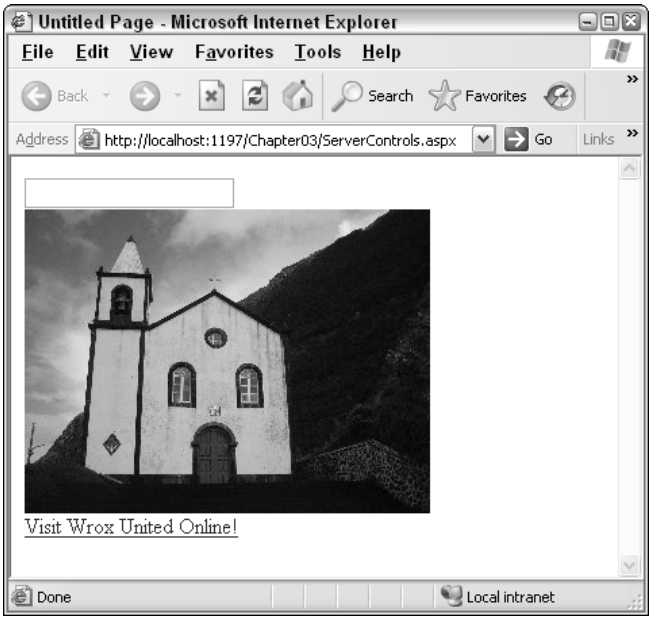


Figure 3-27

Now take a look at the rendered source — while the page is running in the browser, select View ➪ Source from the main menu in your browser, and see how the contents of the `<div>` have been changed:

```
<div>
  <input name="TextBox1" type="text" id="TextBox1" /><br />
  <img id="MyImage" src="azoreschurch.jpg" style="border-width:0px;" /><br />
  <a id="HyperLink1" href="www.wroxunited.net">Visit Wrox United Online!</a>
</div>
```

Web browsers don't know anything about ASP.NET server controls, so when the page is requested, the ASP.NET processor on the web server kicks in and starts converting the server-side elements into simple HTML that the browser is more happy to receive. The `TextBox` control maps straight onto an HTML `<input>` element. The `Image` control is converted into an `<img>` element, but notice how the `ImageUrl` attribute is converted into the `src` attribute:

```
ImageUrl="~/azoreschurch.jpg"
```

The name of the file (or URL to the image) in the `ImageUrl` is converted to the `src` attribute. If the file is local to the project, the file is prefixed with `~/` on the server side.

```
src="azoreschurch.jpg"
```

The `HyperLink` control also mapped fairly directly to its rendered equivalent, where the `NavigateUrl` is easily converted to the `href` attribute of the `a` tag.

In this simple example, you didn't really gain a lot from using server controls instead of hand-coding the HTML, but bear in mind that this page is completely static. If you wanted to respond to user input, react to events, or obtain data from a database, you would need to use server-side code. Server controls make the process of working with visual elements on the server possible.

Types of Server Controls

Many of the ASP.NET server controls that exist are ASP.NET equivalents of HTML elements, so there is a text box, a button, a hyperlink, a drop-down list, and so on. These controls look like the elements that they will eventually be turned into, but there is more to them than that. Each control has a common set of properties (for example, they all have an ID, and controls such as the text box, label, and so on all have a Text property), which makes it easier to work with these controls in code. Having listed the different categories of controls earlier in this chapter, you can concentrate on some of the most commonly used controls as you tour the server controls you can add to a site.

Standard Controls

These controls are the Web equivalents of the tools that you will have encountered when using Windows applications. Web pages that include these controls have that standard application feel that we're all familiar with, so it's great that the process of adding them to pages is quick and simple. Here are some of the most commonly used controls:

- **TextBox Control:** Used for entering text on a page, commonly seen on order forms on shopping sites, or for logging in to a site.
- **Button Control:** From submitting an order to changing preferences on a web site, clicking a button on a page normally causes information to be sent to the server, which reacts to that information and displays a result.
- **Label Control:** Used for displaying simple text in a specified position on a page. The `Label` control is an easy way to change the text on part of a page in response to user interaction.
- **Hyperlink Control:** Used for providing hyperlink functionality on a page that enables navigation to other parts of a site, or to other resources on the Internet.
- **Image Control:** Used for displaying images on a page. The server can change the image that is displayed in the control programmatically in response to user input.
- **DropDown List Control:** Used for offering the user a list of options to choose from; collapses when not in use to save on space.
- **Listbox Control:** Used for offering a fixed-size list of items to choose from.
- **CheckBox and Radio Button Controls:** Used for selecting optional extras with either a yes/no or "this one out of many" style, respectively.

Figure 3-28 shows the ASP.NET Web Site Administration Tool screen that you will learn to use in the next chapter for administering user accounts. On this screen, you'll see many of these controls in one place.

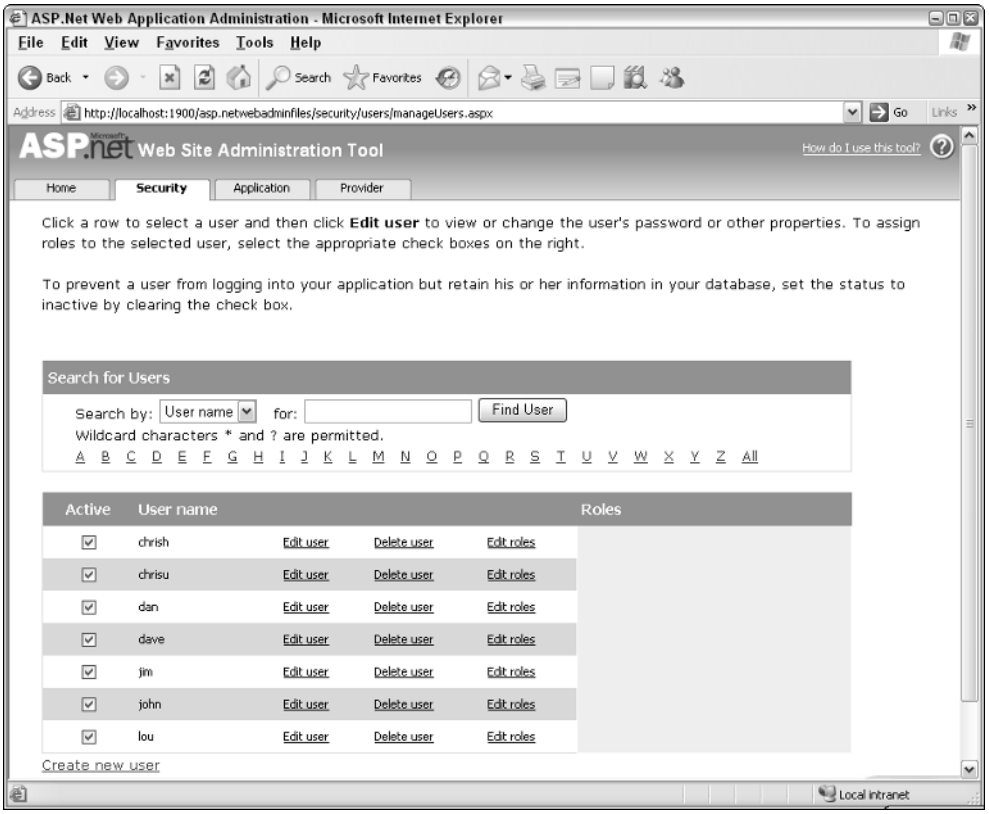


Figure 3-28

The `Search by:` label on the page is likely to be a `Label` control, and it's next to a `DropDownList` control. The `for:` label is next to a `TextBox`, which is next to a `Button` control. Next to each user name is a `CheckBox` for selecting the user, and some `HyperLink` controls for managing the user account. In the next chapter, you'll become very familiar with this configuration application, and it's a great example of many types of controls all on one page.

HTML Controls

Often when creating a site you don't need to do anything with a control on the server. In these situations, you might just want to add simple static HTML to part of a page; for example, just to position elements on a page or to provide a container for groups of elements. The HTML Control Toolbox contains drag-and-drop versions of the most commonly used HTML elements for this purpose. If you browse through this section of the Toolbox (see Figure 3-29), you'll notice HTML controls for client-side elements such as the Input (Text) box, the `Table` control, and the `Div`.

The controls on the toolbar are just a handy way to add the most common HTML elements to a page, and you are not restricted to using only those HTML elements. In Source View, you can add any valid HTML element you like; for example, an anchor tag `<a>` for hyperlinks, or a `<span>` for highlighting text within a section of a page.

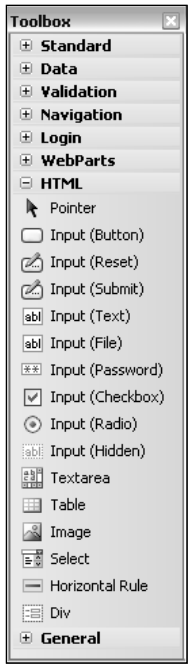


Figure 3-29

Elements such as the `Table` control and the `Div` control are containers and hence can contain other controls within their definitions. For example, in a `Table` control, you can have different controls nested within each table cell. Within a `Div` control you can also place a wide variety of elements and controls. You can nest server-side controls within static, non-server HTML elements such as these for laying out a page.

HTML Controls as Server Controls

It's possible to turn any HTML element into a server control by adding a `runat="server"` attribute to the element. As you'll see in Chapter 6, you can work with *any* server controls (HTML or ASP.NET) on a page dynamically using code when a page is submitted to the server. For example, once you add an ASP.NET `TextBox` control to a page, you can set the value to be displayed in the text area using code running on the server. However, once you add a `runat="server"` attribute (and give the element a unique ID) to, for example, a div element, you can then specify what the div should display and where it should be positioned on the page dynamically, using code running on the server.

Additionally, because you can add a `runat="server"` to *any* HTML element, you could use an `Input type="text"` control instead of the ASP.NET `TextBox` control if you like — and the same goes for the other types of HTML elements that have direct equivalents in the ASP.NET Toolbox.

Should I Use HTML Controls or ASP.NET Server Controls?

This question only really relates to simple elements on a page, such as the text box, the button, tables, and so on. Complicated server controls such as the `Calendar` control exist to speed up development time for sites, so there's no real question of which to use in cases like these. The approach taken by most developers, when making the choice about which type of control to add to a page, is to use ASP.NET's Standard Server Controls for the majority of server-side controls on a page and static HTML elements for layout.

Although this works in most situations (and indeed you'll find that many situations require server controls where HTML controls simply can't offer the correct functionality), you may find exceptions to the rule. For example, adding `runat="server"` to HTML elements is a technique I often use with HTML divs or tables; if I know that I want to show or hide parts of a page depending on user input, I can convert those elements I need to work with on the server into server controls, and then dynamically toggle their visibility. Though it's also easy to create sites that offer the same functionality using standard server controls, the design team I work with only produces page layouts using simple HTML, so it's sometimes easier to convert some of those HTML elements to run on the server than it is to recode the site to use the built-in ASP.NET server controls. There is no real right or wrong approach here, so use your own judgment, but be aware that you may encounter code written by others that takes a different, but equally viable, approach.

Navigation Controls

The three out-of-the-box controls available for navigating a site provide a wealth of functionality for very little effort. Compare this to the situation that was in place previously for ASP.NET developers and you'll see that this is a big improvement — what would have previously been a couple of work items on a task list that might take a couple of hours each for a developer to code now takes a few seconds! The `Menu`, `TreeView`, and the `SiteMapPath` controls are new in ASP.NET 2.0, and are quick and simple to set up. Following is an overview of these controls; later on, you'll add both of these controls to the Wrox United site.

The SiteMapPath Control

This control is used to add breadcrumb functionality to a site, giving you a visual aid to remind you where you are in the site hierarchy. This is demonstrated in the Wrox United site, as shown in Figure 3-30.

The term *breadcrumb* most likely comes from the old fairy tale of Hansel and Gretel — two children who went for an adventure in the woods, leaving a trail of breadcrumbs behind them to help them to find their way home. As you click through pages on a site, you may pass through to different sections and subsections of the site, until you are several links deep into an application. A breadcrumb helps you to go back to a specific point in your navigation path without having to rely on the back button on the browser. You may have encountered situations where you can't hit the back button to head back a link — a bit like a crow eating your breadcrumbs. Some pages submit information to the server in such a way that you can't go back without resending the information.

You'll find breadcrumb functionality available on many different sites across the Internet. One such site is the Wrox United site, as shown in Figure 3-30. However, in order to add one of these controls to the site, you need to have a `Web.SiteMap` file at hand. Got one? Excellent! (If not, you need to go back to Chapter 2 and learn how to create one!)

Once you have a `Web.SiteMap` available to your application, adding a `SiteMapPath` control and seeing some results is easy — all you need to do is add it to a page. To add it to Wrox United, the best thing to do would be to add the control to the master page so that all of the content pages will suddenly have breadcrumbs at their feet!

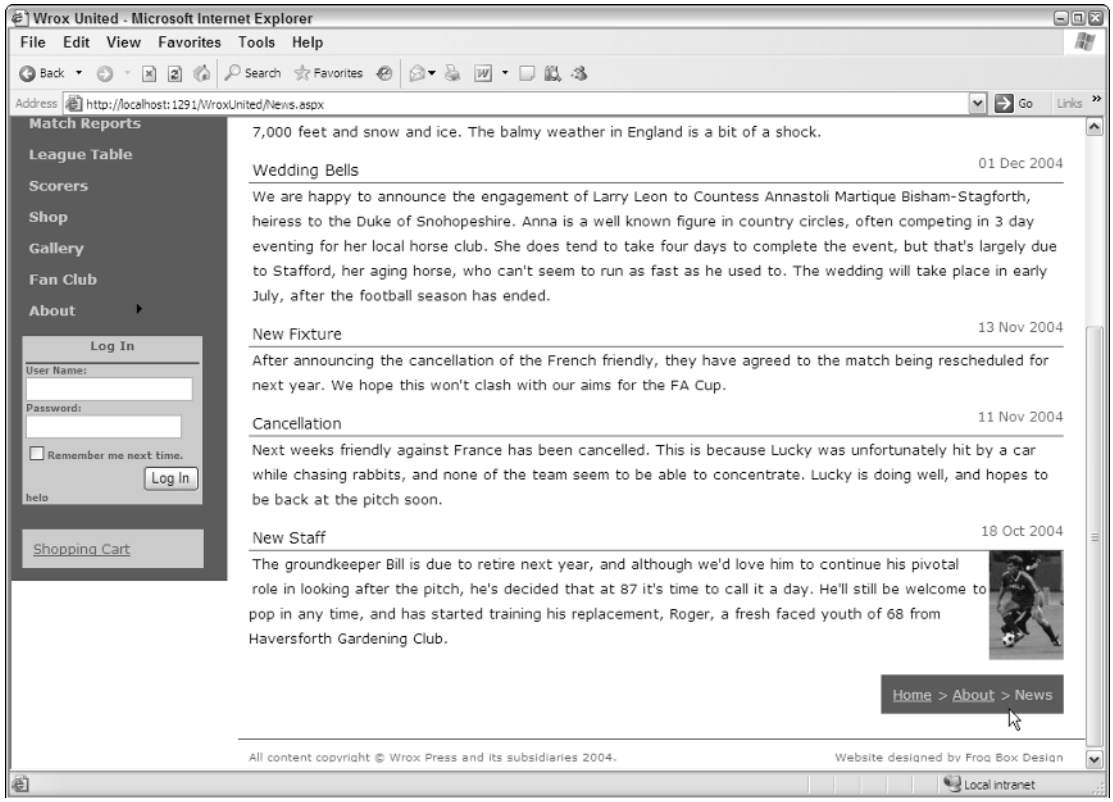


Figure 3-30

For this next Try It Out, you need to work with the Chapter03 version of the Wrox United application (stored within the Chapter 03 folder in the code download as `WroxUnited`). This version of the site has been modified to enable you to try out these examples.

If you open the Chapter 3 version of the `WroxUnited` application as it stands, you'll see what's shown in Figure 3-31. If it doesn't look quite like the figure, don't worry – VWD has some problems displaying pages that use CSS, so you may see the most of the site without having to scroll down.

Although the site looks fairly normal, two things are missing: the links on the left of the page and the breadcrumbs at the bottom of the page. In the following Try It Out example, you'll add these to the site and see how simple it is to add navigation.

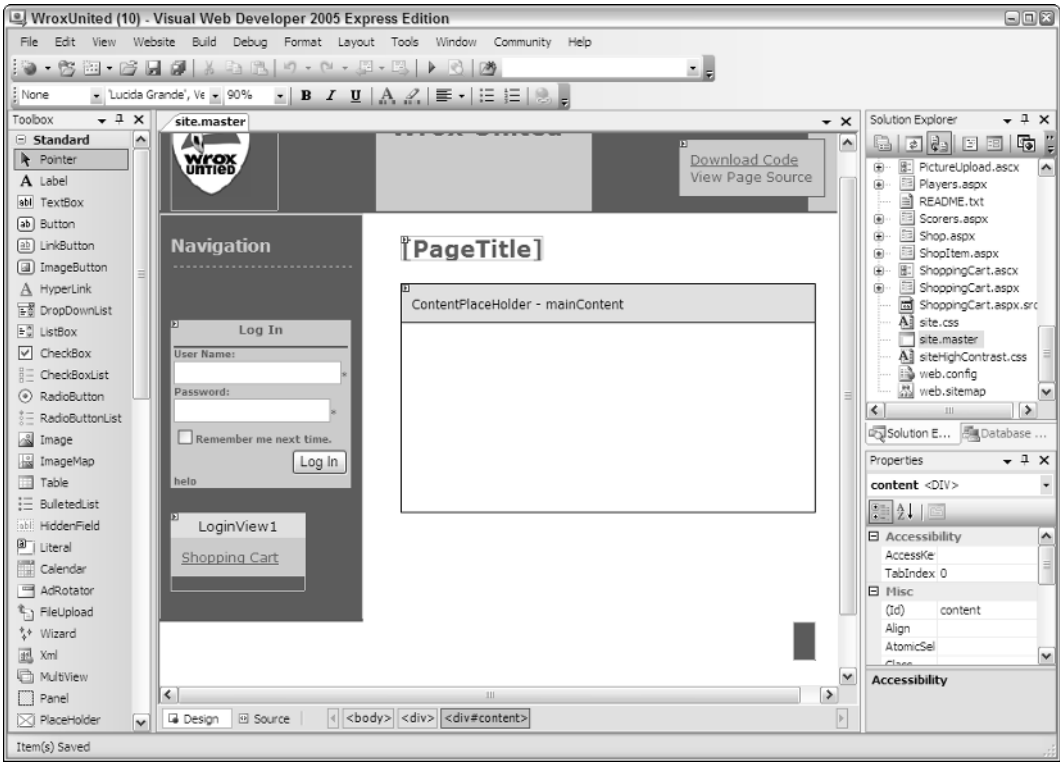


Figure 3-31

Try It Out — Adding the SiteMapPath Control

1. Open up the Chapter 3 version of the Wrox United application (`C:\BegASPNET2\Chapters\Begin\Chapter03\WroxUnited`) and open the `site.master` file. Make sure you're in Design View.
2. Place your cursor inside the Breadcrumbs div at the bottom of the page — it's the red blob in the bottom right of the page. You'll know when you've found the right spot when you see `<div#breadcrumbs>` highlighted at the bottom of the window, as shown in Figure 3-32.
3. Now drag a `SiteMapPath` control into the Breadcrumbs div from the Navigation section of the Toolbox (see Figure 3-33).
4. Ignore the Common Task menu on this one — the only modification to make here is to change the name of the control. Ensure that the `SiteMapPath` control is selected and change its ID to crumbs in the Properties panel. Notice the mouse cursor in Figure 3-34 highlights the ID property for the control.
5. Now run the site again by launching `Default.aspx` and see the results of your hard work down at the bottom of the page, as shown in Figure 3-35. Notice that the URL my browser is using is `http://localhost:1621/WroxUnited/default.aspx`. Your port number (the bit after the colon) will be different.
6. Now try browsing to the History page by changing the `Default.aspx` part of the URL to `History.aspx`. Figure 3-36 shows how the rendered `SiteMapPath` control changes down at the bottom of the page.

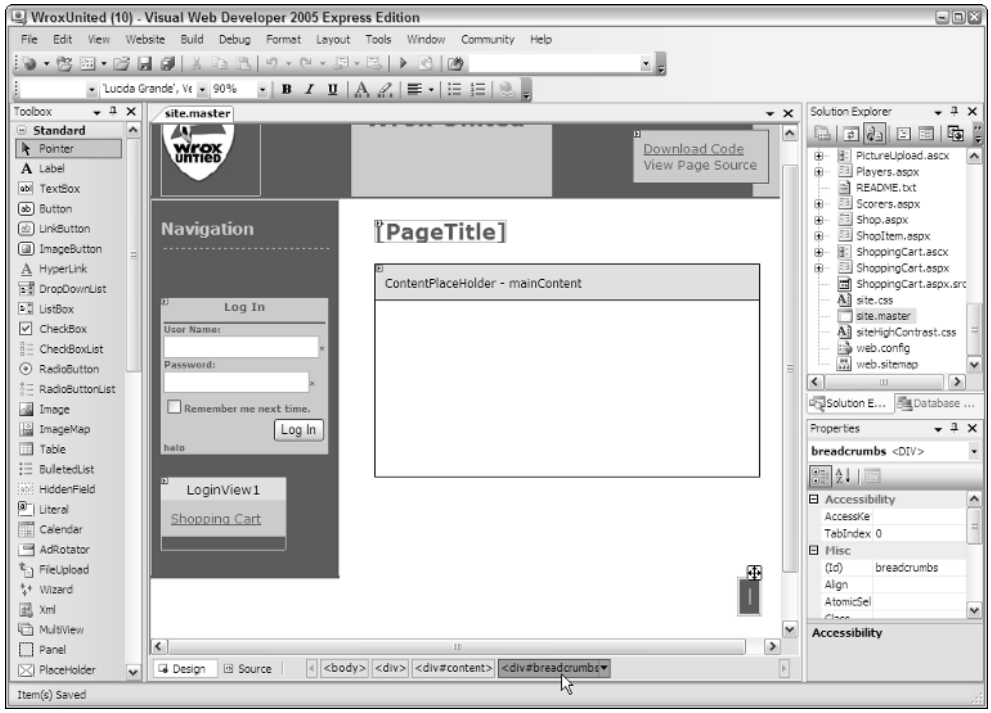


Figure 3-32

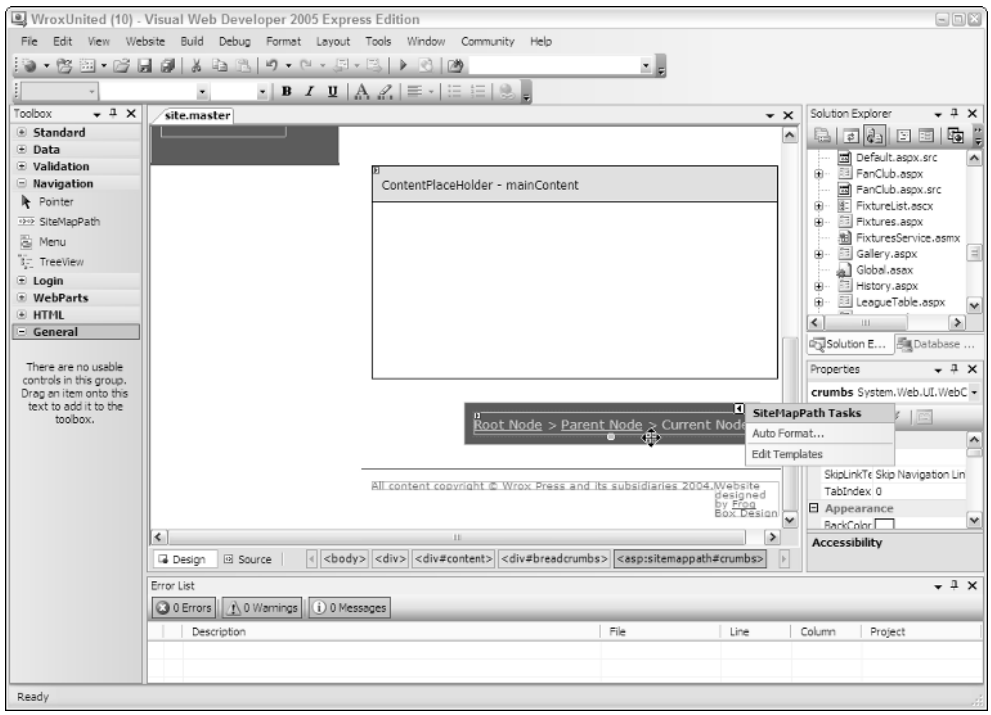


Figure 3-33

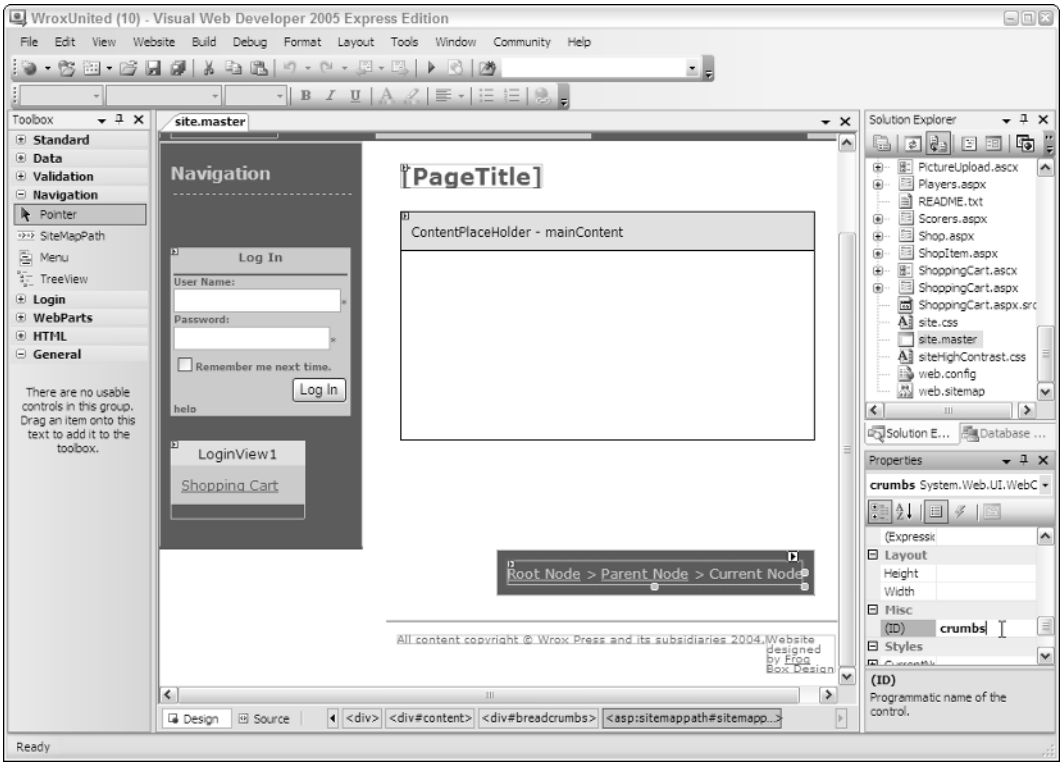


Figure 3-34

Figure 3-35

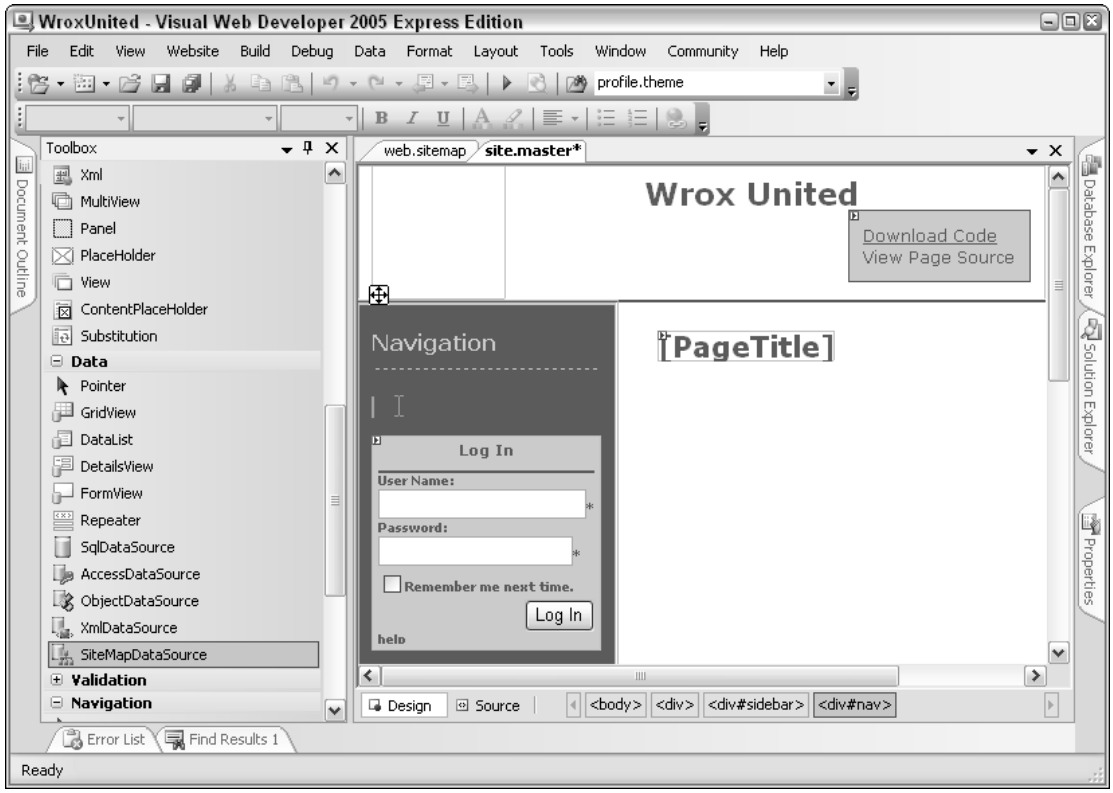


Figure 3-36

How It Works

In this example, you've added a simple `SiteMapPath` control to a modified version of the Wrox United web site to give users some visual feedback as to which page is being viewed, and where in the site hierarchy that page resides. Adding the control to the page is enough to achieve this, because there is a `Web.SiteMap` file included in the application files.

The `SiteMapPath` control hooks in to the `Web.SiteMap` (if it exists) and renders content dynamically by figuring out which page the user is currently viewing, and where that page is situated in relation to the order of nodes in the site map. Here's the `Web.SiteMap` code that relates to the nodes you looked at:

```
<siteMap>
  <siteMapNode title="Home" url="Default.aspx"
               description="Wrox United Home Page">
...
    <siteMapNode title="About" description="About the club" url="about.aspx">
      <siteMapNode title="History" url="History.aspx"
                   description="The history of the club" />
```

Notice that the `History` node resides within the `About` node, which in turn resides within the `Home` node, so when you look at the `History` page, you know that the page below must be the `About` page, and the root node is the `Home` node — which is exactly what you saw on the `SiteMapPath` control:

```
Home > About > History
```

If you'd navigated to a different part of the hierarchy (to either the Match Fixtures, Future Fixtures, or Past Fixtures pages), the display would have changed appropriately. So, navigating to `Fixtures.aspx?type=future` would present the following:

```
Home > Fixtures > Future Fixtures
```

This is how the `SiteMapPath` control that was added to the page appears in code:

```
<div id="breadcrumbs">
  <asp:SiteMapPath ID="crumbs" runat="server">
   </asp:SiteMapPath>
</div>
```

Without customizing the control at all (no specific attributes have been set), the nodes are rendered. The style used for the control is all controlled in the style sheet for the page (Chapter 5 looks at styling pages).

SiteMapPath Control Properties

In the previous Try It Out you added a `SiteMapPath` control without modifying it in any way and the list of nodes was displayed. If you'd modified it to change the number of levels displayed, it could have been used in quite a different way; perhaps to be used to display the name of the current page in a header, for example:

```
<asp:SiteMapPath ID="PageTitle" Runat="server" ParentLevelsDisplayed="0">
</asp:SiteMapPath>
```

So, with this modification, the site map node would display only the name of the current page; in the case of `History.aspx`, the `SiteMapNode` would simply say `History`.

Another modification that could be made would be to change the path separator character, for example:

```
<asp:SiteMapPath ID="crumbs" runat="server" PathSeparator=" : ">
</asp:SiteMapPath>
```

Again, if you were then to navigate to the `History.aspx` page, you'd see the following:

```
Home : About : History
```

In addition to these two properties, you can set many other attributes to customize this control. The following table describes some of these properties in a bit more detail.

Attribute	Description	Options (default in bold)
`RenderCurrentNodeAsLink`	Specifies whether the active node is clickable, or whether the current node appears as plain text.	True / **False**
`PathDirection`	Sets whether the breadcrumbs appear in order from the root link to the current link (from left to right) or vice versa.	**RootToCurrent** / CurrentToRoot
`PathSeparator`	Sets the character to use as the separator marker between nodes.	>, any ASCII character

Having looked at how the `SiteMapPath` control works, it's time to move on to look at the remaining two navigation controls: the `Menu` control and the `TreeView` control. However, to use these controls on a page, you need to add a different type of control to provide the data to these controls; the `SiteMapDataSource` control.

The SiteMapDataSource Control

This control is a non-visual control, and is used to expose the nodes defined in the `Web.SiteMap` file in a way that the `Menu` and `TreeView` controls can understand, and to make it possible to amend the content that these controls will display.

To add this control to a site, you only have to drag a copy onto a page. That's all there is to it. The code that's generated for you will appear as follows in `Source` View:

```
<asp:SiteMapDataSource ID="SiteMapDataSource1" runat="server" />
```

In the next Try It Out example, you will do this for yourself so that you will be able to use the `Menu` control. The `Menu` control is used in the full Wrox United site to provide the means to navigate the Wrox United site, so you won't have to keep typing in links; let's see how this works in connection with the `SiteMapDataSource` control.

The Menu Control

The `Menu` control provides a mixture of static and dynamic menu functionality. You have the option, when you add this control to a page, of making the menu completely dynamic if you want, so an entire navigational structure can be displayed in the menu, a bit like a Start menu. Alternatively, you can adopt a more traditional approach and opt for a fixed menu, or one mixing this functionality. The dynamic bits use client-side JavaScript that ASP.NET generates for you (again, without you having to lift a finger).

In order to add a `menu` control to the site, you first need to add the `SiteMapDataSource` control, which specifies what links your menu will have access to and the order in which they appear. You'll do both of these now in a Try It Out example based on the WroxUnited application.

Try It Out Adding a Menu Control to Wrox United

1. Open up `site.Master` once again and switch to Design View. Position your cursor in the `nav` div on the left of the page, as shown in Figure 3-37.

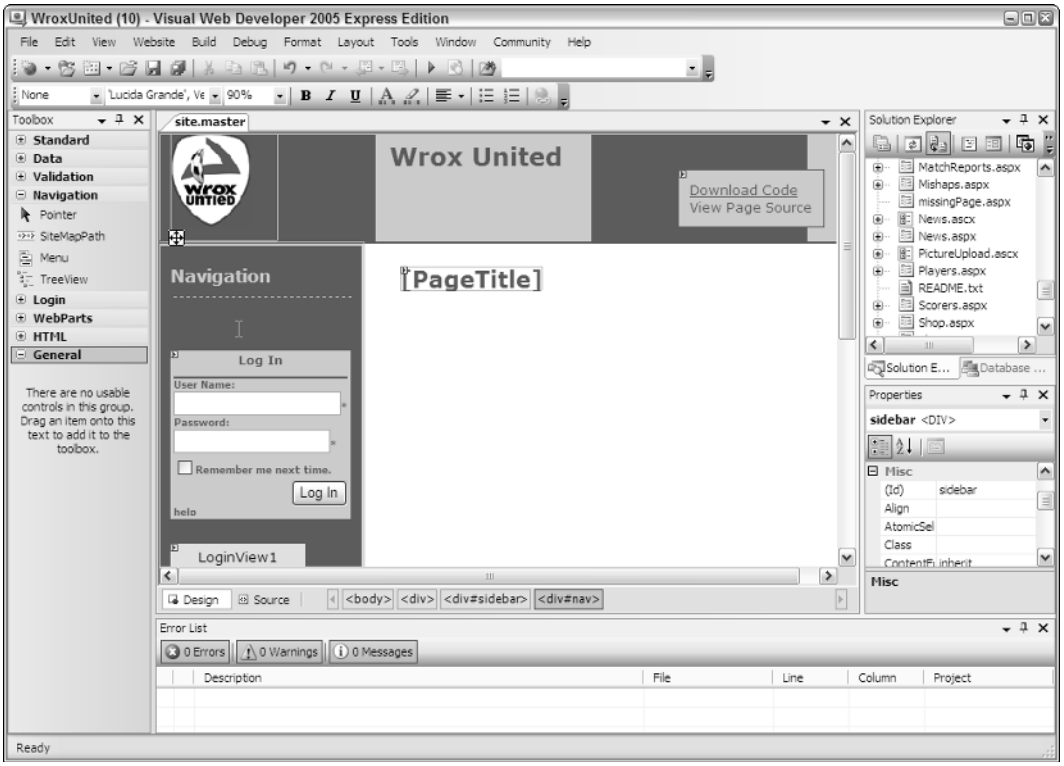


Figure 3-37

2. Now drag a `SiteMapDataSource` control (highlighted on the left in Figures 3-38 and 3-39) onto the page inside the `nav` div (you'll find it hiding in the Data tool group on the Toolbox), and, in the Properties pane, rename the control `siteData`.

   That's all the groundwork you need to do — next, you'll add the `Menu` control itself.

Figure 3-38

3. Drag a `Menu` control onto the page just next to the right edge of the `SiteMapDataSource` control. You will see a fly-out dialog appear as shown in detail in Figure 3-39 — this is the Smart Tasks window:

Figure 3-39

In the dialog, choose the `siteData` data source that you generated in Step 3. Once this has been set, the menu will change as shown in Figure 3-40:

Figure 3-40

4. Click the small arrow at the top-right corner of the menu to close the pop-out menu. Now, with the menu selected, change the menu's `StaticDisplayLevels` to 2 using the Properties pane. You'll immediately notice a difference: have a look at Figure 3-41.

5. Some properties need to have values set before this control will work and behave as it does on the full version of Wrox United. Switch to Source View, and add the following properties in code:

```
<asp:Menu ID="Menu1" runat="server" DataSourceID="siteData" StaticDisplayLevels="2"
      orientation="Vertical"
      StaticSubMenuIndent="0"
      disappearafter="200"
      AccessKey="m"
      EnableViewState="false">
      <DynamicMenuStyle CssClass="dynamicMenu" />
      <DynamicMenuItemStyle CssClass="dynamicMenuItem" />
</asp:Menu>
```

Figure 3-41

6. Now run the site again (press Ctrl+F5 to start without debugging) and you'll see the screen shown in Figure 3-42.

   Notice that you can hover over the About link and a flyout appears with submenu items, including the History page, displayed. This is out-of-the-box dynamic functionality at its finest — and isn't it great?

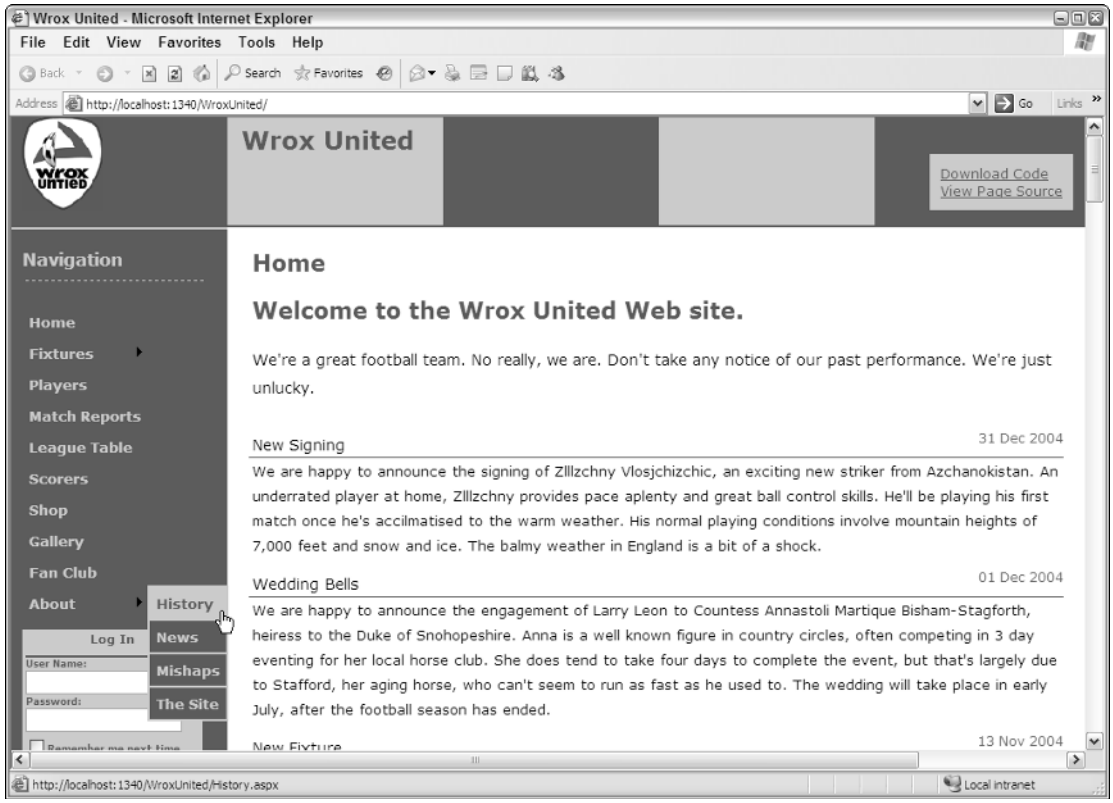


Figure 3-42

How It Works

The `Menu` control that was added to the master page read the contents of the `SiteMapDataSource` control (`siteData`) and rendered a set of links corresponding to the data stored in that data source. The `SiteMapDataSource` itself required no customization (other than a quick renaming) — by default, the `SiteMapDataSource` will read the `Web.SiteMap` file and act as a middle-man for the `menu` control so that it can display links corresponding to the contents of the `Web.SiteMap` file.

The `SiteMapDataSource` can be customized if required using the following parameters:

Property	Values	Result
`EnableViewState`	True/False	Specifies whether the `SiteMapDataSource` control retains its data on postbacks.
`ShowStartingNode`	True/False	Specifies whether the root node should be displayed on any control dependent on this data source.

Table continued on following page

Property	Values	Result
`SiteMapProvider`	Any valid provider	Can be used to specify a custom provider (necessary if, for example, site map data is stored in a completely different structure such as a .csv file or a database instead of the `Web.SiteMap` file).
`StartFromCurrentNode`	True/False	If set to true, then only sublinks from the current node (active page) are shown, instead of the entire hierarchy.
`StartingNodeOffset`	Integer values	Used to shift the starting point of the hierarchy inward. This could be useful if you only want a `Menu` control to show sub-menu links, and not the full site structure. If the menu in Wrox United had this value set to 1, the menu would ignore all the first-level menu items, and only show the next level in the hierarchy, so, in the case of the Wrox United hierarchy, this would show the Future and Past Fixtures, History, News, and similar links.
`StartingNodeUrl`	String representing a URL of a page defined within the `Web.SiteMap` file.	Used to specify a different point at which to start the hierarchy.

Binding a menu to a `SiteMapDataSource` control is a really simple way to generate a hierarchy of links from the `Web.SiteMap` data file, but it is possible to do much more via this data source control, including binding to a completely different data source, and combining different controls (other than a menu) to the data. If you're the sort of person who has to work with site map information stored in a completely different format (other than `Web.SiteMap`), then in order to get a working `SiteMapDataSource` control, you'll need to have a custom `SiteMapProvider` class available. Creating custom providers is quite an involved process (which is beyond the scope of this chapter), so for more information on this process, you should refer to *Professional ASP.NET 2.0*, by Bill Evjen, Wrox Press.

The `Menu` control itself was changed slightly in this example to include some additional property values. Here's a look at these values:

```
<asp:Menu ID="Menu1" runat="server" DataSourceID="siteData" StaticDisplayLevels="2"
      orientation="Vertical"
      StaticSubMenuIndent="0"
      disappearafter="200"
```

```
        AccessKey="m"
        EnableViewState="false">
        <DynamicMenuStyle CssClass="dynamicMenu" />
        <DynamicMenuItemStyle CssClass="dynamicMenuItem" />
</asp:Menu>
```

The additional attributes on the `Menu` control itself are fairly simple. The two on the first line in the listing (`DataSourceID` and `StaticDisplayLevels`) were set in the Properties pane in the example. The remaining attributes control the following:

- `Orientation`: Used to have a horizontal menu bar on a page.
- `StaticSubMenuIndent`: Controls the depth of indentation used to render submenu items, if the levels are set to appear in static mode.
- `DisappearAfter`: Dictates how long a flyout will remain visible before disappearing.
- `AccessKey`: Enables keyboard shortcuts for enhanced usability.
- `EnableViewState`: An ASP.NET feature that, if set to `true`, is used to maintain control state when a page is posted back to the server. This is used, for example, on text boxes, when submitting data to the server, for keeping the values in the text box when the page refreshes. This is unnecessary in this control, and will slightly improve page performance if disabled.

In addition to these attributes are two properties that help to define the visible style of the rendered control. The `DynamicMenuStyle` controls the appearance of the flyout itself, and the `DynamicMenuItemStyle` controls the appearance of the links. The styling for these items is controlled by CSS. You'll learn more about this in Chapter 5.

There is just one last navigation control to consider in this chapter: the `TreeView` control. This control is very similar in usage to the `Menu` control.

The TreeView Control

The `TreeView` and the `Menu` controls are very similar to implement, though the rendered experience is quite different. With a `TreeView` control, you end up with a user experience more akin to using Windows Explorer to work through the files stored on your file system, with expandable nodes that contain sublevels.

Deploying the control is very similar to deploying a `Menu` control; you just drag it onto the page and select the `SiteMapDataSource` control to use to provide its data. If this control were used on the Wrox United site, it would appear shown in Figure 3-43.

Notice that the Home node and the Fixtures nodes are expanded in the preceding view, though the About link is collapsed. If you replaced this control yourself, aside from some minor styling quirks, this could easily be used to navigate the site instead of the `Menu` control.

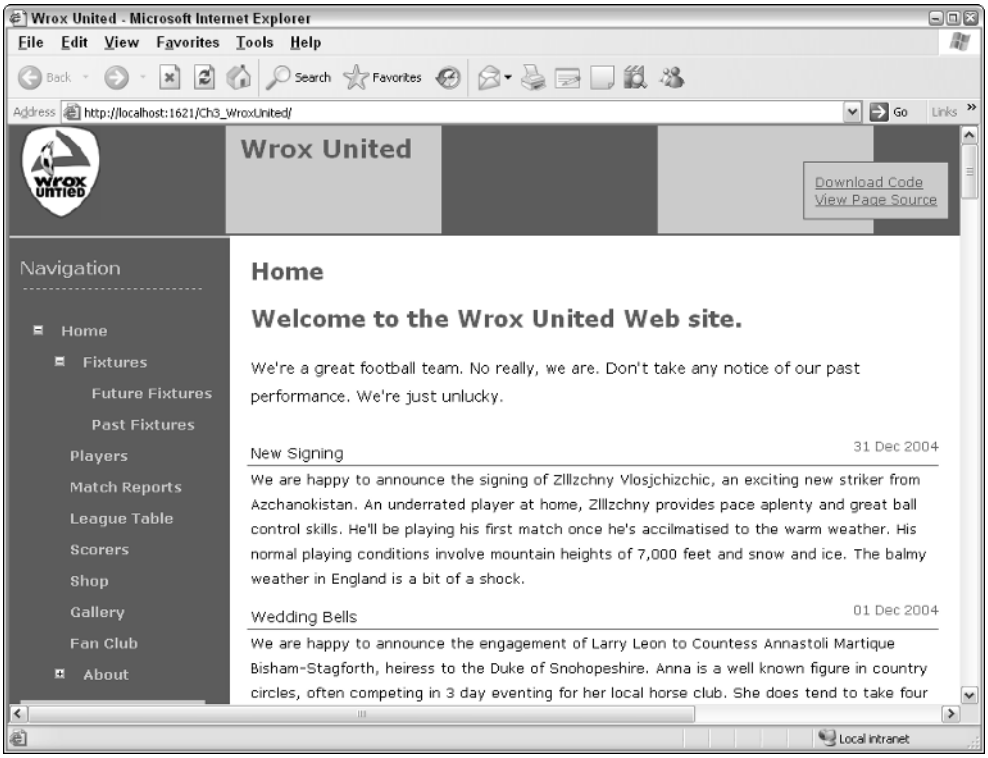


Figure 3-43

Summary

This chapter looked at the differences between code that the browser can understand and server controls, which the server can convert into a format that is displayable on the browser. In particular, you should now feel comfortable with the following facts:

- HTML is the language that the browser can understand, and is used throughout web programming to form the web pages we view on any site.
- XHTML is a version of HTML that follows a strict set of guidelines, with the aim that both current and future browsers will all be able to speak the same language, thus removing some of the uncertainty when developing a web site.
- Client-side code and server-side code are two different entities; server-side code is processed on the server, and is processed and turned into client-side code that the browser can understand.
- ASP.NET's server controls can be used to construct complex sites in a short space of time via the VWD environment, and can be added to a page either in Design View or in Source View.

- Server controls are converted (by the server) into HTML that the browser can understand, and JavaScript for dynamic client-side elements, provided the browser has JavaScript support.
- Complex functionality can be added to a web site for navigating around the pages in a site with minimal effort on the part of the developer.

The next chapter starts to look at how to personalize a site by using server controls and some neat ASP.NET functionality to log in to the web site.

Exercises

These exercises are designed to help you get more comfortable with the VWD interface. The sample code (available from `www.wrox.com`) is an end solution, but you'll obviously gain more knowledge and understanding by trying out these exercises for yourself. Answers to these exercises are in Appendix A.

1. Practice using the drag-and-drop functionality of VWD to put together a simple web page that displays the following information:
   - The WroxUnited Logo (available for free download from `www.wrox.com` — or just use any small image of your choice).
   - The names of the players and some information about each of them, arranged in a table, as shown in Figure 3-44.

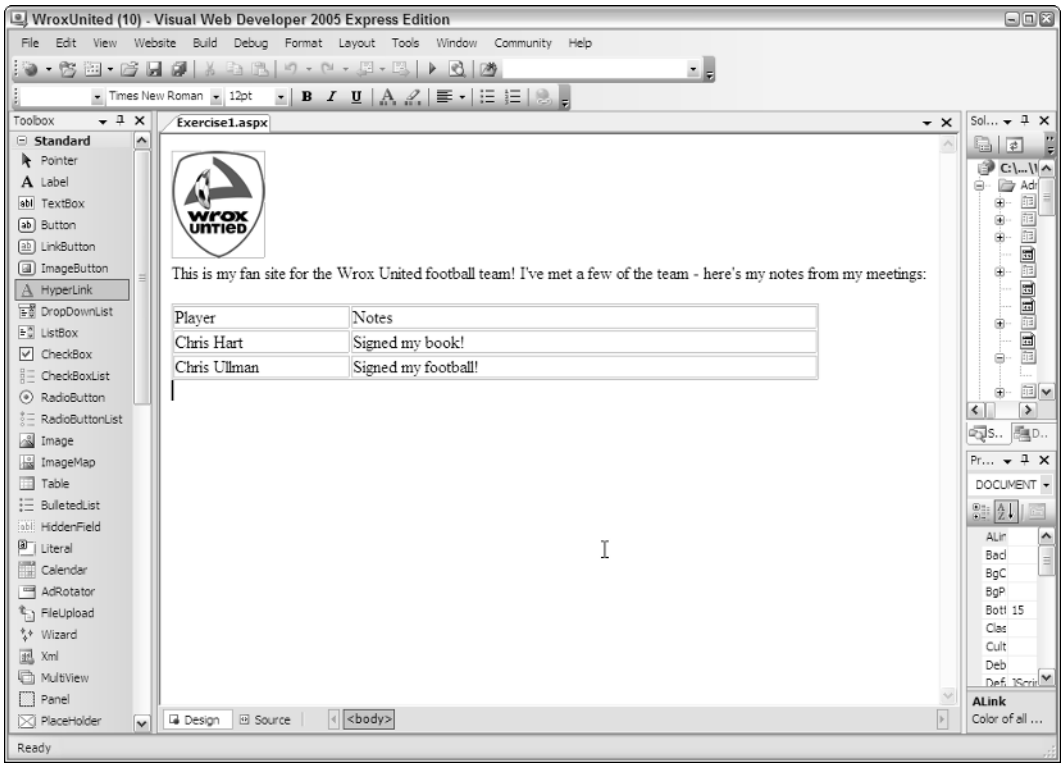


Figure 3-44

2. Head back to Wrox United and go to the Master page. Try deleting the `Menu` control and replacing it with a `TreeView` control. Bind that control to the `siteData` data source, and bingo — you should see a fully populated tree of items, both in Design View (shown in Figure 3-45) and when you run the page, as shown previously in Figure 3-43.

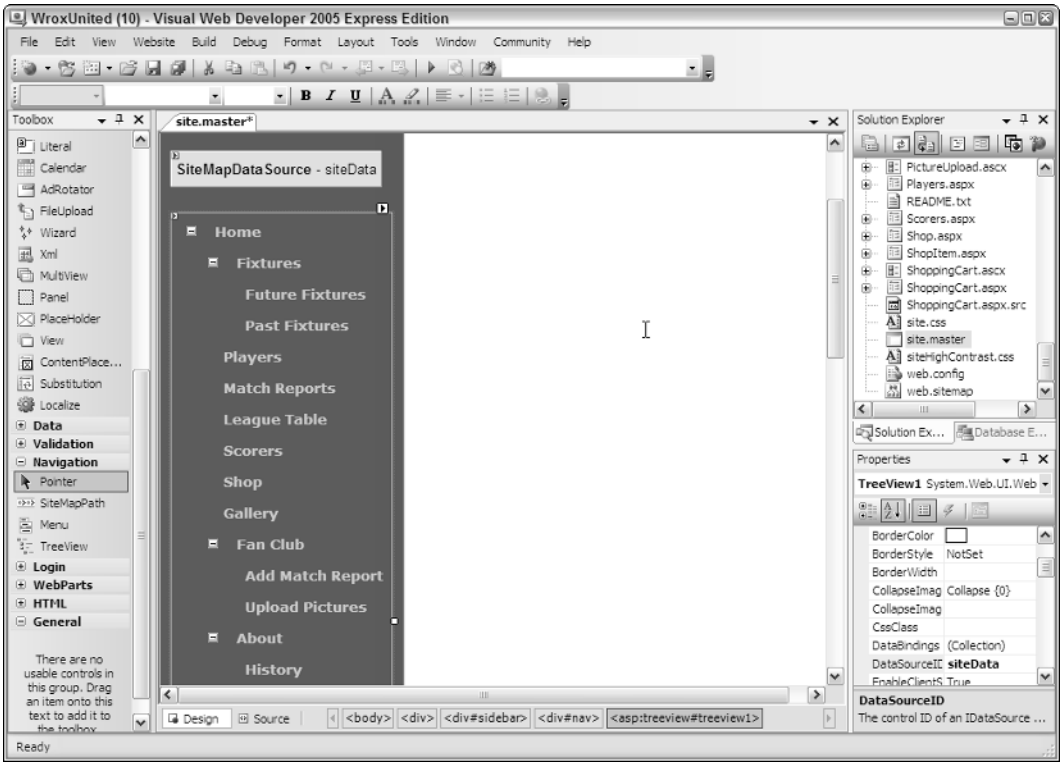


Figure 3-45

4

Membership and Identity

The concept of membership appeals to human beings on a low level, and stems from the sense of wanting to belong to a group. We want to feel part of the team, and for others to know who we are, so it was only a matter of time before the Web jumped on the bandwagon and adopted this concept as a way of life. If you sit down and consider how many web sites you have logged in to and stored a simple user profile, you may find that you're a member of many more groups than you first imagined. From sites that sell books and gadgets to community sites that discuss the merits of owning a Ford Puma, or that enthuse about a BBC TV comedy show called *Look Around You*, I know I'm a member of far too many sites to name. And then there is the familiar dilemma of "which username and password do I use to log in to this site?"

One of the most successful sites on the Web, Amazon.com, started life as a bookstore, but has evolved into something much larger. When you log in to Amazon now, you find entire pages on the site that offer only those items related to your spending habits.

In this chapter, you learn how to personalize sites using some of the membership features available to ASP.NET 2.0. This chapter discusses the following:

- The concepts of identity, authentication, and authorization
- The membership server controls, including the `Login` control
- Storing member profiles so that they can be retrieved
- Restricting access to certain areas of a site to allow only specified members
- Personalizing a site based on the active user profile

You'll also extend the Wrox United sample application so that you can log in to the site and personalize the site according to a set of stored preferences based on the membership profile.

Security Basics

You need to feel comfortable with some key important concepts before you start to put together web applications involving membership, and those are the concepts of identity, authentication, and authorization.

Identity — Who Am I?

When you think of your identity, you can use several unique features to describe yourself. For example, I am a woman with blonde hair who enjoys watching sci-fi shows and building PCs, but that's not necessarily of interest to someone who is interested in my skills on the badminton court. Identity information stored on a web site will likely be tailored to only relevant aspects of a person. For example, a shopping web site can store your name, telephone number, e-mail address, and home address, which are all facts that are relevant to the sale of goods. They may not care about your interests (unless they are as big as Amazon), so they won't need to store that sort of information about you, but that doesn't stop you from having those aspects of your identity.

So your identity, the concept of who you are, is a collection of a wide range of facts. You may even have a résumé (or CV as we Brits call it) that puts many of these facts down on paper, but these facts again are only those relevant to potential employers. It's up to you to decide which facts to store on your résumé, and which facts to leave off. The same is true when you store membership information about members on a web site in that you should choose which facts you need to know about the members of a site early on in the development process.

Authentication — This Is Who I Am

When you attempt to log in to a web site, you pass in certain credentials; for example, an e-mail address and password combination. The web site then has to determine that you are who you claim to be, so the e-mail address and password combination that you enter must match the combination stored on file on the server for the specified e-mail address.

The process of *authentication* is all about proving you are who you say you are. The e-mail and password combination is a tried and tested method adopted by many of the web sites out there offering retail or community services, and although it's not bulletproof, as long as you choose a strong enough password and don't tell it to anyone, and as long as the site is coded well, your profile will be kept unique for your use only.

Authorization — This Is What I Can Do

Once you have passed in your username and password to a web site, the web server will then not only verify that the password matches the username, but it will see what permissions you have been granted by the webmaster of that site. The next step from authentication is *authorization*, and this is the process of retrieving more information about the type of user account you may have with a site.

Take, for example, a banking web site. Once your login credentials have been verified, the server will look and see what level of access you have to the site. Like most users of a bank site, you'll be authorized to check your balances and perhaps transfer money between accounts or pay bills. If, however, the bank

was the victim of a security scare (like many *phishing* e-mails circulating around the Internet), you may find that you suddenly lack permission to add third-party standing orders to your account via the online application until the security issues have been resolved. This switching off of functionality may well be controlled by the administrators of the server by setting a special flag against either a subset of users or all users, stating that they no longer have authority to amend their account details.

Logging In to a Site

The process of logging in to a site, from a user's perspective, is a case of entering a set of credentials, then being shown a different user interface corresponding to your profile. Commonly, this will happen by username and password combination; however, more secure sites, such as banking web sites, can use other methods of logging in, including PINs and security certificates. The general principle of authentication remains the same, though, regardless of the method used to pass those authentication credentials to the server. And once you're authenticated, it's a simple matter to inquire about whether you have the required level of access for the resource you're looking for via the authentication mechanism.

ASP.NET Security

Moving beyond the theory, ASP.NET 2.0 has some great tools available to help with implementing a login-authentication-authorization framework with minimal effort. In previous editions of ASP.NET, you would have to write code to implement a login framework, to authenticate against a database, and to react to the currently logged-in user. Though you will still eventually find yourself having to write code for working with users (as you'll discover in later chapters), a lot of the pain of the initial process has been taken away with the inclusion of some great controls and wizards. In this section, you learn more about the server controls available for working with logins, and the ASP.NET Web Application Configuration utility.

Login Controls

In this section, you start the process of building up a simple mock web site with just two pages; a `Default.aspx` as the front page and a `login.aspx` page for logging in to the site. You'll work through a series of steps using Try It Out examples, and then pause along the way to look at what's going on behind the scenes. Later in this chapter, you'll take some of these principles and apply them to the Wrox United web site to integrate the login framework into that application.

This section introduces the following controls:

- The `Login` control, which provides text boxes, buttons, and built-in validation to enable you to add login functionality to a page with a single drag-and-drop operation.
- The `LoginView` control, which provides a way of altering the appearance of the page dependent on whether a user is logged in or not, or showing different content to different groups of users.
- The `LoginStatus` control, which gives a simple bit of feedback to users so that they know whether they have remembered to log in to the site.

In the following Try It Out, you put some of these controls to use. This example will build up the skeleton site by creating the pages and adding the login controls.

Try It Out Personalized Site: Web Page Design

1. Open up VWD and create a new blank web site in your `C:\BegASPNET2\Chapters\Begin` directory called `Chapter04`. By default, you should have a page called `Default.aspx` already added to the project, as shown in Figure 4-1.

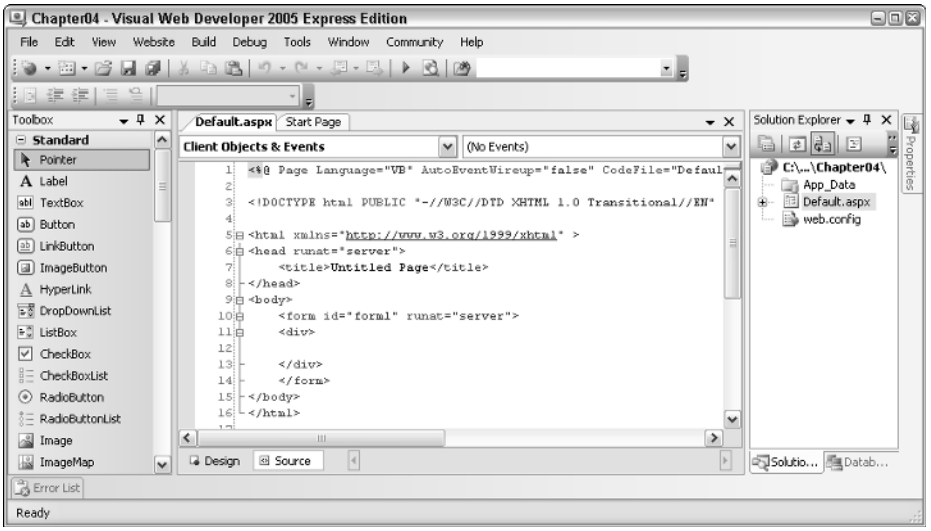


Figure 4-1

2. Time to add some controls. Switch to Design view, drag on a `LoginView` control from the Login controls section of the Toolbox (see Figure 4-2). In the Common Tasks menu that appears, ensure that Anonymous Template is selected and type **You are not logged in** in the main box.

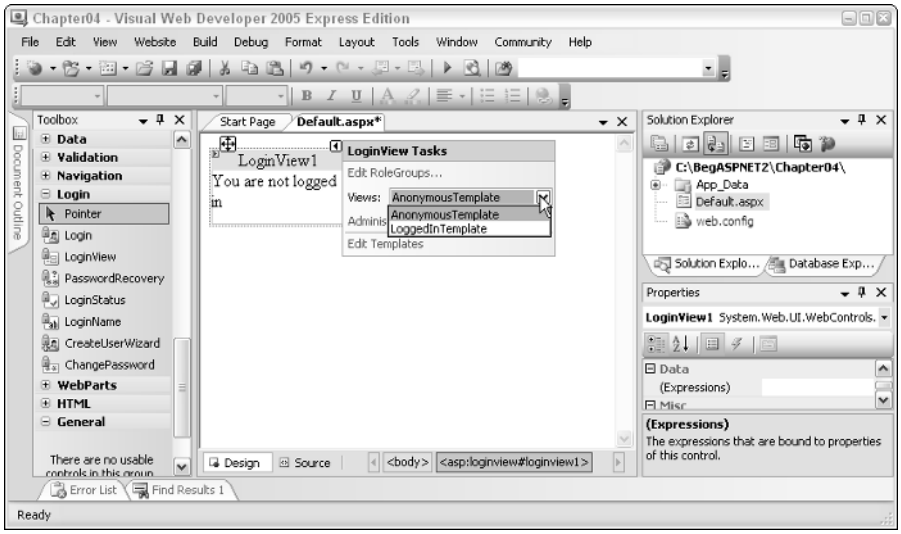


Figure 4-2

3. Pop out the Common Tasks menu again by clicking the small arrow in the top right and select LoggedInTemplate from the drop-down list, then type **You are logged in** in the box. This will ensure that the page will tell you when you're logged in or not.

4. Drag a `LoginStatus` control onto the page underneath the `LoginView` control, as shown in Figure 4-3. This control will give you a hyperlink to either log in or log out, depending on whether or not you're currently logged in.

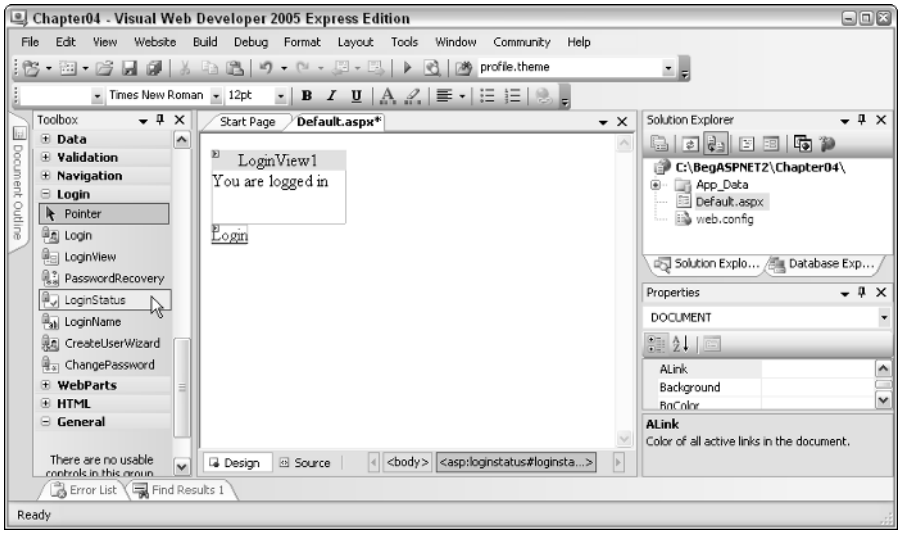


Figure 4-3

5. The next step is to create a login page, so right-click the root of the web site in the Solution Explorer and select Add New Item. In the dialog that appears, depicted in Figure 4-4, select Web Form and call it `Login.aspx`.

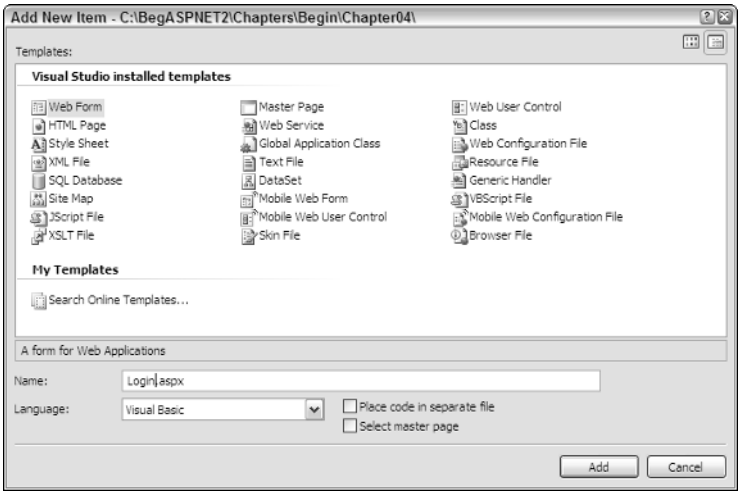


Figure 4-4

6. In the newly created page, drag a `Login` control onto the page from the Login section of the Toolbox, as shown in Figure 4-5.

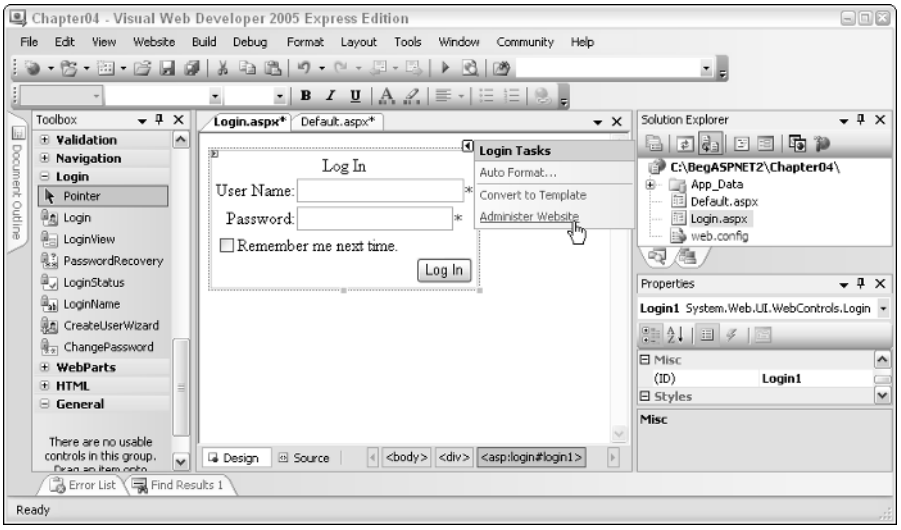


Figure 4-5

7. In the flyout that appears, you have the option of administering the web site. At this stage, you have the framework ready to roll, but you'll need to configure the site by adding some user accounts before the site will work, so click the Administer Website link in the flyout to launch the ASP.NET Web Application Configuration Tool, which is covered in the next Try It Out example.

How It Works

These controls are really quite powerful, and although you're not quite at the stage of running the example, you can feel confident that you're only a few steps away from having a fully functional (if a little simplistic) application for trying out login functionality. These controls are a new addition to this edition of ASP.NET; previously, you would have had to add text boxes, buttons, and write lines of VB.NET or C# code to handle the login process, to display messages relating to whether or not you are logged on, and to change the view of the page depending on the current user. At this stage, all you've had to do is drag and drop a couple of controls onto a page, and you'll be pleased to know that this is all you need to do to get the framework of an application together.

So, first take a look at the controls that were added to the pages, starting with the `Default.aspx` page.

Viewing the source on `Default.aspx` will display the following code:

```
<asp:LoginView ID="LoginView1" Runat="server">
  <LoggedInTemplate>
    You are logged in
  </LoggedInTemplate>
  <AnonymousTemplate>
    You are not logged in.
  </AnonymousTemplate>
</asp:LoginView>
<asp:LoginStatus ID="LoginStatus1" Runat="server" />
```

You can see that two controls are defined in the code: a `LoginView` control for displaying login information and a `LoginStatus` control that can be used to control the login and logout processes. Note that if you configured your site as in this example, you will not see the anonymous template message because anonymous users are denied access to the site (and are redirected straight to the login page).

In the `Login.aspx` page, you will see the following code has been added:

```
<asp:Login ID="Login1" Runat="server">
</asp:Login>
```

Barely any code at all! Everything has been pre-written, so you don't see any text boxes, you don't see any validation code — you just see a single line of code. ASP.NET 2.0 has tools available so that you can actually create complex controls like this yourself, but that's a bit beyond this chapter.

Try It Out — Personalized Site: User Account Configuration

Once you click the administration link in Step 7 of the previous Try It Out, the web page shown in Figure 4-6 will be displayed (note that the port number used will be different whenever you launch this for the first time).

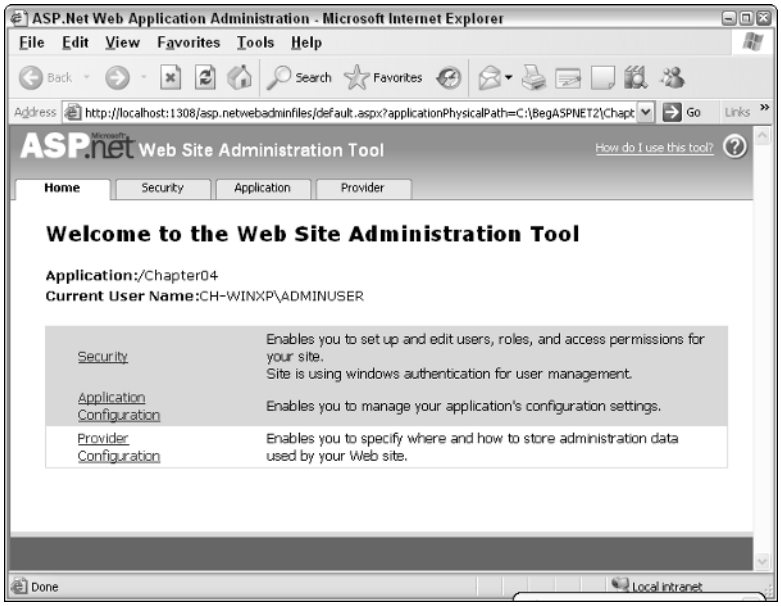


Figure 4-6

1. Click the Security link to take you to the Security settings administration tab, shown in Figure 4-7.

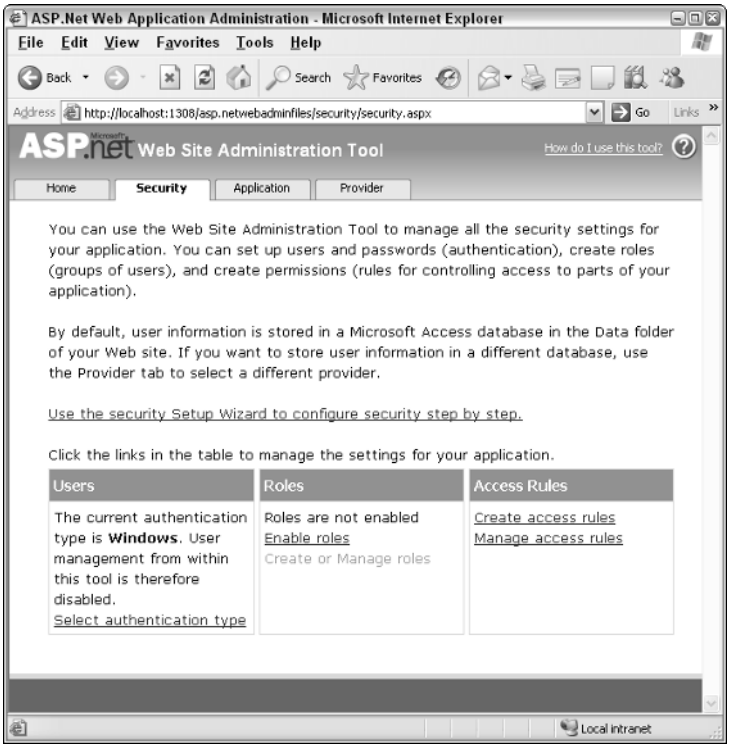


Figure 4-7

2. In this page you will see a hyperlink that enables you to launch the Security Setup Wizard. Click this link to proceed to the first stage in the wizard, as depicted in Figure 4-8.

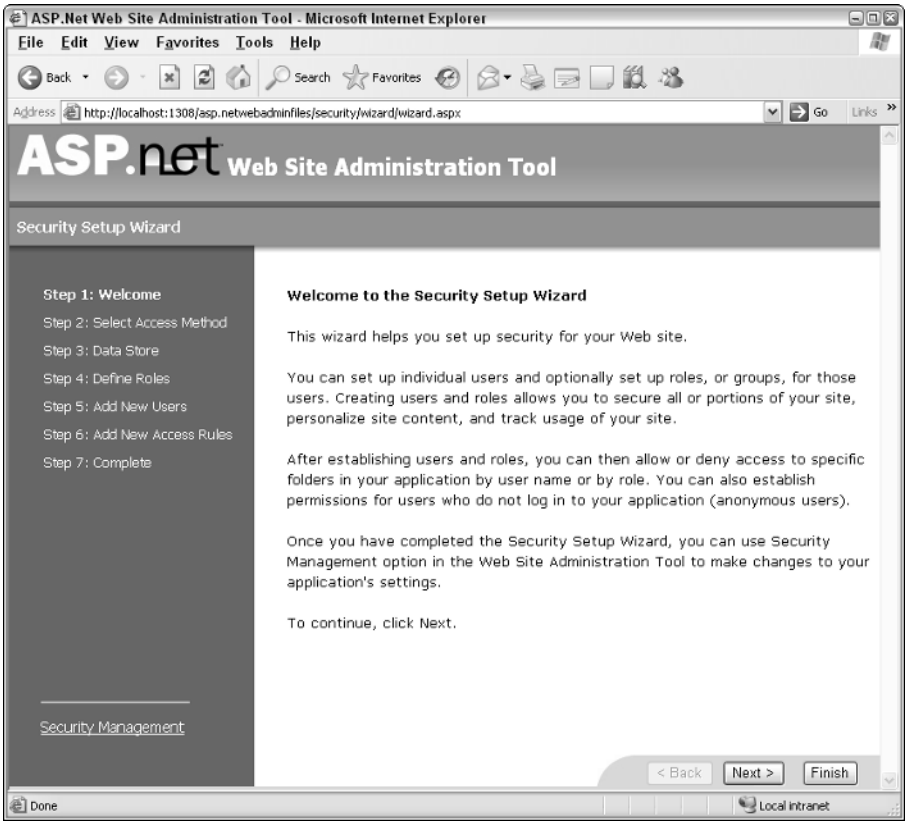


Figure 4-8

3. Click Next to skip past the first page, and you'll arrive at the screen shown in Figure 4-9. Select the From the Internet radio button to enable both anonymous users and users who have to log in via the Web.

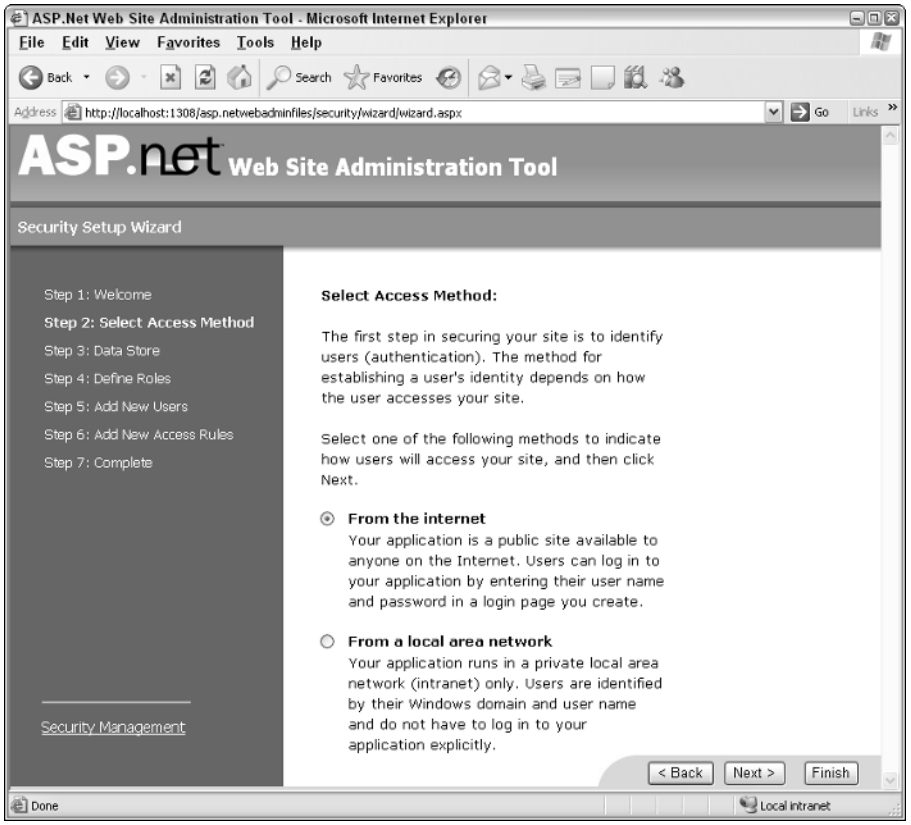


Figure 4-9

Click Next to continue to the next screen, displayed in Figure 4-10.

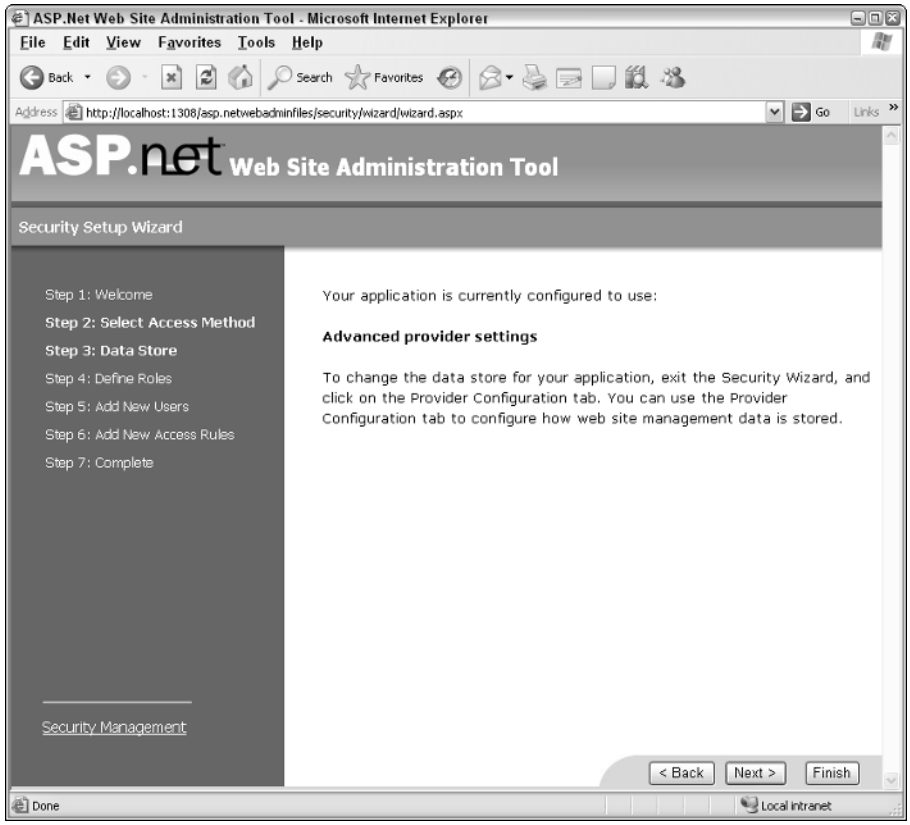


Figure 4-10

You can skip straight past this step and click Next to continue — the default provider will enable all of the required functionality without additional work. In the next screen, you are asked if you want to define any roles for the web site. In this example, you can skip this step — you will be defining roles later in this chapter. Keep the checkbox unchecked and click Next.

4. When you reach the next screen, shown in Figure 4-11, you will be prompted to enter some details for a user.

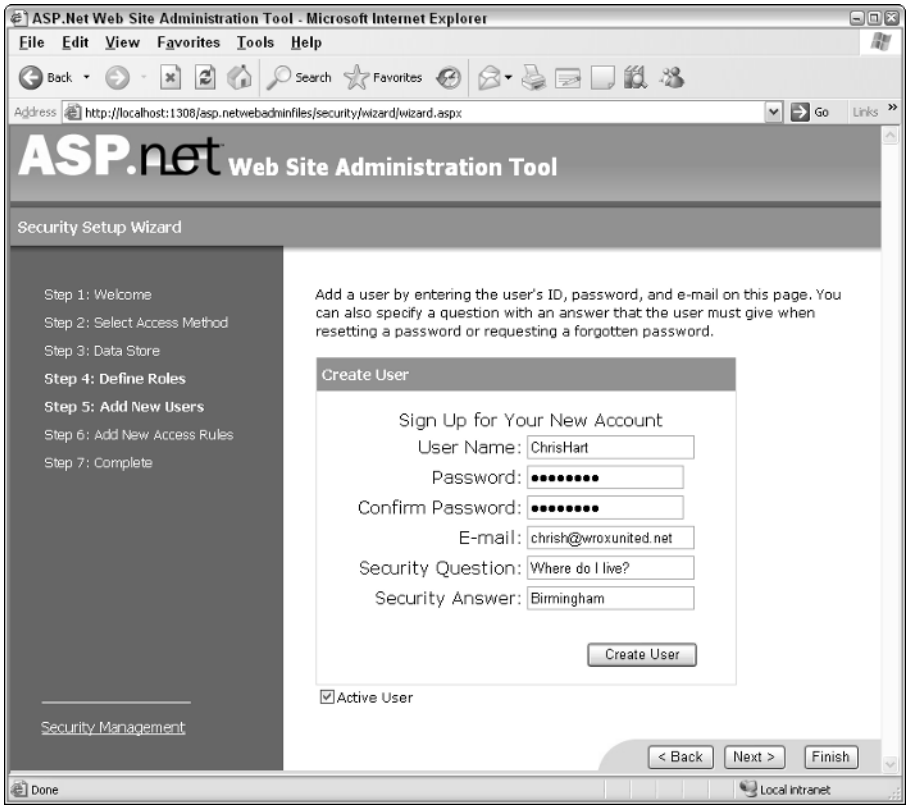


Figure 4-11

5. As shown in Figure 4-12, enter some details for a user of the site — these could be your name, my name, anyone's name! Just make sure you don't forget the password you enter — you'll need this later on. Clicking the Create User button shows a confirmation prompt, at which point you can click Continue to create another user. At this stage, you should create two users — one standard user and one that you'll use later as the administrator of the site.

   Later, you'll be able to give these users appropriate access permissions for the site. Note that you don't get the option to make these users members of any roles at this stage — this is done later in the setup process. Click Next to continue.

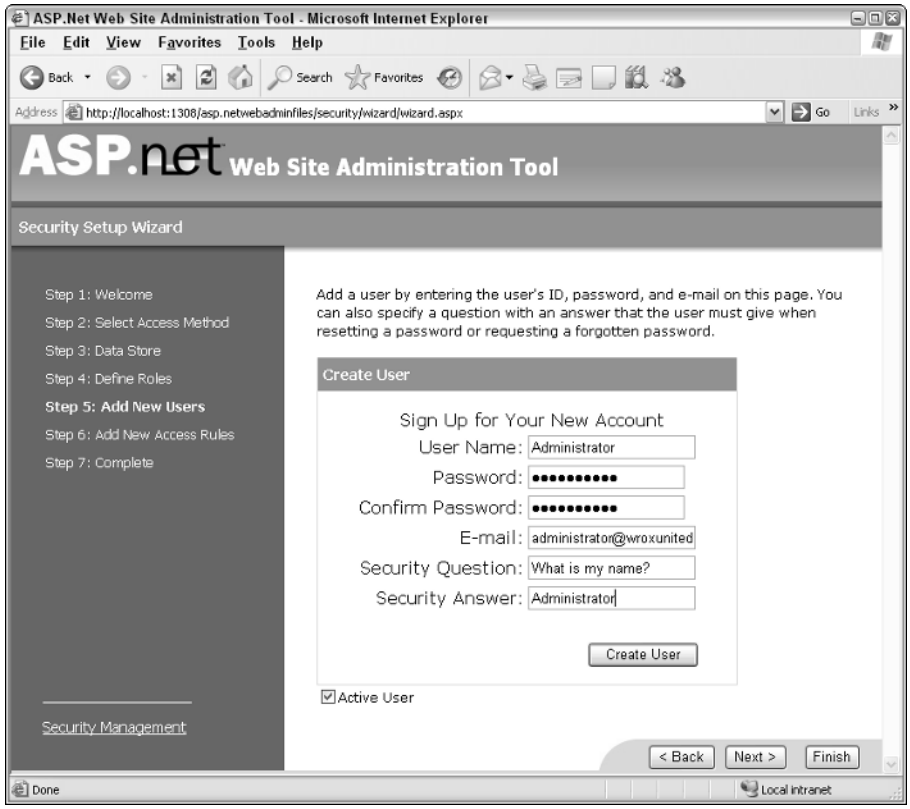


Figure 4-12

6. The next step is to define the accessibility levels for the site, defining who is able to see the content of the site, and who is denied access. At this stage, you can add permissions to users directly. Later on, you will add those users to groups and assign rights and permissions to entire groups of people. As illustrated in Figure 4-13, you need to grant the Allow permission to each user individually, and deny access to all anonymous users. To set permissions for a user, select the User radio button, enter the username in the box next to the radio button, select Allow, and click Add This Rule. To deny access to anonymous users, select the Anonymous Users radio button, click Deny in the Permission section, and click Add This Rule.

   Once you click Next, you should see that you have completed the wizard, which means that you should now have a web site with some user profiles and some access rights restrictions. All that remains is to try out the pages!

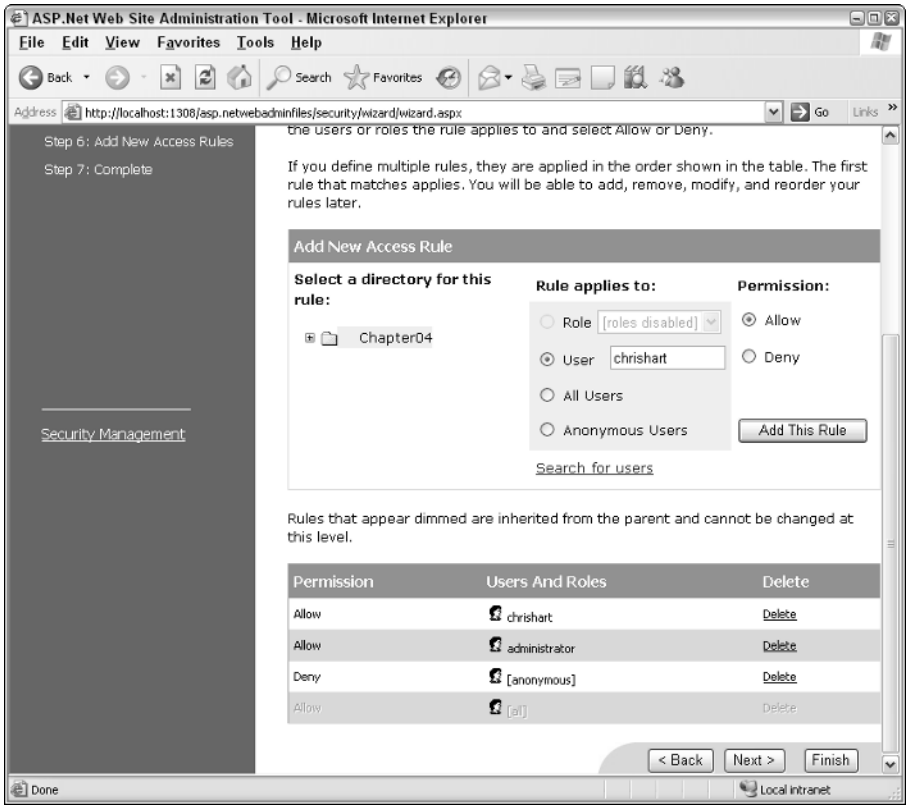


Figure 4-13

7. Back in VWD, press Ctrl+F5 to run the `Default.aspx` page — you should see the screen shown in Figure 4-14.

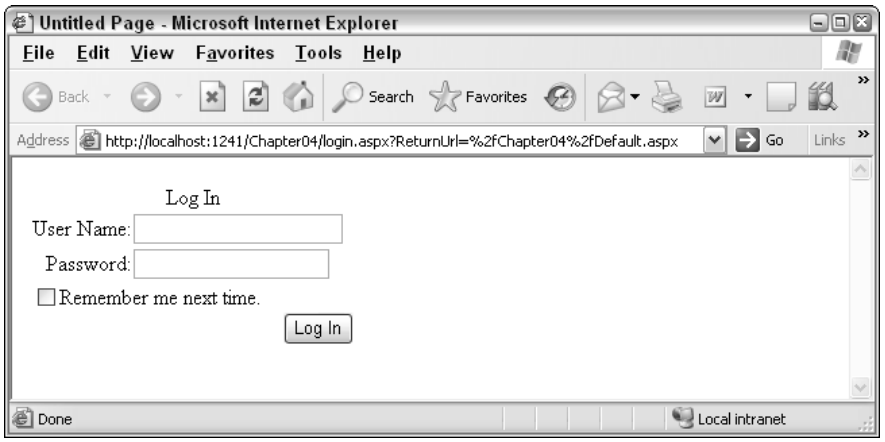


Figure 4-14

Because anonymous access is denied for the site, you are immediately taken to the login page. Notice that the address of the page indicates that your intention was to view the `Default.aspx` page.

8. Before you log in, try entering some invalid credentials (a username and password that don't exist, but not a blank password). You should see the message shown in Figure 4-15.

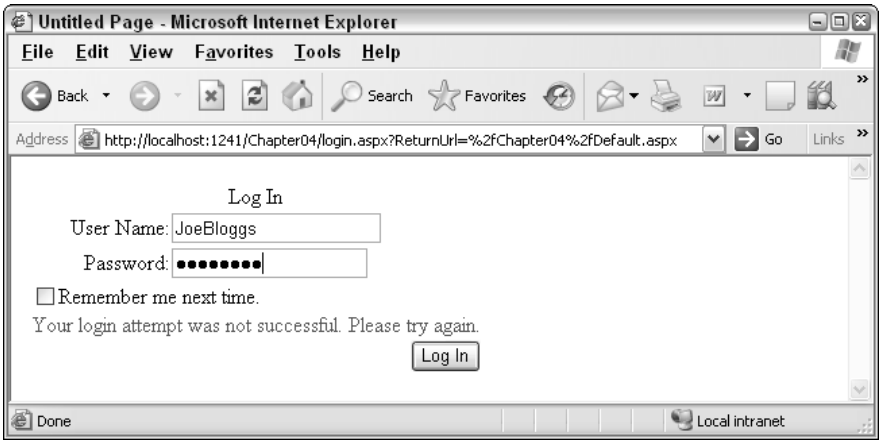


Figure 4-15

9. Now try to log in as one of the user accounts available to the site; you will automatically be taken back to the `Default.aspx` page, as illustrated in Figure 4-16.

Figure 4-16

Clicking the Logout link will take you back to the `Login.aspx` page—the site will not let anyone view pages without being logged in first.

How It Works

The `Login` controls available to ASP.NET pages are a real gift from the Microsoft teams. I've lost count of the number of sites I've worked on that had custom login functionality, all coded by hand, and now all I have to do is drag a few controls onto a page. On top of that, the wizards available for configuring user accounts and permissions make it even easier to get results up and running quickly. You may prefer to use your own user account data store, or even to link in to Active Directory user accounts, but this can be changed later in your development process.

This Try It Out simply walked you through the process of configuring user accounts. Though that is a necessary process, the Website Administration Tool is more interesting in what it creates behind the scenes. First, the user account profiles that were created have to be stored in some central repository, so the tool creates a new profile database for you for this purpose. Take a look at the Chapter04 folder in your `C:\BegASPNET2\Chapters\Begin\Chapter04` directory and you should see a folder called `App_Data`. Right-click and select Refresh Folder, and you should see a file called `AspNetDB.mdf`. This is a Microsoft SQL database file, and you can view the structure and contents of the database tables within the VWD environment, as shown in Figure 4-17 (you'll learn more about this process when you get to the database chapters).

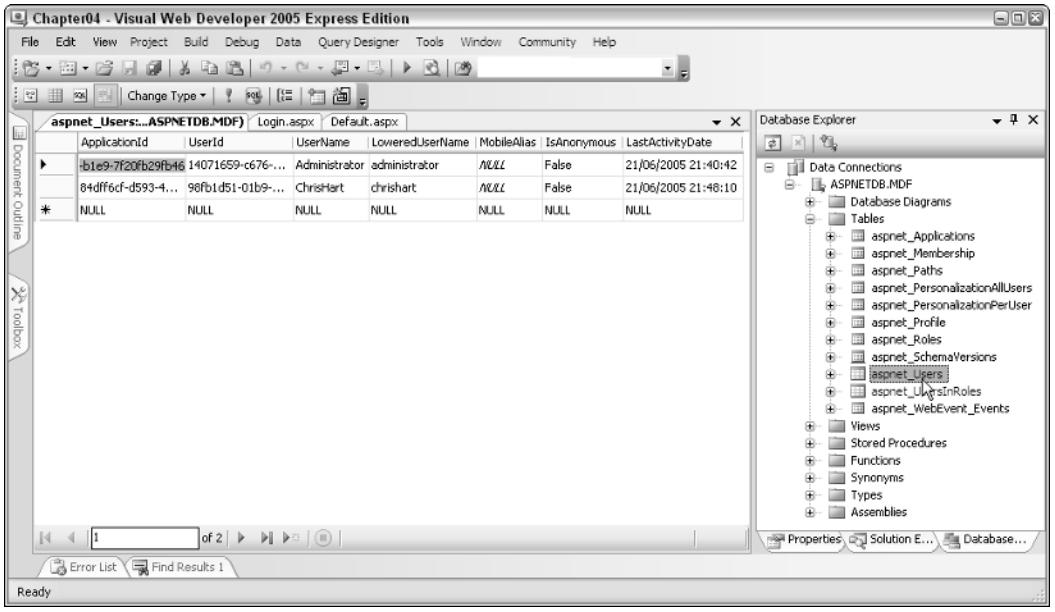


Figure 4-17

The other part of the configuration was to assign some permissions to user accounts for accessing the site. By running the wizard, you're able to run through this process quite easily. Once the wizard is finished, you have a new file in your solution called `Web.config` (the configuration file that stores preferences related to the way the application runs on your server — see Chapter 2 for more details). If you look in the `Web.config` file stored in your Chapter04 folder, you will see the statements shown in Figure 4-18.

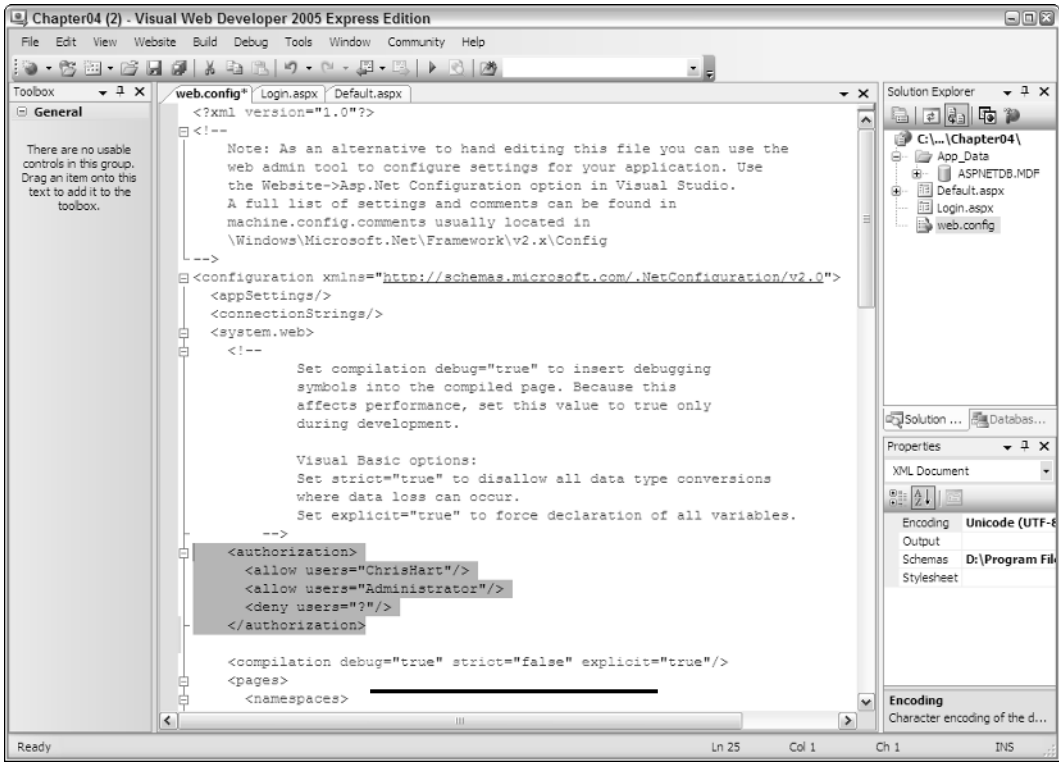


Figure 4-18

Notice that the `<allow . . . />` and `<deny . . . />` parts of the configuration file reflect the permissions that were set as part of the example. You can add and modify these statements yourself directly in the `Web.config` file by typing them in, or you can use the Administration Tool to streamline the process, whichever you prefer.

It's worth a quick note to say that the `LoginView` control can do much more than display specific text to users depending on whether or not they're logged in. In Chapter 11, you'll see that this control can be used to change the appearance of a page entirely based on not just user identity, but also on roles. This control can contain text, HTML, or even other controls. The next Try It Out shows an example of this in action.

Personalization

The capability to personalize a site to reflect the preferences of the currently logged-in user is a great way to give a site a sense of community and belonging. Although you won't be doing too much personalization in this site, the next chapter explores some of the features available to ASP.NET developers to give users a more personalized user interface and browsing experience.

A useful addition to any personalized site is to provide some kind of feedback to logged-in users to confirm that they have been correctly identified. The `LoginName` control is a simple way to add this functionality. In this Try It Out, you learn how this control is used. For this example, you will need to enable anonymous access.

Try It Out — Displaying User-Specific Information

1. You can choose which way you want to enable anonymous access — you can either edit the `Web.config` file (refer to the previous "How It Works") or you can launch the Web Site Administration Tool. To relaunch the tool, right-click the administration site icon in your system tray and select Open in Web Browser. Alternatively, to modify the `Web.config` file, simply open it up in VWD and change the following highlighted line of code:

```
<authorization>
  <allow users="?" />
  <allow users="administrator" />
  <allow users="chrishart" />
</authorization>
```

   The question mark represents all unknown (anonymous) users, so by changing `deny` to `allow`, you can enable anonymous access.

2. Next you need to make a slight change to the web page code to add the `LoginName` control. Open up `Default.aspx` and pop out the Common Task menu next to the `LoginView` control (click the small right-hand arrow next to the control and select the `LoggedInTemplate`, as shown in Figure 4-19). Change the text to **You are logged in as**, and then drag a `LoginName` control to the end of the text.

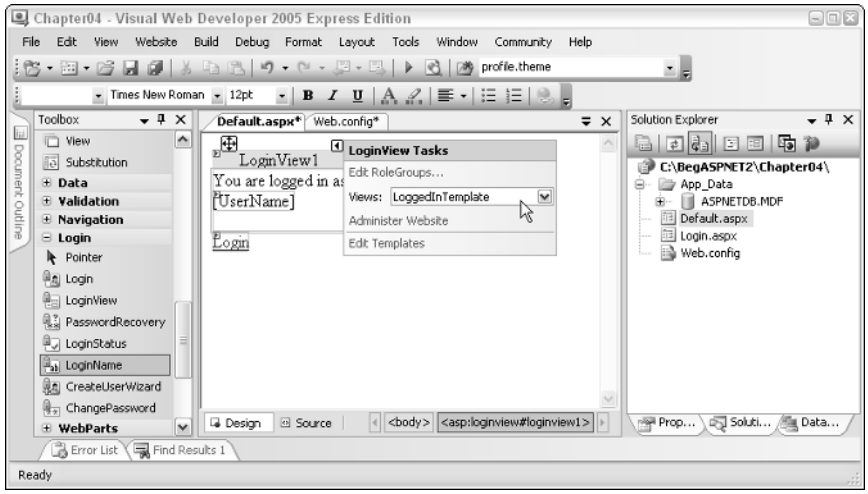


Figure 4-19

3. There is no need to make any amendments to the `LoginName` control once it's been added to the page, so all that remains is to save your changes and run the page. The first thing you should see is the anonymous user's perspective on the site, shown in Figure 4-20.

Figure 4-20

Now click the Login link and log in to the site. Once logged in, you should see something similar to Figure 4-21, depending on which user account you used.

Figure 4-21

How It Works

The `LoginName` control is a quick an easy way to display a user's currently logged-in identity on a site. If you switch to Source View for the page, you can see the `LoginName` control, shown here with a gray background:

```
<LoggedInTemplate>
  You are logged in as
  <asp:LoginName ID="LoginName1" runat="server" />
  <br />
</LoggedInTemplate>
```

Some HTML code has been added to my code; because I pressed Return after the `LoginName` control (so that the `LoginStatus` control would appear on the next line), there's a `<br />` HTML tag in the code. This is the HTML code for a simple line break. You'll often find tags like this, added to your code after switching from Design View to Source View. The two most common are the ` ` character, which is a non-breaking space (a space character that keeps the items immediately before and after it on the same

line), and the <br />, which is a simple line break. The bit of code that is most relevant in this case is not the HTML, but the LoginName's source. Again, there's hardly anything exciting to see in the generated source, because ASP.NET does all the hard work of finding out what the currently logged-in user's name is behind the scenes, and inserts it when the page is rendered.

Note that the LoginName control was not added to the Anonymous template, but then there's no reason to do so — if you view the site as an anonymous user, the control will not display anything when it is rendered.

So you've spent a while experimenting with user accounts and logging in to the site. Earlier in the chapter, the concept of roles was discussed. The following section takes a look at what roles are and how they are used to refine the membership characteristics of a site.

Membership

Defining which users can access a site is a perfectly viable way to build a small site, but it would have to be very small and remain small to be a manageable solution. A far better solution would be to define a set of user roles, and add user accounts to the appropriate roles. Once users are members of a role, you can assign permissions based on a role.

For example, consider a typical site configuration scenario: all the members of an Administrators role can access the site, and can access all areas of the site. All members of a Users role can access the site, but cannot access certain restricted areas. All anonymous users will see a cut-down version of the site, but without any personalization, and certainly without any permissions for visiting restricted areas of a site.

Chapter 11 examines roles in more detail, including refining the Wrox United site to make good use of roles. In the meantime, you can experience roles for yourself in the next Try It Out, because the Chapter04 example site is extended to include roles. In this example you will be defining two roles: Users and Administrators. These roles have to be created before you can add users to the roles.

Try It Out — Adding Users to Roles

1. Start off by launching the Web Site Administration Tool once more. If you have been running the tool recently, you can right-click the icon in your system tray for the administration site and select Open in Web Browser. Or, as an alternative, you can click Website ➪ ASP.NET Configuration from the main VWD menu bar. Once the tool is up and running, select the Security tab and click the Enable Roles link, as shown in Figure 4-22.

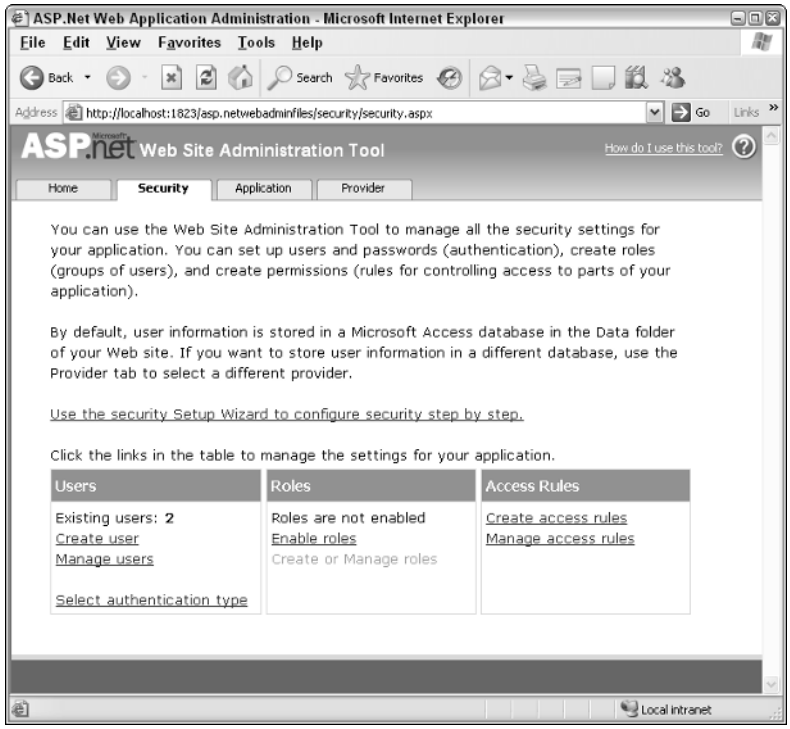


Figure 4-22

2. The Create or Manage Roles link should then be enabled, so click it to enter the Create New Role screen. In here, you need to create the two roles; users and administrators, by entering a role name in the text box and clicking Add Role (see Figure 4-23).

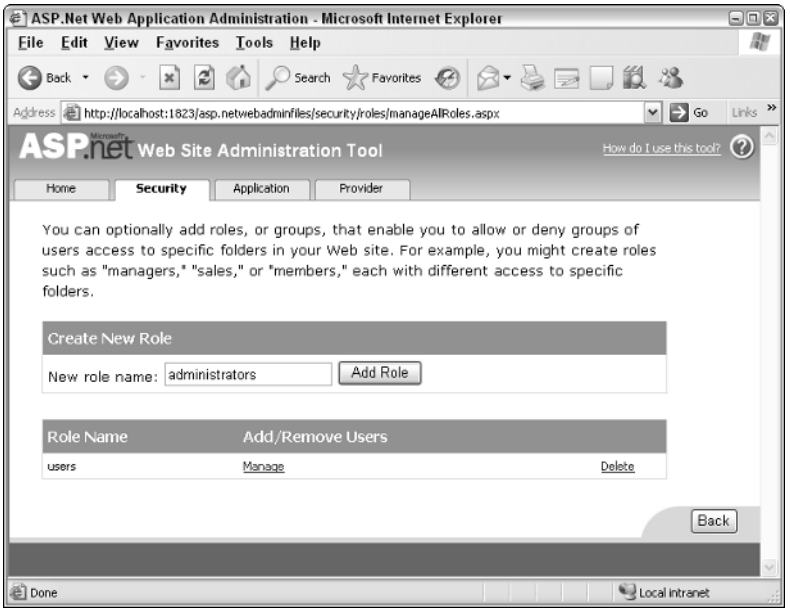


Figure 4-23

3. Click the Manage link for the Administrators group, then search for the Administrator user account, using the search tools shown in Figure 4-24. The easiest way to find the Administrator account is to search for all accounts beginning with the letter A, so type `a*` in the text box and click Find User. Add the Administrator account to the Administrators role simply by checking the User Is In Role checkbox.

4. Add the remaining user accounts to the Users role in the same way.

5. Click the Security tab to return to the main Security section of the administration tool. Once there, click the Manage access rules link to return to managing the access rules for the site. In the same interface as you used in the earlier example for managing access rules (see Figure 4-13), remove the access rules for the individual user accounts, and instead grant access to the site to both the administrators and users groups. As you delete rules, you'll be prompted as in Figure 4-25.

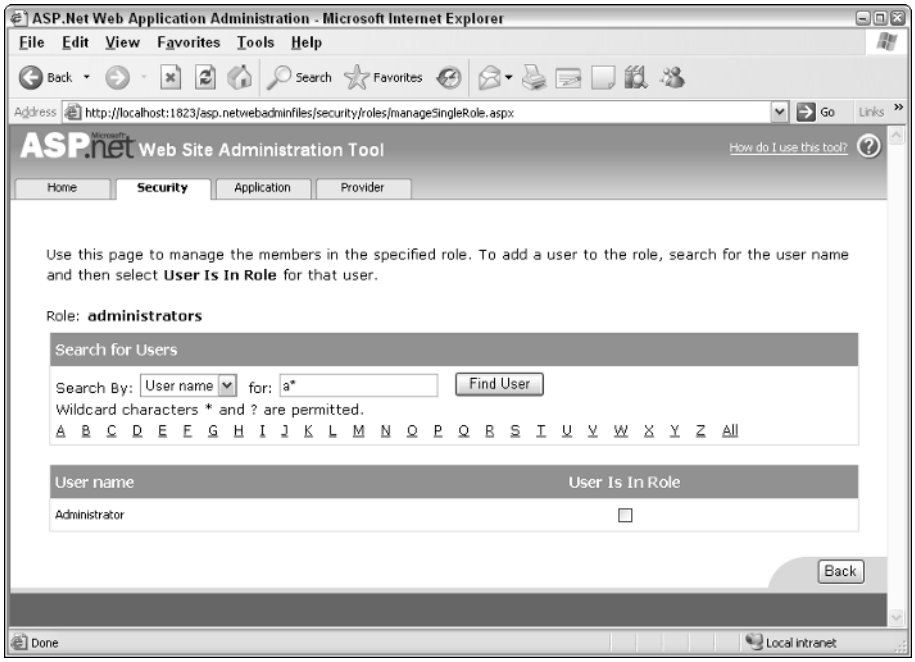


Figure 4-24

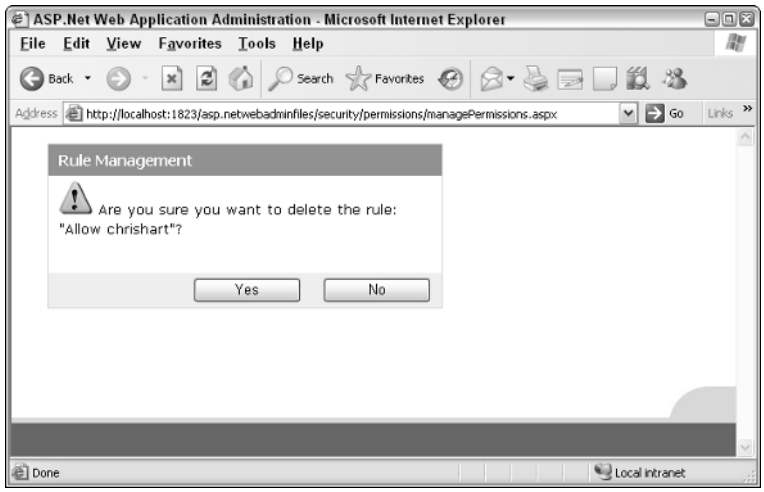


Figure 4-25

You can then add the new permissions on a role-by-role basis with the interface shown in Figure 4-26.

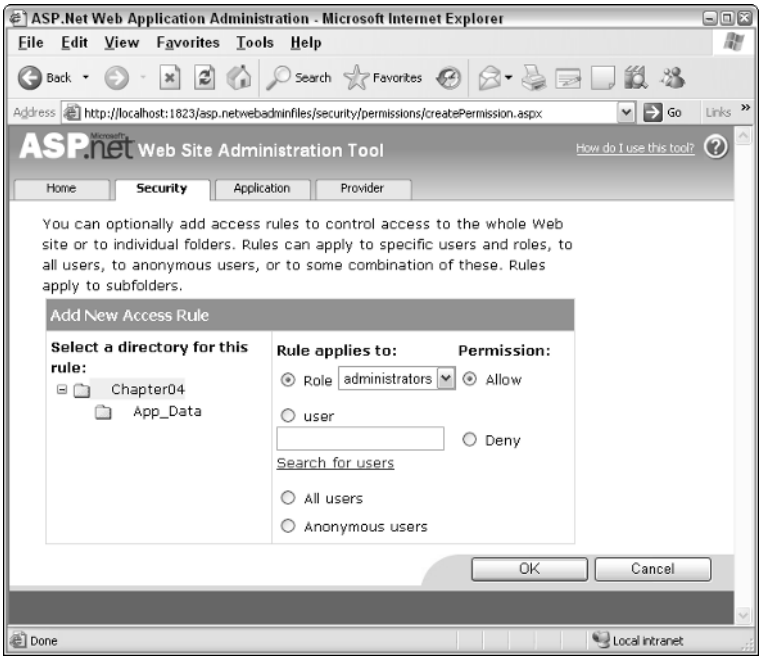


Figure 4-26

Once you have added the rules, you should see the list of rules shown in Figure 4-27.

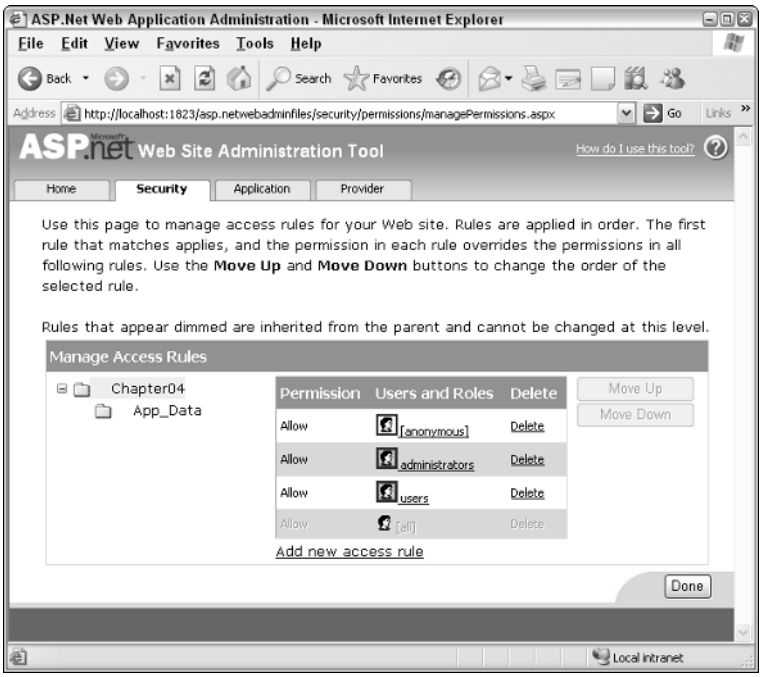


Figure 4-27

6. If you run the application again now, you should be able to log in as any of the user accounts and access the site as before. If you change the permissions for one of the roles, all members of that role will be affected, hence you could block access to all non-administrative users if you wanted.

How It Works

All of the changes made in this example were performed via the magic Web Site Administration interface, which simplifies the process of adding role definitions and access rules. If you were to do this by hand, as you will see in just a moment, you would have to manipulate the contents of the Roles table in the `AspNetDB.mdf` database that was shown earlier to include two role definitions, and then add users to those roles by changing the UsersInRoles table by hand. Then you would have to manipulate the `Web.config` file to change the access permissions to the site.

This configuration process was all handled for you automatically by the tool, so it's made configuration and administration quite a lot simpler! However, this is a Visual Web Developer and Visual Studio 2005 feature, not an ASP.NET feature, so you would have to do this by hand if you didn't have access to the VWD environment.

If you flick back to the Source View of your `Web.config` file, you'll see the following changes have been made (shown with a gray background):

```
            <roleManager enabled="true" />
            <authorization>
                <allow users="?" />
                <allow roles="administrators" />
                <allow roles="users" />
            </authorization>
```

In addition, the process of enabling roles has modified the user profile database slightly too, by adding two new tables: one to store roles and one that tells you which users are members of which roles (see Figure 4-28).

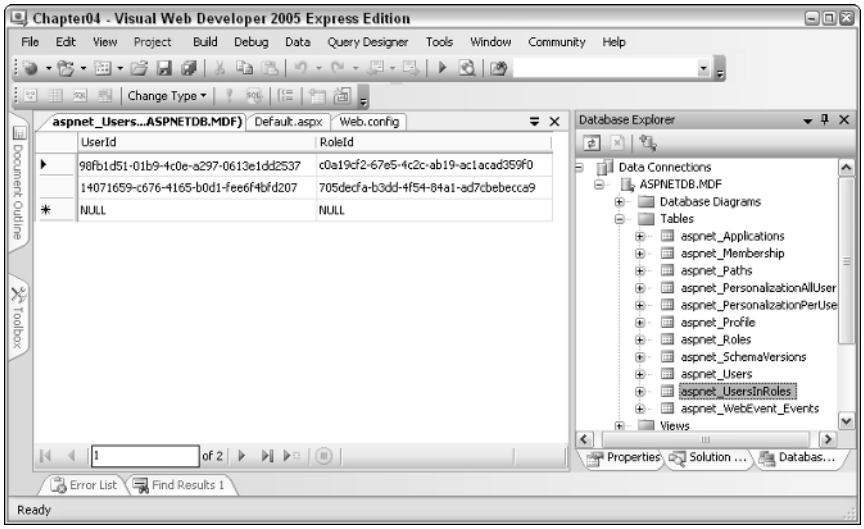


Figure 4-28

Authentication

One area not yet discussed is that of how the authentication works for this application, and what options are available in ASP.NET for authentication. The examples so far have all relied on what's known as Forms authentication. So, what is Forms authentication, and what are the other options available?

- **Forms authentication:** Login requests are made by filling in a form on a web page and submitting that form to the server. Once the server receives the request, a cookie is written to the user's local machine, and this cookie is passed back to the server by the browser along with each request that is sent so that the user remains authenticated for as long as is required.
- **Windows authentication:** Login pages pass user credentials to a web server (IIS only, not the web server built into VWD). The web server then handles the authentication using whichever method is configured on the virtual directory that the application is running within. IIS hooks in to the Windows operating system and Active Directory domain structures, which means that it can rely on user profiles that are stored externally, and use standard Windows credentials to log in to the site. Depending on the configuration of your site, and depending on which user account you have used to log in to your machine, you may not even have to log in to the site directly, because your current Windows credentials can be passed to the web server automatically for authentication. This is really handy when it comes to developing intranet applications.
- **Passport authentication:** Login credentials are passed to a Microsoft Passport server where user profiles are stored centrally. You may be familiar with this from logging in to a Hotmail account. And because you can configure Windows to log on to a Passport account on start up, you can access your Hotmail inbox without even having to type a password.

Forms Authentication Model

This section looks at how Forms authentication works. Consider the following scenario:

- The user — let's call him Bob — wants to view Page A, which can't be accessed by anonymous users, so when Bob tries to view Page A, the browser instead displays a login page, as shown in Figure 4-29.

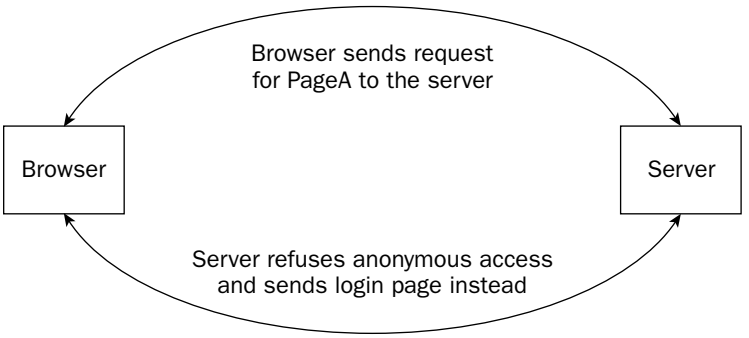


Figure 4-29

- Bob is now looking at a login page. Because Bob has registered with this site previously, he logs in to the site using his username and password combination. Figure 4-30 shows the interaction between Bob's browser and the server.

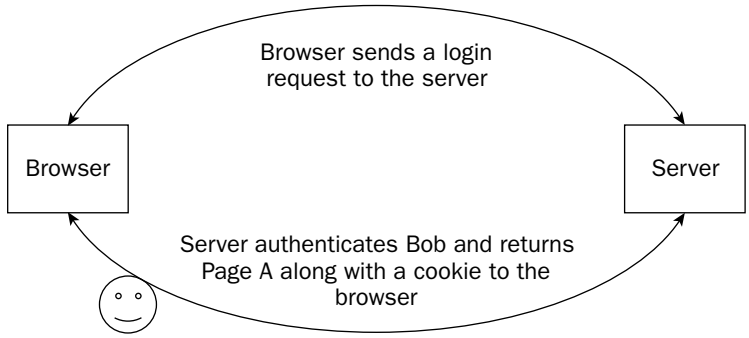


Figure 4-30

- Bob can now view Page A and is a happy user. Now Bob wants to view Page B by following a link from Page A. Along with the request for the page, Bob's browser sends a copy of the cookie to the server to let the server know that it's Bob who's trying to view the page. The server knows who Bob is, and likes Bob, so sends Bob Page B as requested, as shown in Figure 4-31.

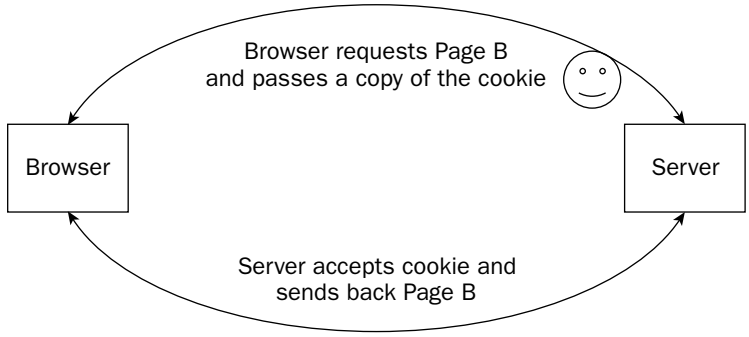


Figure 4-31

- If Bob now requests the site's home page, the browser will still tack on the cookie to the request, so even though the home page is not restricted content, the cookie is still sent to the server. Because the page isn't restricted, the server doesn't worry about the cookie, ignores it, and sends back the home page.
- Bob then heads back to Page A. Because the cookie is still fresh on Bob's machine, the cookie is still sent to the server. The server is still happy with Bob, so it lets Bob view the page.
- Bob goes off and makes himself a coffee. He then makes some lunch. By the time he gets back to his computer, 25 minutes have elapsed. Bob now wants to view Page B again, but the cookie on his machine has expired. The server doesn't receive a cookie along with the page request, so Bob has to log back in again.

Cookies on a user's machine will normally be set to expire after a specific amount of time has elapsed. In this scenario, the server gives out cookies with a 20-minute expiry, which means that as long as the user keeps making requests within 20 minutes of each other, the cookie will remain active. However, more than 20 minutes away from the site and the user will have to log back in to the site to view restricted content.

You will note that the login page built in the earlier examples included a box that offered you the "remember my details for next time" option. This will write a more permanent cookie to your browser's cookie collection so that your account name will be prepopulated when you revisit the site. Because you should never store password information in a cookie, you should always have to enter your password, but at least your username field will be filled in for you on each visit.

Other methods of authentication (Windows and Passport) provide the end user with a similar experience. For example, the Windows authentication model relies on the web server (which will likely be IIS) to control access to the site, but can also incorporate the timeout mechanism to block users that have been idle for too long. To configure Windows authentication, you would need to specify which users or roles from the corporate Active Directory (AD) domain could access a site. These users could then access the site whenever they are logged on using their login details to a PC on the corporate network.

It's also possible to view a Windows authenticated site from outside of the corporate environment, though you will be asked to enter your standard Windows logon credentials when you attempt to access a page protected by Windows authentication.

Passport authentication isn't as widely adopted as Microsoft perhaps would have liked, but some sites on the Internet do link up to the Passport network to handle web site authentication (for example, Expedia.com). Passport authentication relies on the entire repository of user accounts being accessible from anywhere in the wired world, a bit like a central Active Directory for web accounts.

This book uses Forms authentication to handle all authentication with the Wrox United application.

Wrox United Security

The Wrox United site that you've been working on so far will need to have some security applied to it if you want to be able to include some personalization in the site. In the finished site (`www.wroxunited.net`) you'll see that there is shopping cart functionality built in to the site. Additionally, the finished site will also have an administration area, where you can edit fixtures, team members, and much more. This all means that you're going to have to add some users and roles at some stage—because you will have gained plenty of experience of using the configuration tool, you will now be able to perform the first stage in this process. The next Try It Out walks you through the user accounts and roles configuration for the Wrox United site. At this stage, you don't have to worry about locking down parts of the site; that's a task for later in the book.

Try It Out — Configuring Security in the Wrox United Site

1. Start by opening your chapter version of the Wrox United site in VWD. Once it's opened, click the Website menu and select ASP.NET Configuration. This will launch the configuration tool for the site. Figure 4-32 shows the configuration screen that is displayed for the finished version of the site.

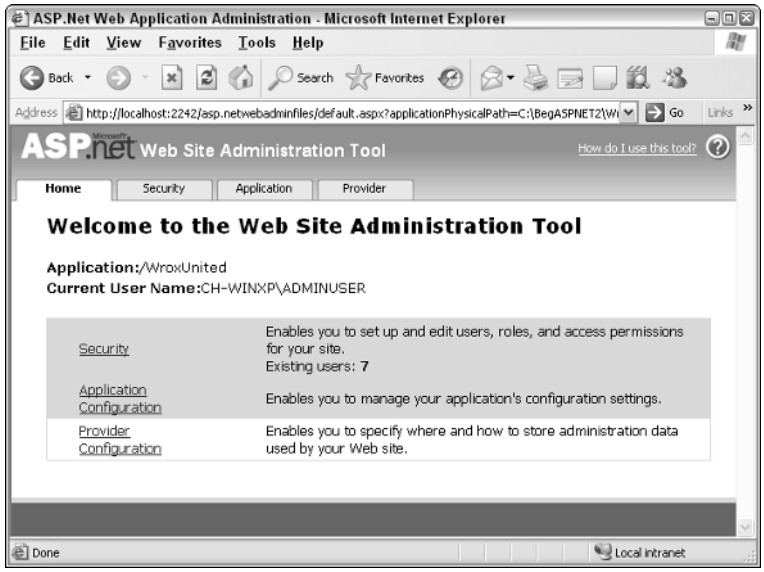


Figure 4-32

2. Click the Security link to go into the section where you can configure users and roles. As you did previously in this chapter, launch the security setup wizard. As you walk through the wizard, select the following:

   - ❑ The application will be used over the Internet.
   - ❑ Roles are enabled.
   - ❑ If they don't yet exist, create roles for Administrator, FanClubMember, Manager, Owner, and Reporter (see Figure 4-33).
   - ❑ Finally, create some user accounts — start with at least five so you can have at least one user in each role. The user accounts predefined with the Wrox United application are shown in Figure 4-34.

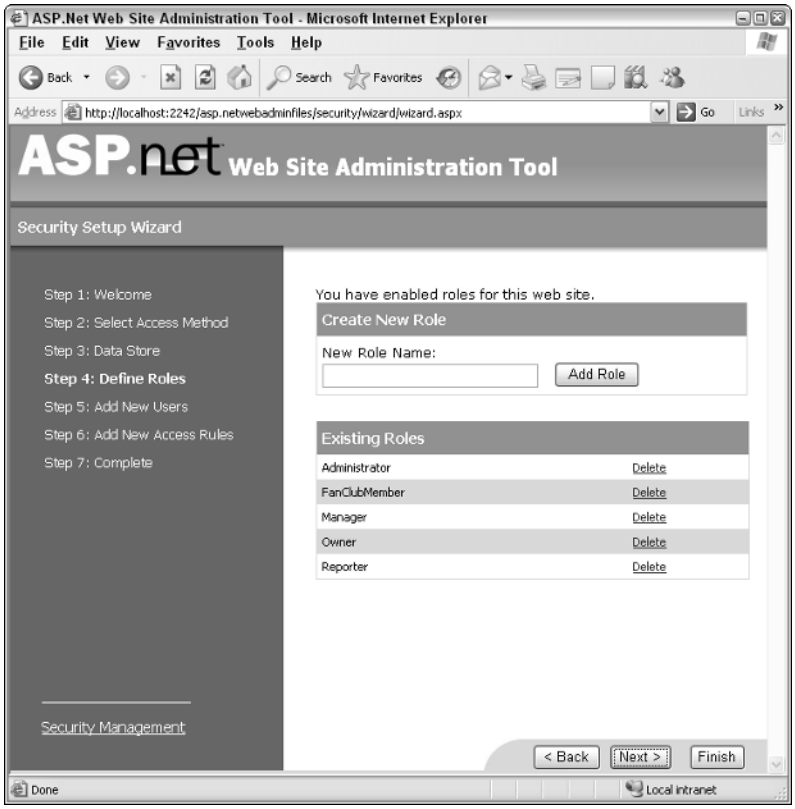


Figure 4-33

Take a look at the configuration for the finished application and you'll see that the preconfigured user accounts are each members of different roles, so while the ChrisH account is a member of the Reporter role, Jim is a member of the Owners role, and Lou is a member of the Fan Club.

3. Once you finish the wizard you need to make a couple of subfolders within the WroxUnited directory that will contain specific areas of the site — the Admin and the FanClub sections.

4. Now you can head into the section for managing Access Rules and add the following rules:

   - For the main WroxUnited folder, allow anonymous access.
   - For the FanClub folder, firstly deny access to all users, then add a second rule to only allow access to members of the FanClub role.
   - For the Admin folder, deny access to all users.

Because these user accounts and roles are not going to be used at this stage, you don't need to do any further work to the site just yet. However, this preparation work will pave the way for further work later down the line when you create other pages in the site.

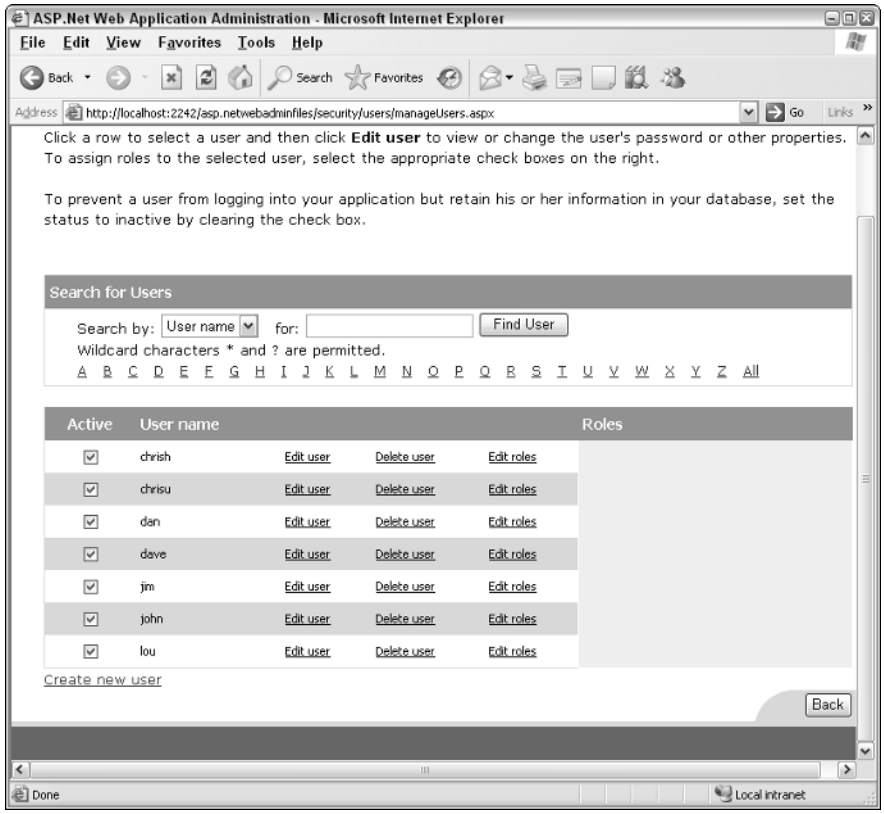


Figure 4-34

How It Works

With the Wrox United application, you have access to the configuration of a fully functional web application. Feel free to have a look through this configuration using both the administration tool and the `Web.config` file to see how the basic permissions are enabled. This example is only a taste of what will come later in the book, because Chapter 11 covers the details of role-based access to a site and shows you different techniques for enabling and disabling content by role.

The code generated for filtering access to the FanClub folder has been added to the `Web.config` file that lives within the FanClub folder. This code appears as follows:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <system.web>
    <authorization>
      <allow roles="FanClubMember" />
      <deny users="*" />
    </authorization>
  </system.web>
</configuration>
```

Notice that the FanClubMember role has been defined as the only role that has permission to access the content in this folder.

The directory-level permission created in this example has created a restricted zone in the site. Chapter 11 walks through some examples using the Administration section and the Fan Club sections, demonstrating different parts of ASP.NET 2.0 technology. These examples will rely on an understanding of the foundations built in this section.

Summary

This chapter discussed the basics of security, the concept of identity, and the process involved in logging on to a site. These are familiar concepts to anyone who spends time on the Internet, surfing fan sites, community portals, or online shops, and because these concepts are so universal, you've seen how ASP.NET 2.0 has been designed to make the process of creating sites that use this functionality.

The core concepts to understand are as follows:

- **Identity:** The concept of an individual as described by a set of attributes that make that individual unique.
- **Authentication:** The concept of identifying a user to a server by passing a set of credentials to the server. If the server can identify the user attempting to connect, he or she will be authenticated.
- **Authorization:** The process of taking authenticated user credentials and comparing them against a set of access control list information, providing the answer to the question "can this user access the requested resource?"
- **Personalization:** The capability to provide information that is specific to the currently logged-in user.
- **Membership:** The concept of belonging. This chapter considered the concept of users being members of specific roles.

The next chapter expands on the concept of personalization and looks at how ASP.NET sites can be personalized.

Exercises

1. Change the configuration of your Chapter 4 web site to allow anonymous access, but to deny access to one specific user account.
2. Add a subfolder to the Chapter 4 web site called Admin. Within this folder, add a page called `MainAdmin.aspx` with a `LoginName` control on it and any other controls you might want. Change the access permissions for that specific folder so that only members of the Administrators group can view the page.

5

Styling with Themes

The process of developing any web application usually revolves around two main areas: functionality and appearance. The functionality aspect of a web application includes the structure of the site, the behavior of the controls, the user experience, code for securing the application, what happens when the user clicks a button, and so on. The appearance of a site is somewhat more aesthetic, and involves the use of color, images, the layout of pages, and to some extent, the style of code that is rendered to the browser. A successful application will strike a good balance between the two sides, providing a visually pleasant site that is easy to use and to work with for all users, and it's the balancing act between the two sides where many sites fail.

This chapter starts by introducing the fundamental tools available for styling web applications, before introducing the styling capabilities of Visual Web Developer. It goes through the basics of styling individual controls before moving style information into a separate CSS file, then introduces themes — a new technique for styling pages and sites.

In this chapter, the following topics are discussed:

- Styling a web site, from styling individual elements to the use of CSS style sheets
- Developing style sheets for an application in VWD
- Using ASP.NET 2.0's themes and skins to rapidly develop styled web content that conforms to a standard look and feel
- Adding style to the Wrox United site using themes and skins

Additionally, this chapter also discusses the concepts of usability and accessibility, which are two important areas of web design that should be considered when developing any web site.

Styling a Site

It may sound obvious, but the front page appearance of a site is the first thing your visitors will see, and although we are told never to judge a book by its cover (particularly in the case of Wrox author mug shots!), most of us will still have an initial impression of a site based on its appearance, whether it's a fairly neutral response (it's ok, it does the job, where's the search box?), a positive response

(neat, slick, pretty, show me more!), or a negative response (yuk, messy, I'm going somewhere else!). Initial impressions count, so it's important that you get them right.

In any site design there are common elements; for example, some kind of header that gives you a company name, an idea of what the site is about, or a reflection of why you are looking at the site. You will also find areas such as menus, search boxes, groups of links, footers, and so on. A page without these sorts of elements will only be relevant to a specific audience; for example, a developer proving a concept, or the reader of a book who's trying out some new technology. Positioning these elements precisely is important, as is structuring the content to fit the style of site you're trying to develop.

Styling and laying out a site is an integral part of web development. Although laying out a site is one aspect, the styling of a site can be a bit trickier. This chapter focuses on styling pages and the rules and hierarchy involved in this process — laying out elements and positioning items on a page is part of web design that is discussed throughout this book.

Style Attributes

The easiest and quickest way to change the way an element appears on a page is to add a `style` attribute. The `style` attribute can be applied to any visible element on a page. For example:

```
<div style="font-weight:bold;color:red;border-bottom:solid 2pt navy">This is a
styled "div" tag</div>
```

Figure 5-1 shows how this `style` attribute will look in Internet Explorer.

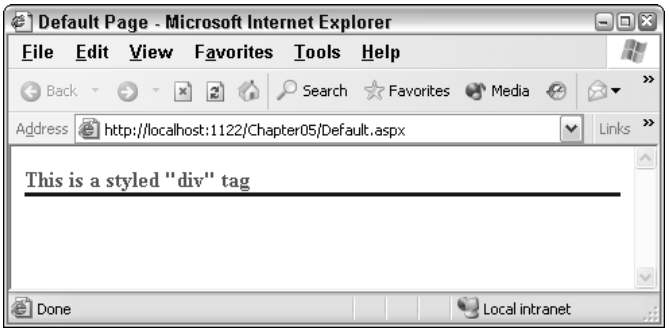


Figure 5-1

In the following Try It Out, you start by creating a web site that you can use to host all of the examples in this chapter.

Try It Out — Styling a Simple Page, Part 1 — Element by Element

1. In VWD, open the starter web site called Chapter05 (`C:\BegASPNET2\Chapters\Begin\`). This starter site contains just a few files to give you a head start on the examples within this chapter.
2. Add a new blank .aspx page and call it `Default.aspx`. Switch straight to Source View and type in the following highlighted lines of code between the `Form` tags:

```
<form id="form1" runat="server">
    <div style="font-weight:bold; color:red; border-bottom:solid 2pt navy;">
    This is a styled "div" tag
    </div>
</form>
```

Notice how Visual Web Developer helps you as you type in the style information (see Figure 5-2).

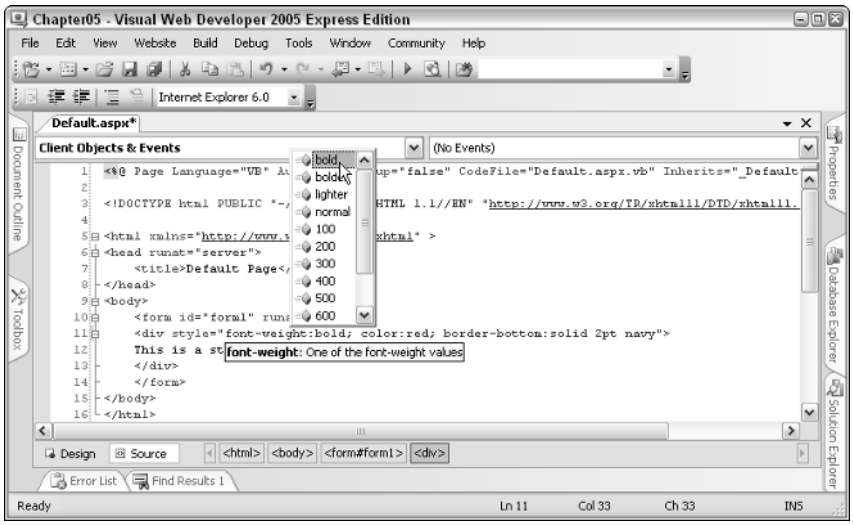


Figure 5-2

3. Now switch over to Design View and see how your formatting has been applied to the page, as shown in Figure 5-3.

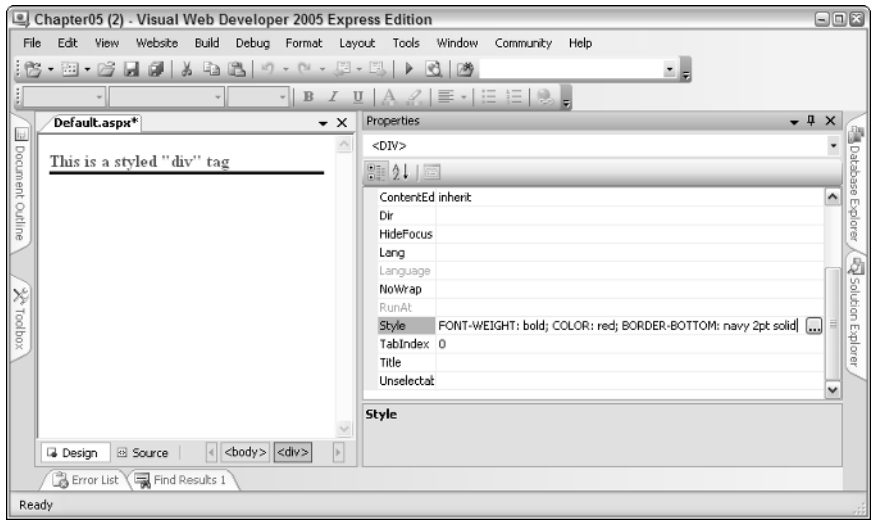


Figure 5-3

4. Notice how the `style` tag has the style attribute information visible in the properties pane. If you click somewhere within the value for the `Style` attribute, you'll notice the ellipsis button (...) next to the style information. Click this button and you will see the Style Builder dialog, shown in Figure 5-4.

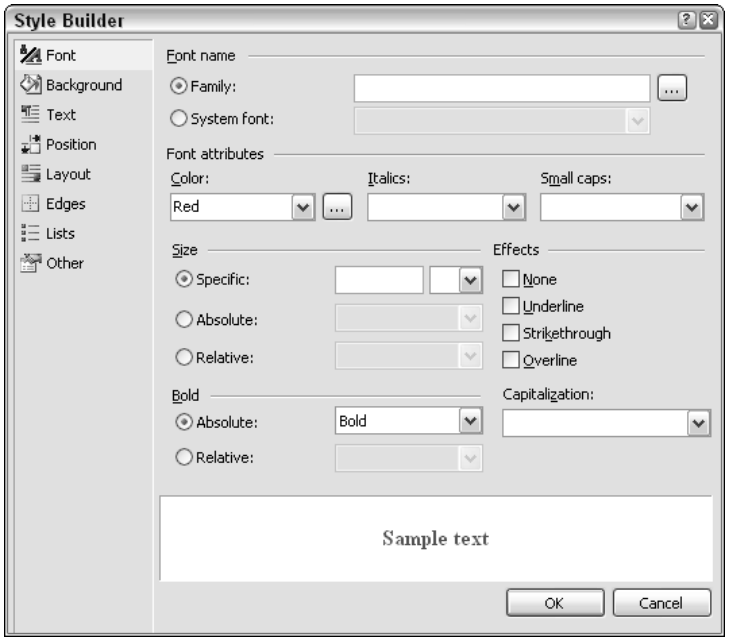


Figure 5-4

This dialog comes in very handy when you are styling elements, because you won't have to remember the individual syntax for each style. All you need to do is select the attributes you want to apply to the element and click OK to apply the style. Go ahead and do that with another page.

5. Create another .aspx page and call it `StyledPage1.aspx`. In this page, you need to add a simple `<div>` element with the text "This is highlighted text," and a Heading 1 (`h1`) element with the text "This is also highlighted text."

6. Using the Style Builder dialog (see Figure 5-5), set the style for both elements to use the Trebuchet MS font family, and set them to appear in Navy. This will add the following code to Source View for you automatically:

```
<div style="font-family: 'Trebuchet MS';Color: Navy;">
  This is highlighted text.</div>
<h1 style="font-family: 'Trebuchet MS';Color: Navy;">
  This is also highlighted text.</h1>
```

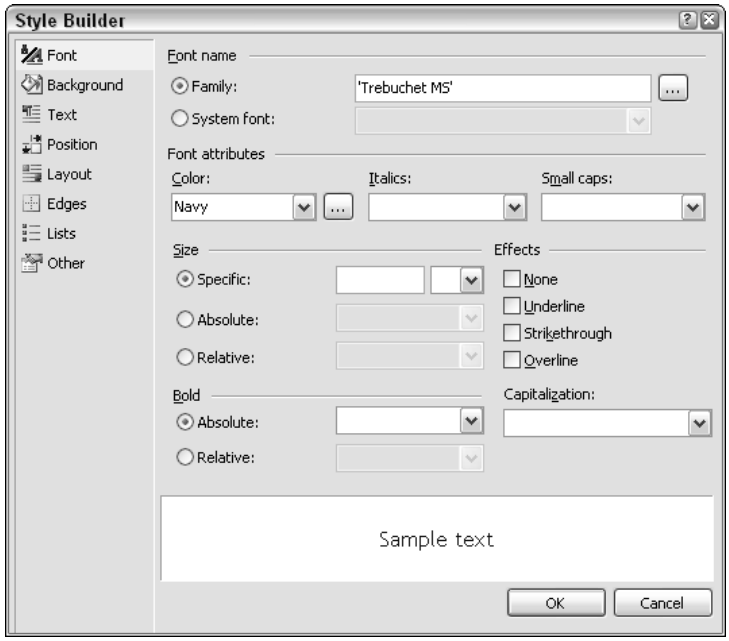


Figure 5-5

7. View the page in your browser to see the finished article. It should look similar to Figure 5-6.

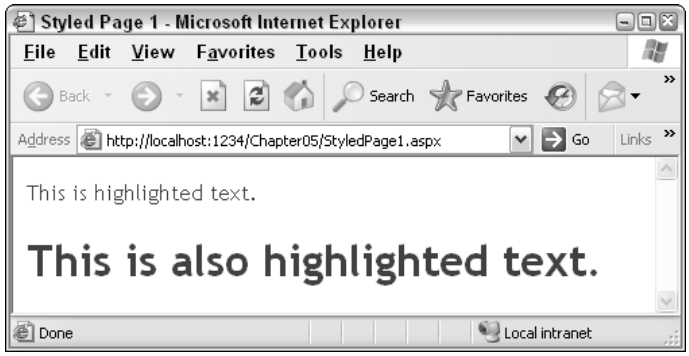


Figure 5-6

How It Works

Now it might not look fantastic, but it didn't take long to change how this element appeared on the page. This technique can then be applied to each element on the site. You can apply many different possible style attributes to a site, and so Appendix E includes some of the most common elements to help you to pick out your favorite styles for a site.

The good news is that having learned to style elements on a page, it's just a short step to reorganizing your code into using a style sheet. The style attributes on HTML elements use exactly the same syntax as the style syntax used in style sheets, so move on to the next section and tidy up all this style code.

CSS — Cascading Style Sheets

The concept of style sheets has been around for several years now (it was first made a recommendation by the W3C in December 1996), and every well-designed web application will be backed by a well-defined CSS style sheet that defines a specific look and feel for the site. Using a style sheet, you are able to define how every type of element on a page will appear, and you can also create definitions for specific styles that you can pick and choose from to apply to specific elements on a page. For example, you can specify that every instance of a `<div>` tag should contain navy text, or you can define a style *class* called `HighlightedText` that you can apply to any `<div>`, or other similar element, on a page. Here's a section from a style sheet that defines these styles:

```
div
{
  font-family: 'Trebuchet MS';
  Color: Navy;
}

.HighlightedText
{
  font-family: 'Trebuchet MS';
  Color: Navy;
}
```

Notice that the only difference between these two is that the `HighlightedText` class has a period before the name of the custom class. This identifies the section as a class that can be applied to any element you want, instead of defining default styling for a particular type of element.

To apply a style to an element you don't need to do anything to the element itself; as long as your page knows where the style information for the page can be found, the style will be applied automatically (locating style information is discussed in just a moment). However, to specify a custom class to be used to style an element, you use the `Class` attribute, for example:

```
<div class="HighlightedText">This is highlighted text.</div>
<h1 class="HighlightedText">This is also highlighted text.</h1>
```

Although you can't see the color of the text in this printed book, you can see that the font style that was defined in the preceding style class has been applied to these two elements in Figure 5-7.

Figure 5-7

Of course, if you try this out for yourself, you should see the font has also been rendered in navy blue.

Style Syntax

Style definitions are surrounded by curly brackets (braces). The position of the opening brace is usually either next to the name of the element or class, or on the following line; for example, the `div` style can be rewritten as follows:

```
div{
  font-family: 'Trebuchet MS';
  Color: Navy;
}
```

You can choose whichever presentation style you prefer — personally, I like my braces to all line up in a vertical line.

Style information can also be applied to elements like anchor tags (`<a>`) with some specific modifiers to provide some dynamic hover-style appearance as follows:

```
a:link, a:visited
{
  color: #cc3300;
  text-decoration: underline;
}
a:hover
{
  text-decoration: none;
}
a:active
{
  color: #ff9900;
  text-decoration: underline;
}
```

This code will render red links with underline on a page that, when you hover your mouse over them, lose their underline, and when you click them, they momentarily appear slightly orange. This is to provide you with some feedback that you are hovering over a link, and that you have just clicked a link. The comma-separated items mean that the following style information will be applied to both style definition items (in this case, the `a:link` and `a:visited` items).

The first step in moving to a fully CSS-based layout is to decide what styles you want to use for each element and construct a set of style definitions.

> **You can put style definitions in two places so that they can be used in a web page. The first option is to embed style information at the top of the web page within a `<style>` tag, placed within the `<head>` element. The other option is to create a separate external style sheet to store the style definitions, and to link that external style sheet to each web page that it should be applied to.**

In the next sections, you look first at placing style definitions within the <style> tags on a page, and then see how to attach an external CSS style sheet.

Moving from Style Attributes to a Style Section

If you are only interested in styling a single page, you can embed style information in the <head> section of the HTML for the page as follows:

```
<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
  <title>Styled Page 1</title>
  <style>
    .HighlightedText
    {
      font-family: 'Trebuchet MS';
      Color: Navy;
    }
  </style>
</head>
<body>
  <form id="form1" runat="server">
    <div class="HighlightedText">This is highlighted text.</div>
    <h1 class="HighlightedText">This is also highlighted text.</h1>
  </form>
</body>
</html>
```

This code is the same code used to display the previous example. Notice how you can embed the style information quite easily within the <head> of the page using the <style> tag. This technique is fine for single pages — in fact, if you ever save a Word document as HTML, you'll see that this technique is used to define the document styles in use so that the document can be rendered as HTML. I just saved this document from within Word 2003 as a Web Page (Filtered), which produces HTML code that's a lot cleaner than the standard auto-generated code when you just save as a Web Page from Word. After I saved it, I viewed the source code that was generated, and found the following style definition that describes how some of the highlighted sections of code used in this chapter are defined:

```
p.code, li.code, div.code
  {margin-top:0cm;
  margin-right:0cm;
  margin-bottom:0cm;
  margin-left:30.0pt;
  margin-bottom:.0001pt;
  line-height:112%;
  font-size:8.5pt;
  font-family:Courier;}:
```

This technique isn't really ideal for constructing a web site with style information applied to many different pages, because you would have to copy the <style> tags and style definitions across to all of the pages in the site individually. The solution for that scenario is to move to a separate CSS.

Moving to a Separate CSS

This step is perhaps the simplest to achieve. Once you have style definitions encapsulated within `<style>` tags, it's a really simple matter to extract that information into a separate style sheet. All you need to do is create a file with the file extension of .css, copy across all the style information from your web page, and then add a link to that style sheet as follows:

```
<head runat="server">
  <title>Styled Page 2</title>
  <link href="StyleSheet.css" rel="stylesheet" type="text/css" />
</head>
```

The style sheet file contains only style information, so say you had a style sheet with all of your style code in it:

```
.HighlightedText
{
    font-family: 'Trebuchet MS';
    color: Navy;
}
a:link, a:visited
{
    color: #cc3300;
    text-decoration: underline;
}
a:hover
{
    text-decoration: none;
}
a:active
{
    color: #ff9900;
    text-decoration: underline;
}
```

You can then link that style sheet to your web page, and make a minor addition to the page code:

```
<form id="form1" runat="server">
  <div class="HighlightedText">This is highlighted text.</div>
  <h1 class="HighlightedText">This is also highlighted text.</h1>
  <div><a href="default.aspx">This is a sample link</a></div>
</form>
```

When you view this page you'll see the result shown in Figure 5-8.

Figure 5-8

Go ahead and try out these concepts. In the next Try It Out, you create a simple styled page that is based on the `StyledPage1.aspx` that you created earlier.

Try It Out — Styling a Simple Page, Part 2 — Using CSS

1. Create another new page in your Chapter05 web site and call it `StyledPage2.aspx`.
2. Copy the `<div>` and heading from StyledPage1.aspx and remove the `style` attributes from each element. In their place, add a `class` attribute, and give it a value of `"HighlightedText"`:

```
<form id="form1" runat="server">
  <div class="HighlightedText">
    This is highlighted text.</div>
  <h1 class="HighlightedText">
    This is also highlighted text.</h1>
</form>
```

3. Add a hyperlink to the page below the heading with the text "This is a sample link". Enter `"default.aspx"` as the value for the `href`:

```
<form id="form1" runat="server">
  <div class="HighlightedText">
    This is highlighted text.</div>
  <h1 class="HighlightedText">
    This is also highlighted text.</h1>
  <div><a href="default.aspx">This is a sample link</a></div>
</form>
```

4. After the hyperlink, add a line break, followed by an ASP.NET `Label` control. Remember that server controls have a different set of properties than standard controls, so set the label's `CssClass` property to `"HighlightedText"`, and the `Font-Italic` property to `"true"`:

```
    This is also highlighted text.</h1>
  <div><a href="default.aspx">This is a sample link</a></div><br />
  <asp:Label CssClass="HighlightedText" Font-Italic="true" ID="Label1"
    runat="server" Text="This is an ASP.NET label"></asp:Label>
</form>
```

5. Right-click the Chapter05 site in the Solution Explorer and select Add New Item. Select StyleSheet from the list of icons and accept the default name: `StyleSheet.css`. In this file, add the following code:

```
.HighlightedText
{
  font-family: 'Trebuchet MS';
  color: Navy;
}
a:link, a:visited
{
  color: #cc3300;
  text-decoration: underline;
}
a:hover
{
  text-decoration: none;
}
a:active
{
  color: #ff9900;
  text-decoration: underline;
}
```

Notice how you get the same syntax help when you work with a CSS style sheet as when you work with `<style>` attributes on a HTML control in Source View, as displayed in Figure 5-9.

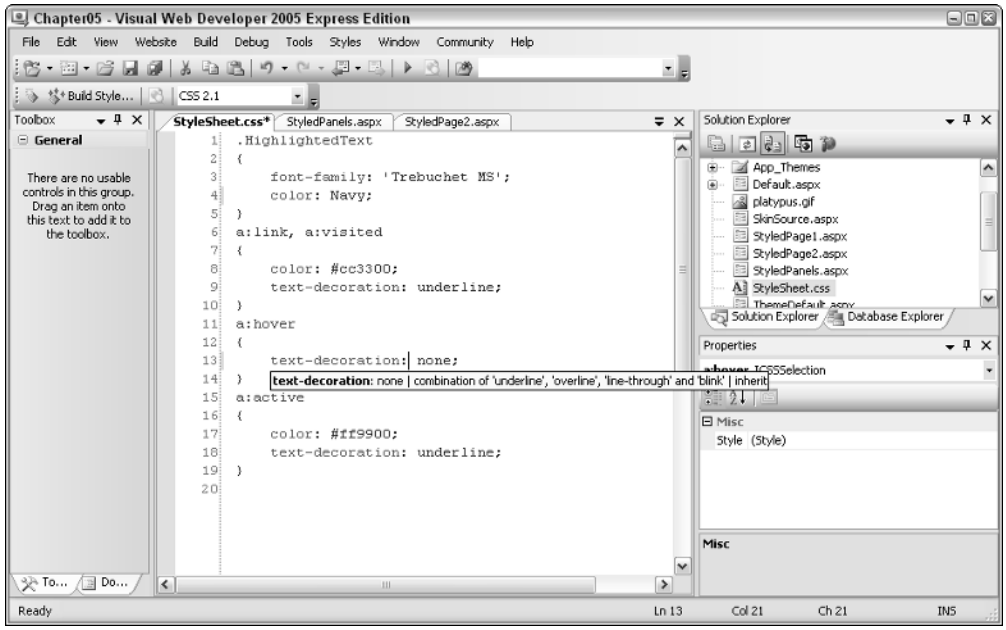


Figure 5-9

Also notice the Build Style icon on the toolbar; if you click this button, it launches the Style Builder dialog. You can try this out for yourself — add another element definition (a `<div>`,

perhaps), and add the opening and closing curly braces. Place your cursor between those braces and click the button to launch the style builder. Once you have selected the styles you want, you just click OK and your styles appear as CSS items in the `StyleSheet.css` file.

6. There is just one final finishing thing to do, which is to tell your page to refer to the styles defined in the .css file. Switch back to `StyledPage2.aspx` and flip to Design View. You should see the screen shown in Figure 5-10.

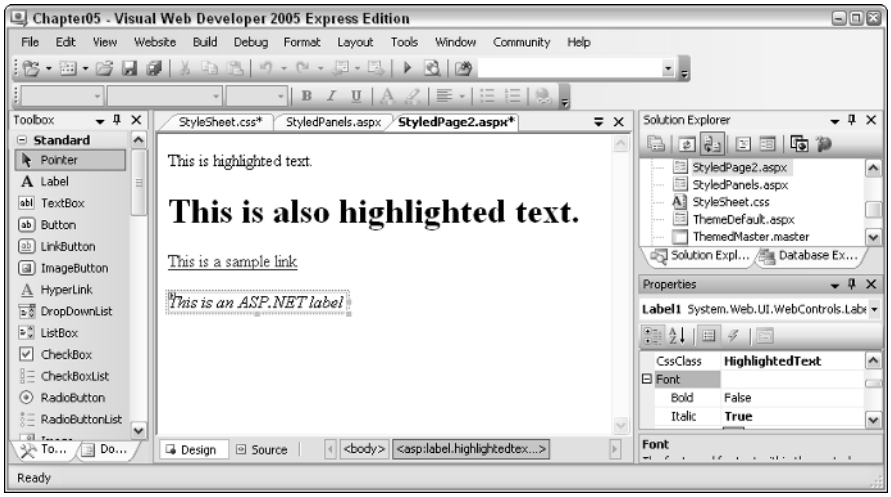


Figure 5-10

7. Now drag and drop the `StyleSheet.css` file icon from the Solution Explorer onto the design surface. As soon as you do that, your page will change appearance (see Figure 5-11).

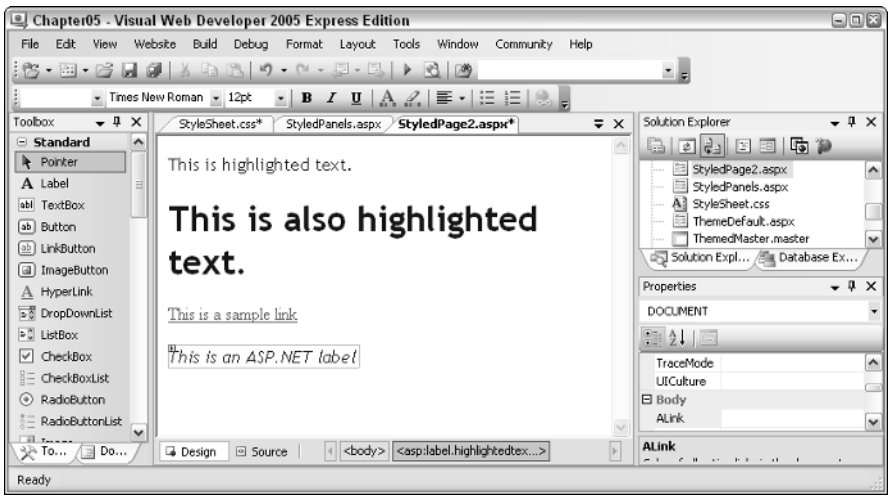


Figure 5-11

If you run the page now, you'll see pretty much the same thing in your browser window.

How It Works

Only two things are required to style an HTML element on a page using a separate CSS file. One is the class to be used by the element, and the other is a link that the page will use to locate the CSS file. When you dragged the CSS file onto the design surface of the page, the following code was added for you at the top of the page:

```
<html xmlns="http://www.w3.org/1999/xhtml">
<head runat="server">
  <title>Styled Page 2</title>
  <link href="StyleSheet.css" rel="stylesheet" type="text/css" />
</head>
```

That link at the top of your page tells your page where to find its style information. From that moment on, any `class` attributes in the page will attempt to refer to the CSS style sheet for the styling information for those elements. If the class cannot be found, no styles are applied, unless they are specified manually in the `Style` attribute of the element.

HTML elements with `class` attributes specified can also have additional style information specified in the `Style` attribute. Any styles defined in the `Style` attribute will override those specified in the CSS file, giving you the chance to fine-tune the appearance of selected elements on your page.

Server controls are somewhat different. Because a server control will be converted to appropriate HTML when it is rendered, the available properties will be different. In this example, you used a `Label` control. The `Label` control is a relatively simple control, so there's not a huge amount of styling you can add to it. In this case, you added a link to the CSS style, and defined one additional style. The `CssClass` attribute used by server controls relates directly to the `class` attribute found on HTML elements. The individual style attributes are similar to the individual parts found in the HTML style attributes:

```
<asp:Label CssClass="HighlightedText" Font-Italic="true" ID="Label1"
  runat="server" Text="This is an ASP.NET label"></asp:Label>
```

When the label is rendered, the following code is generated:

```
<span id="Label1" class="HighlightedText" style="font-style:italic;">This is an
ASP.NET label</span>
```

Notice that the custom style attributes are converted to a standard `style` tag on the browser. Because CSS styling is applied on the client side, once the page is rendered the `class` and `style` attributes on the HTML elements will have styles and CSS styling applied just like static HTML elements.

Limitations of CSS and Server-Side Code Styles

When you style a site using CSS, you can specify how specific elements will appear on a page. This works just fine in a static HTML web site, but when it comes to server-side elements, you will start to run into problems. Take, for example, a simple ASP.NET `Panel` control. If you drag a `Panel` control onto a page, add some text, and view the page in two different browsers (for example, Internet Explorer and an older or more limited browser like Links), you will see different results when you view the source of the page. Here's some example source code:

```
    <form id="form1" runat="server">
      <asp:Panel ID="Panel1" runat="server" Height="50px" Width="125px">This text
is contained within an ASP.NET Panel control
      </asp:Panel>
    </form>
```

Now, viewed in Internet Explorer 6 and Firefox 1.0.2, the following source code has been generated:

```
<form method="post" action="StyledPanels.aspx" id="form1">
  <div>
    <input type="hidden" name="__VIEWSTATE" id="__VIEWSTATE"
      value="/wEPDwULLTEwODU4OTkxMzRkZHehxD/SHmjEeZzCKx7+bB752B3R" />
  </div>

  <div id="Panel1" style="height:50px;width:125px;">
    This text is contained within an ASP.NET Panel control
  </div>
</form>
```

Now if you view that same page in an older browser (for example, Mozilla 5.0):

```
<form name="form1" method="post" action="StyledPanels.aspx" id="form1">
  <input type="hidden" name="__VIEWSTATE" id="__VIEWSTATE"
    value="/wEPDwULLTEwODU4OTkxMzRkZHBovyeleyCJNtOpi+uco+l/zE5a" />

  <div id="Panel1">
    This text is contained within an ASP.NET Panel control
  </div>
</form>
```

Notice how the `Panel` has been rendered to a `<div>` control in both cases, but in the second case, it has lost its height and width information. It's a small change in this case, but it's a great improvement over ASP.NET 1.1, which used to render HTML tables on older browsers for ASP.NET `Panel` controls. For example:

```
  <table id="Panel1" cellpadding="0" cellspacing="0" border="0" height="50"
width="125">
    <tr><td>
      This text is contained within an ASP.NET Panel control
    </td></tr>
  </table>
```

Now although ASP.NET 2.0 has removed a lot of issues like this from our day-to-day programming lives, the problem still remains that what you see on the server side isn't the same as you will see on the client side, and you can't guarantee that an element will always be rendered in the same way on every browser. What ASP.NET 2.0 attempts to do is to provide a mechanism for specifying the appearance of an element based on its server-side control type, not on its client-side control type, so that when a control is rendered on different browsers, consistency is maintained where possible. This is achieved using themes and skins.

Themes

Themes are used to define the look and feel of a web site, similarly to how pages are styled using CSS. However, unlike CSS, themes can specify how server-side elements, like a `TreeView` control, for example, will appear when they are rendered on the browser. Remember that server controls have to be converted to standard HTML and possibly JavaScript if a browser is to understand how to render them on a page. A themed server control will have style attributes applied to each of the relevant client-side elements that are generated when the page is requested.

A theme, once it has been created, can be used in one of two ways. A theme can be used as a Stylesheet theme, which acts in a similar way to a regular CSS style sheet. The alternative is to use your theme as a Customization theme, which changes the order of preference for style rules that you may be used to, so that the Customization theme will specify the style to use for each element, overriding any style preferences specified in a separate style sheet, or even in the `style` attributes of an element.

The basic method for creating a theme is the same, whichever way you use it. Additionally, you can choose to use one theme throughout an entire site, or a different theme on each individual page.

Creating a Theme

The process of creating a theme involves creating a `.skin` file, which defines the appearance of each element on the page, and placing this skin file within a folder, the name of which specifies the name of the theme. All themes are stored within a folder in an application directory called `App_Themes`. Here's a look at a sample skin file:

```
<asp:Calendar runat="server" Font-Names="Century Gothic" Font-Size="Small">
    <OtherMonthDayStyle BackColor="Lavender" />
    <DayStyle ForeColor="MidnightBlue" />
    <TitleStyle BackColor="LightSteelBlue" />
</asp:Calendar>

<asp:TreeView runat="server" ExpandDepth="1" Font-Names="Century Gothic"
  BorderColor="LightSteelBlue" BorderStyle="Solid" >
    <SelectedNodeStyle Font-Bold="True" ForeColor="SteelBlue" />
    <RootNodeStyle Font-Bold="True" />
    <NodeStyle ForeColor="MidnightBlue" />
    <LeafNodeStyle Font-Size="Smaller" />
    <HoverNodeStyle ForeColor="SteelBlue" />
</asp:TreeView>

<asp:Label SkinId="textLabel" runat="server" Font-Names="Century Gothic" Font-
Size="10pt" ForeColor="MidnightBlue"></asp:Label>

<asp:ImageButton SkinId="homeImage" runat="server" ImageUrl="~/platypus.gif" />
```

This file contains definitions for four types of elements. The ASP.NET `TreeView` control and the ASP.NET `Calendar` control in this file define how each of the calendars and tree view controls on a site will appear. Notice that these controls have no `ID` tag — this is a feature of all skin files. Each element within a skin file appears without an ID. At run time, if you have a page that has this theme specified as the default theme, and contains a `Calendar` control, the calendar on the page will automatically inherit the styles defined in this file.

The other two controls in this skin file, the `Label` and the `Image Button` controls, have associated `SkinId`s. These attributes enable you to create sites with many different types of `Label` controls or `Image Button` controls on them, and style selected instances of those controls using the skin data provided — the link to the skin file is controlled by the `SkinId` property. Hence, if you want to include two `Label` controls on a web page and style one of them using a theme, you can use the following syntax:

```
<asp:Label ID="Label1" SkinID="textLabel" runat="server" Text="Label">
  Styled label</asp:Label>
<asp:Label ID="Label2" runat="server" Text="Label">Unstyled label</asp:Label>
```

The `SkinID` property in this example specifies the style to apply to this control, as long as it has been defined in the theme used on that page.

In the following Try It Out, you create a simple theme in VWD and see how to define style formatting. You'll use this theme, and one other, in the examples later in this chapter.

Try It Out Creating Themes

1. In VWD, open up the Chapter05 web site. Right-click the C:\...\`Chapter05\` folder at the top of the Solution Explorer and select Add ASP.NET Folder ➪ Theme. You will see the screen shown in Figure 5-12.

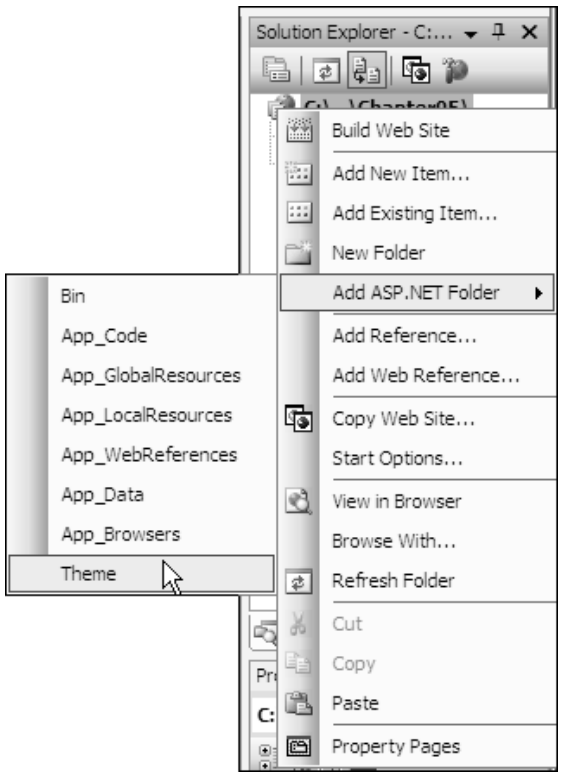


Figure 5-12

2. This will create a new folder within the application called `App_Themes`, and a new empty folder within `App_Themes` that you will have to name. Name the new folder Blue.

3. Right-click the `App_Themes` folder and add a new Theme folder named Red. You now have two themes available to your site, although you don't yet have any skin files containing style definitions. This is the next part.

4. Right-click the Blue folder and select Add New Item. Select Skin File and call it `BlueBits.skin`, as shown in Figure 5-13.

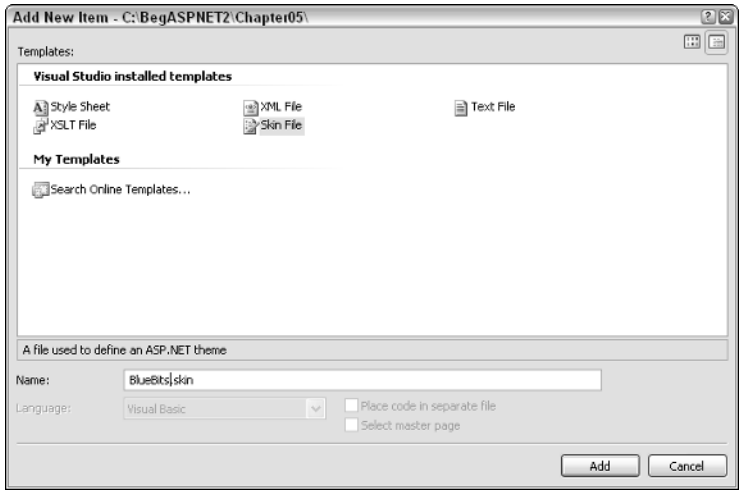


Figure 5-13

Click Add. Take a look at the resulting file (see Figure 5-14) and you'll see some default comments that overview some of the basics of skin files.

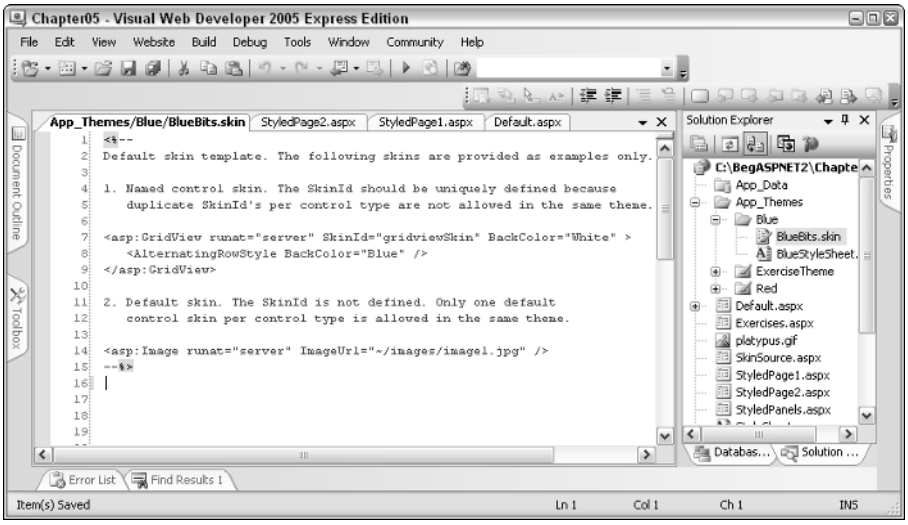


Figure 5-14

5. Repeat this step to add a skin file for the Red theme, called `RedBits.skin`.

6. For these examples, you'll find it really handy to create a simple ASP.NET page for trying out new styles before you add controls to a skin file. Create a new web page called `SkinSource.aspx` by right-clicking the `C:\...\Chapter05` root in the Solution Explorer and selecting Add New Item, selecting a Web Form, calling it `SkinSource.aspx`, and clicking OK.

7. Drag two `Calendar` controls onto the page. These controls need some styling, and the first step is to manually add some styles to each of these controls so that the first one can be used in a blue theme, and the second can be used in a red theme. In just a moment, you'll see the styles to use for these controls — first, Figure 5-15 shows how they will look when they are styled.

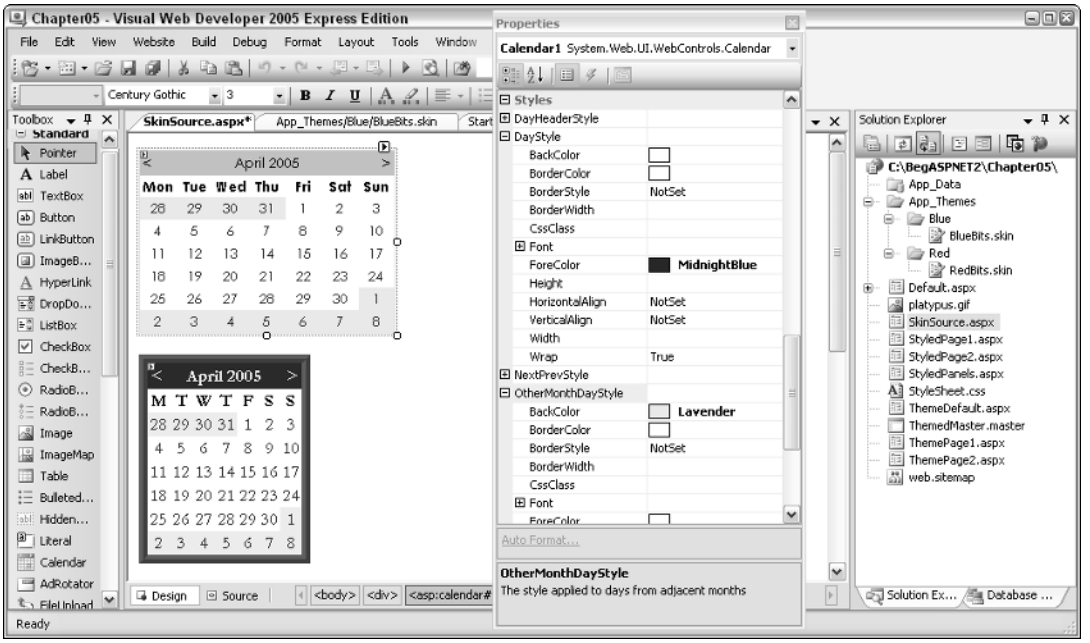


Figure 5-15

Notice that the Properties pane contains many different style options for the `Calendar` control. Set the properties as follows:

Blue Skin

Attribute	Style	Code
Font-Names	Century Gothic	`<asp:Calendar ID="Calendar1" runat="server" Font-Names="Century Gothic" Font-Size="Small"> <OtherMonthDayStyle BackColor="Lavender" /> <DayStyle ForeColor="MidnightBlue" /> <TitleStyle BackColor="LightSteelBlue" /> </asp:Calendar>`
Font-Size	Small	
OtherMonthDayStyle - BackColor	Lavender	
DayStyle - ForeColor	MidnightBlue	
TitleStyle - BackColor	LightSteelBlue	

Red Skin

Attribute	Style	Code
Font-Names	Garamond	`<asp:Calendar ID="Calendar2" runat="server" Font-Names="Garamond" Font-Size="Medium" BorderColor="Chocolate" BorderStyle="Ridge" BorderWidth="8px" DayNameFormat="FirstLetter"> <OtherMonthDayStyle BackColor="BlanchedAlmond" /> <DayStyle ForeColor="Maroon" /> <TitleStyle BackColor="Maroon" Font-Bold="True" ForeColor="#FFFFC0" /> </asp:Calendar>`
Font-Size	Medium	
BorderColor	Chocolate	
BorderStyle	Ridge	
BorderWidth	8px	
DayNameFormat	FirstLetter	
OtherMonthDayStyle - BackColor	BlanchedAlmond	
DayStyle - ForeColor	Maroon	
TitleStyle - BackColor	Maroon	
TitleStyle - Font-Bold	True	
TitleStyle - ForeColor	# FFFFC0	

8. Now drag a `Label` control onto the page and style it with a bit of color and font styling. The following code creates two labels and defines styles that should match with your blue and red themes:

```
<asp:Label ID="Label1" runat="server" Text="Label" Font-Names="century gothic"
Font-Size="10pt" ForeColor="MidnightBlue"></asp:Label>

<asp:Label ID="Label2" runat="server" Font-Names="garamond" Font-Size="11pt"
ForeColor="DarkRed" Text="Label"></asp:Label>
```

Once you have finished defining styles, you are ready for the next phase.

9. Open up the `BlueBits.skin` file in VWD and copy and paste the HTML for your blue `Calendar` and `Label` controls in the `SkinSource.aspx` page into the skin file and remove the `ID` tags for each of them.

10. Finally, add a `SkinID` attribute to the `Label` control to give it a unique style reference that you can use later (see the bold text in the following listing):

```
<asp:Calendar runat="server" Font-Names="Century Gothic" Font-Size="Small">
    <OtherMonthDayStyle BackColor="Lavender" />
    <DayStyle ForeColor="MidnightBlue" />
    <TitleStyle BackColor="LightSteelBlue" />
</asp:Calendar>

<asp:Label SkinId="textLabel" runat="server" Font-Names="Century Gothic"
  Font-Size="10pt" ForeColor="MidnightBlue"></asp:Label>
```

11. Repeat Steps 7 and 8 for the red controls, placing them in the `RedBits.skin` definition file:

```
<asp:Calendar runat="server" Font-Names="Garamond" Font-Size="Medium"
BorderColor="Chocolate" BorderStyle="Ridge" BorderWidth="8px"
DayNameFormat="FirstLetter">
    <OtherMonthDayStyle BackColor="BlanchedAlmond" />
    <DayStyle ForeColor="Maroon" />
    <TitleStyle BackColor="Maroon" Font-Bold="True" ForeColor="#FFFFC0" />
</asp:Calendar>

<asp:Label SkinId="textLabel" runat="server" Font-Names="Garamond" Font-Size="11pt"
ForeColor="DarkRed" />
```

It's simply a case of repeating the process for any other controls you might want to add to your skin file. In the next Try It Out, you'll be adding a `Calendar` control and a `Label` control to pages and seeing how these themes change their appearance. Additionally, you'll also add a `TreeView` control and an `ImageButton` control, so you will need to have some more information in your skin file to render these.

12. Add the following code to the blue skin (`BlueBits.skin`) file to specify styling for the `TreeView` and `ImageButton` controls:

```
<asp:TreeView runat="server" ExpandDepth="1" Font-Names="Century Gothic"
BorderColor="LightSteelBlue" BorderStyle="Solid" >
    <SelectedNodeStyle Font-Bold="True" ForeColor="SteelBlue" />
    <RootNodeStyle Font-Bold="True" />
    <NodeStyle ForeColor="MidnightBlue" />
    <LeafNodeStyle Font-Size="Smaller" />
    <HoverNodeStyle ForeColor="SteelBlue" />
</asp:TreeView>

<asp:ImageButton SkinId="homeImage" runat="server" ImageUrl="~/platypus.gif" />
```

13. Now you need to add similar code to the red skin (`RedBits.skin`) file to specify how to style a `TreeView` control:

```
<asp:TreeView runat="server" ExpandDepth="1" Font-Names="Garamond"
BorderColor="Chocolate" BorderStyle="Ridge">
    <SelectedNodeStyle Font-Bold="True" ForeColor="Chocolate" />
    <RootNodeStyle Font-Bold="True" />
    <NodeStyle ForeColor="DarkRed" />
    <LeafNodeStyle Font-Size="Smaller" />
    <HoverNodeStyle ForeColor="Chocolate" />
</asp:TreeView>

<asp:ImageButton SkinId="homeImage" runat="server" ImageUrl="~/platypus.gif" />
```

That's all there is to it as far as creating a theme is concerned — you should now have two themes available to your Chapter05 pages: blue and red.

How It Works

The presence of a .skin file within an `App_Themes` in your web application is all that's needed to make the themes within the folder available to your application. If you are hosting your web sites on a web server running IIS, you can alternatively place your themes within your `<drive>:\Inetpub\wwwroot\aspnet_client\<version>` folder, which makes them available to all of the applications hosted on your server.

You can create more than one .skin file for each theme you work on. All you need to do is create another .skin file within the theme's directory and create more control definitions within this file. This may help you to split up your .skin file definitions into smaller pieces. For example, if you created a site that had two different fonts in use on it (for example, one for text and one for code snippets), you could have styles defined in two .skin files, one containing the body text styles and one containing code snippet styles.

You can also include CSS style sheets in themes and use styles generated by your friendly designer on your web site. You'll see how this works later on. First, you need to have a go at putting these red and blue themes into action!

The .skin files that formed the themes in the previous example define some standard control styles that can be applied to any instance of a `Calendar` control on a page, or any instance of a `Label` control with the appropriate `SkinID` on a page. In this Try It Out, you apply these themes to some simple pages in a site. Note that the entire code for this chapter is available to download from `www.wrox.com`.

Try It Out — Applying Themes to Pages

1. Start by creating a master page for the site. This is going to be a very small and simple site, but having a master page will help you to navigate consistently around the site. Call the master page `ThemedMaster.master`. Into the master page, add a `TreeView` control on the left-hand side of the page, and place the `ContentPlaceholder` to the right by using the following HTML. Notice the style attributes on the two bold `<div>` elements that will help to lay out the contents of the page in two columns:

```
<body>
  <form id="form1" runat="server">
    <div style="float:left;padding-right:15px">
     <asp:TreeView ID="TreeView1" runat="server">

      </asp:TreeView>
    </div>
    <div style="float:left">
      <asp:contentplaceholder id="ContentPlaceHolder1" runat="server">
      </asp:contentplaceholder>
    </div>
  </form>
</body>
```

2. You'll need to create a simple web.sitemap for this example to act as the data source for the `TreeView` control. Right-click the Chapter05 folder and select Add New Item. Add a web.sitemap with the following code:

```
<?xml version="1.0" encoding="utf-8" ?>
<siteMap xmlns="http://schemas.microsoft.com/AspNet/SiteMap-File-1.0" >
  <siteMapNode url="ThemeDefault.aspx" title="Default" description="Default Page">
    <siteMapNode url="ThemePage1.aspx" title="Page1" description="Themed Page 1" />
    <siteMapNode url="ThemePage2.aspx" title="Page2" description="Themed Page 2" />
    <siteMapNode url="Default.aspx" title="SubPage" description="Sub Page">
      <siteMapNode url="StyledPage1.aspx" title="Page1" description="Page 1" />
      <siteMapNode url="StyledPage2.aspx" title="Page2" description="Page 2" />
    </siteMapNode>
  </siteMapNode>
</siteMap>
```

3. Now add a `SitemapDataSource` to the master page and set the `DataSource` for the `TreeView` control — just like you did in Chapter 3. You should now have the following code:

```
<body>
  <form id="form1" runat="server">
    <div style="float:left;padding-right:15px">
     <asp:TreeView ID="TreeView1" runat="server" DataSourceID="SiteMapDataSource1">
     </asp:TreeView>
     <asp:SiteMapDataSource ID="SiteMapDataSource1" runat="server" />
    </div>
    <div style="float:left">
      <asp:contentplaceholder id="ContentPlaceHolder1" runat="server">
      </asp:contentplaceholder>
    </div>
  </form>
</body>
```

Figure 5-16 shows what you should see in Design View.

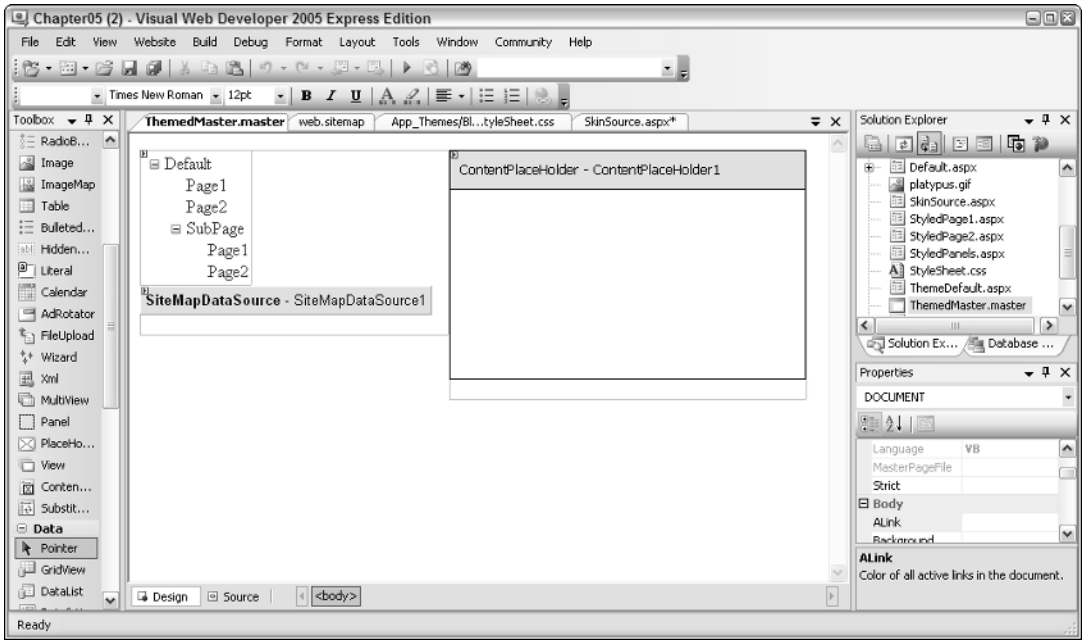


Figure 5-16

4. Time to build some content pages. In this example, you should create three very simple pages. The first one is called `ThemeDefault.aspx`. Start by right-clicking the Chapter05 folder and select Add New Item. Make sure you check the box to specify a master page for the new page and select the master page you just created when prompted (see Figure 5-17).

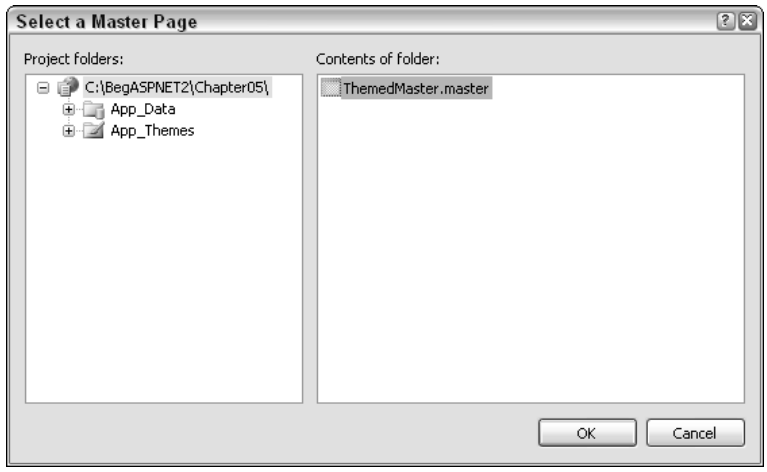


Figure 5-17

5. In the `Content` placeholder on this new page, type in some plain text: `"Default page!"`, and then drag two `Label` controls onto the page. Set the first `Label` control's `text` property to `"Styled label"` and the second `Label` control's `text` property to `"Unstyled label"`. Finally, set the first `Label` control's `SkinID` property to `textLabel`. This will link up the `Label` control to use the skinned label's styling. Your page should look like Figure 5-18.

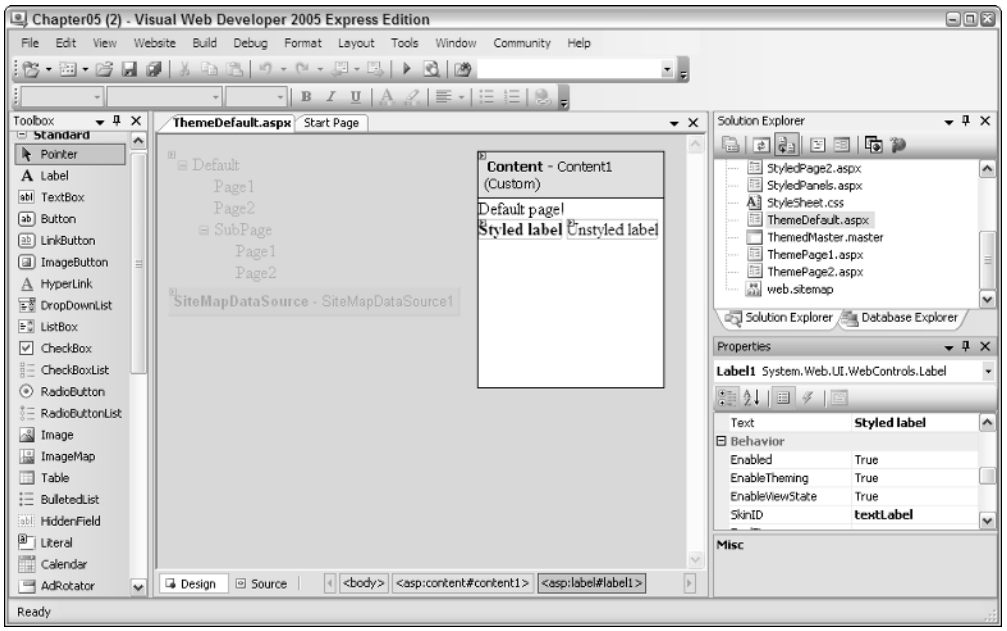


Figure 5-18

6. Last, you need to specify which theme to use for this page. Let's use the blue theme. If you are in Design View, click the gray area and view the properties for the Document: In this properties list, you should set the `Theme` property to `Blue`. Save the page and that's the first one out of the way.

   If you prefer to use Source View and work with HTML directly, your code should be similar to the following—notice the `MasterPageFile` and `Theme` attributes (in bold) on the `@Page` directive at the top of the page that control the layout and style for this page:

```
<%@ Page Language="VB" MasterPageFile="~/ThemedMaster.master" Title="Untitled Page"
Theme="Blue" %>
<asp:Content ID="Content1" ContentPlaceHolderID="ContentPlaceHolder1"
  Runat="Server">
    Default page!<br />
    <asp:Label ID="Label1" SkinID="textLabel" runat="server" Text="Label">
      Styled label</asp:Label>
    <asp:Label ID="Label2" runat="server" Text="Label">
      Unstyled label</asp:Label>
</asp:Content>
```

7. Now you need to add two more pages in the same way. Call them `ThemePage1.aspx` and `ThemePage2.aspx`. Make sure that you specify the same master page for these content pages.

8. In `ThemePage1.aspx`, enter the text `"Page 1"` and add a `Calendar` control onto the Content area of the page. Set the page's `Theme` property to `Blue`. The source code for this page should look as follows:

```
<%@ Page Language="VB" MasterPageFile="~/ThemedMaster.master" Title="Untitled Page"
Theme="Blue" %>
<asp:Content ID="Content1" ContentPlaceHolderID="ContentPlaceHolder1"
  Runat="Server">
    Page 1<br />
    <asp:Calendar ID="Calendar1" runat="server"></asp:Calendar>
</asp:Content>
```

9. In `ThemePage2.aspx`, enter the text `"Page 2"` and add an `ImageButton` control to the page. Set its `SkinID` property to be `homeImage` and the `PostBackUrl` property to be `ThemeDefault.aspx`. This will mean that if a user clicks the image, she will be taken back to the `ThemeDefault.aspx` page. Finally, set the page's `Theme` property to `Red`. The source code for this page should look as follows:

```
<%@ Page Language="VB" MasterPageFile="~/ThemedMaster.master" Title="Untitled Page"
Theme="Red" %>
<asp:Content ID="Content1" ContentPlaceHolderID="ContentPlaceHolder1"
   Runat="Server">
    Page 2<br />
    <asp:ImageButton ID="ImageButton1" SkinID="homeImage" runat="server"
      PostBackUrl="ThemeDefault.aspx" />
</asp:Content>
```

10. Right — you've finished the groundwork, so it's time to see the results of your hard work! Click the `ThemeDefault.aspx` in the Solution Explorer and press Ctrl+F5 to run the page (see Figure 5-19).

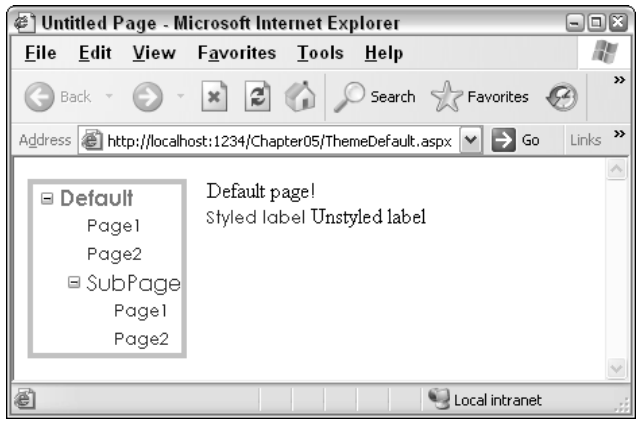


Figure 5-19

Click through to Page 1 to see the `Calendar` control, shown in Figure 5-20.

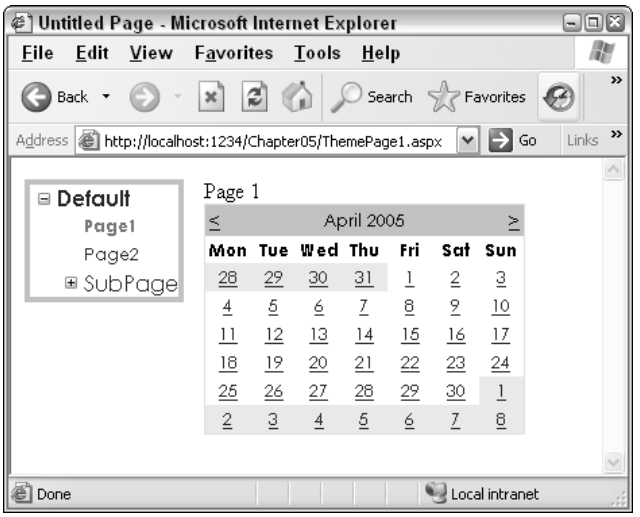


Figure 5-20

And finally, Page 2 (see Figure 5-21) includes the `ImageButton` control, and will use the red theme.

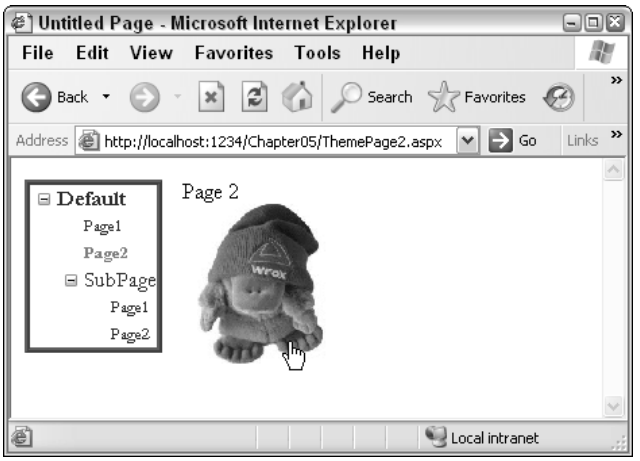


Figure 5-21

11. Change the `Theme` attribute on Page 1 to use the red theme. Save the page and view it again. It should look like Figure 5-22.

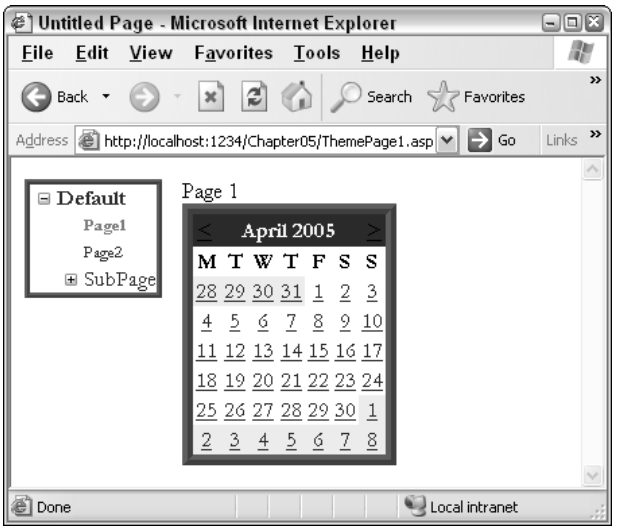


Figure 5-22

How It Works

In this example, the themes built in the previous Try It Out example have been applied to a simple collection of pages. You'll recall that master pages were first discussed way back in Chapter 2, and in this chapter you've seen that when you have a page that uses a master page, the entire rendered page is treated as a single entity. Remember how you set the ThemeDefault.aspx page to use the Blue theme, but you didn't specify any `Theme` property on the master page? The truth is that you can't actually specify a theme directly on a master page in any case. Your pages in this example have shown how changing the `Theme` property on each page individually has styled the entire page (including the `TreeView` control added to the master page) with the same consistent look and feel. That style can easily be switched on different pages, as you saw with Page 1 in this Try It Out.

The main pieces of code that you need to be aware of are the `Theme` property in the `Page` directive and the `SkinID` attribute on server controls. Adding just these two pieces of information to a page resulted in the finished pages. Take `ThemePage2.aspx` as an example:

```
<%@ Page Language="VB" MasterPageFile="~/ThemedMaster.master" Title="Untitled Page"
Theme="Red" %>
<asp:Content ID="Content1" ContentPlaceHolderID="ContentPlaceHolder1"
   Runat="Server">
    Page 2<br />
    <asp:ImageButton ID="ImageButton1" SkinID="homeImage" runat="server"
      PostBackUrl="ThemeDefault.aspx" />
</asp:Content>
```

The `Theme` attribute at the top of the page specifies which theme should be applied to the entire page, including the contents of the master page that it's connected to. The `SkinID` property specifies which skin of an `ImageButton` control to apply to the ImageButton on the page, so if you had many different `ImageButton` control styles defined in your skin file, this attribute would specify which one to use on your page.

In the preceding example, you used the `Theme` attribute specified at the top of each page to indicate which theme to use to style a page. There is another attribute that you can use to style the elements on a page: the `StyleSheetTheme` attribute. Both the `Theme` attribute and the `StyleSheetTheme` attribute take the name of the theme to apply as the value, and both are used to style pages using themes, but the attribute you choose to use can result in slightly differently rendered pages. Here's why.

Customization Themes — You Have Control!

The pages in the previous example used the `Theme` attribute, which means that you have just used *Customization* themes to style each of the pages in the example. A Customization theme has total control over the styling of elements on a page. If you manually style elements on a page controlled by a Customization theme, those styles will only be applied if the elements to which they are added are not already styled by the theme.

Stylesheet Themes — CSS for Server Controls

If you'd prefer to use your themes like a style sheet, you can easily choose to do so by using the `StyleSheetTheme` attribute at the top of a page. This change in attribute means that you can still give developers the freedom to add some small amounts of styling to controls using style attributes on each tag, while providing a common look and feel for a site in the theme itself.

The best way to see the differences between Stylesheet themes and Customization themes is to have a play, so in this Try It Out you modify the previous example to see the differences.

Try It Out — Customization and Stylesheet Themes

1. Open up `ThemeDefault.aspx` and add a `Font-Bold="true"` to the code for the `Styled label`. Alternatively, switch to Design View, select the `Styled label` and select the Font node from the Properties tab and specify that the font should be bold:

```
<asp:Label ID="Label1" SkinID="textLabel" runat="server"
  Text="Styled label" Font-Bold="True"></asp:Label>
```

2. Run the page now and you'll see a bold label, as depicted in Figure 5-23.

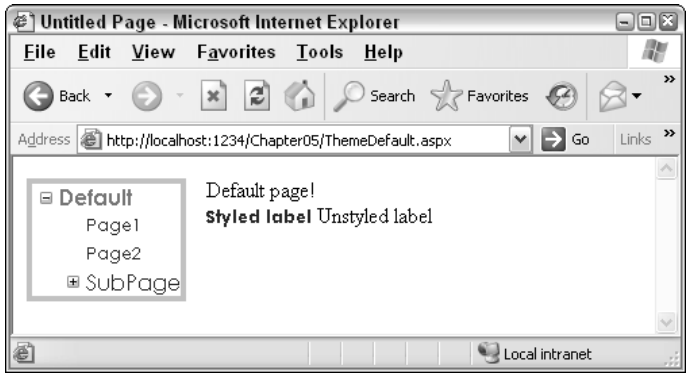


Figure 5-23

3. Now edit the label declared with the `SkinId="textLabel"` in the `BlueBits.skin` file and add the following bolded declaration:

```
<asp:Label SkinId="textLabel" runat="server" Font-Names="Century Gothic"
  Font-Size="10pt" ForeColor="MidnightBlue" Font-Bold="False"></asp:Label>
```

4. Run the page again and the label will no longer be bold, evidenced in Figure 5-24.

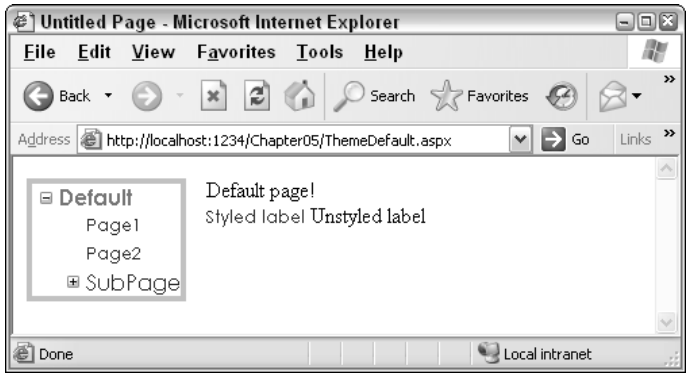


Figure 5-24

5. Change the `Theme` attribute at the top of the `ThemeDefault.aspx` page to read `StyleSheetTheme` instead of `Theme`. Alternatively, in Design View, edit the properties for the page and specify that the page's `StyleSheetTheme` should be `Blue`, and delete the `Theme` property. Run the page again and you'll see that the label is now bold once more.

How It Works

The first step in this exercise was to add a `Font-Bold="True"` attribute to the label. Because the bold attribute hadn't been specified in the Customization theme, the style in the page was applied successfully and the control was rendered with bold blue text.

However, adding a `Font-Bold="False"` to the skin's `textLabel` control overrides the style in the page because the page is still using the Customization theme (the `Theme` attribute at the top of the page). As a result, the second time you ran the page, you saw that the page now has a non-bold blue label.

The last step was to change to using a `StyleSheetTheme` instead of a `Theme` attribute at the top of the page. This enabled the page's styles to once more take priority, and so the bold blue label returned the third time the page was run.

Using a Stylesheet theme or a Customization theme is completely up to you. Choosing a Customization theme gives your designer a bit more control over the look and feel of a site, whereas the Stylesheet theme lets you play with control rendering yourself. Bear in mind, though, that if you start adding your own style attributes to controls, you may find that your site appears somewhat strangely if you ever decide to change the contents of the theme, or switch to a completely different theme.

Using Both Stylesheet Themes and Customization Themes

No rules in ASP.NET specify that you can only use a Stylesheet theme or a Customization theme in your pages. If you want to have two levels of styling available to your pages, some mandatory, some optional, you can use both types of theme on your site.

For example, you may specify that major page elements must stay consistent from page to page. The `<body>` tag of a page must always be in a certain font, and the `Menu` control must always contain a certain style of node, but you may want to only use styling on `Label` controls as a guideline or default style. You can therefore create one theme that defines rules for main page elements and `Menu` controls and specify that theme to be used as the Customization theme. You can then create a different theme with some other style information in it that you can apply to a site as you create it and override certain element styles, and then apply the second theme as a Stylesheet theme. The following list is the order of application when it comes to styling:

1. Stylesheet theme
2. CSS styles
3. Element styles
4. Customization theme

Styles specified in a Customization theme will always override all other settings.

Themes and CSS Together

CSS is a great way to style a site, so it's great that there's a really simple way to integrate style sheets in your themes. All you need to do is add a style sheet file to the theme's directory and slot it in right next to your skin files. Your non-ASP.NET designer will certainly be pleased that you can easily integrate his designs in your server-side pages!

Because this isn't a tough concept, you can jump straight in with a quick example to show how this works.

Try It Out Integrating CSS and Themes

1. Head straight back into VWD, right-click the Blue theme folder, and select Add New Item. In the dialog that pops up, add a new style sheet and call it `BlueStyleSheet.css`.

2. In the newly created style sheet, add the following code:

```
body
{
   font-family:Arial;
}
.bigtext
{
    font-size:xx-large;
}
```

3. Now flip back into `ThemeDefault.aspx` and add a `CssClass` attribute to the unstyled label, with a value of `"bigtext"`:

```
<asp:Label ID="Label2" CssClass="bigtext" runat="server" Text="Unstyled label">
</asp:Label>
```

4. Run the page now and you'll see that the label now has xx-large text style applied (see the CSS style sheet definition), and the default font for the page (everything within the `<body>` tag) is now formatted using Arial as the font face, as shown in Figure 5-25.

Figure 5-25

5. Flip to the `BlueBits.skin` file and add another `Label` control definition. Set its `SkinID` to be `"bigLabel"` and give it a `CssClass` attribute of `"bigtext"` and save the file:

```
<asp:Label SkinId="bigLabel" runat="server" CssClass="bigtext"></asp:Label>
```

6. Remove the `CssClass` attribute from the label and set its `SkinID` attribute to `"bigLabel"`:

```
<asp:Label ID="Label2" SkinID="bigLabel" runat="server" Text="Unstyled label">
</asp:Label>
```

Notice that the IntelliSense in VWD kicks in here and helps out by giving you the option of specifying which label style to use (see Figure 5-26), because you now have more than one available in your selected theme.

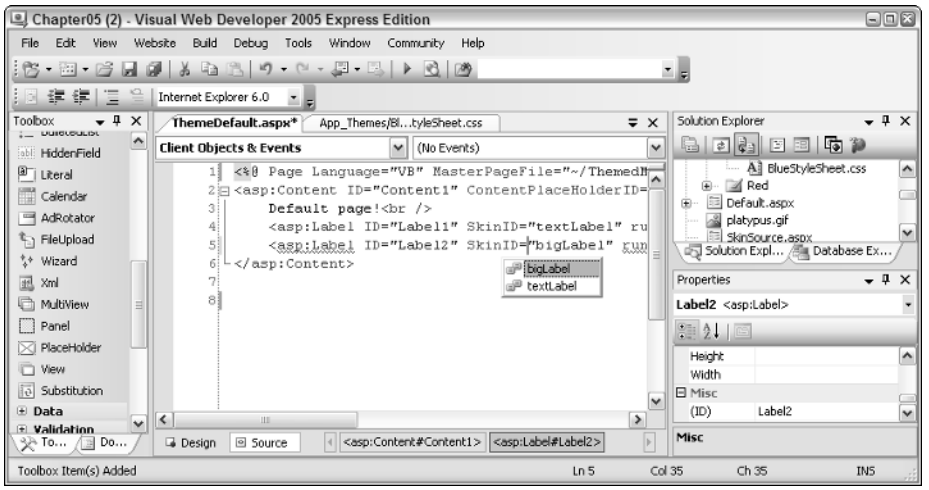


Figure 5-26

Note that you will get the IntelliSense support here only if you have saved the skin file before going back into the `ThemeDefault.aspx` page.

Running the page once more will render the same result; the only differences are whether the skin file or the page contains the styling information.

How It Works

By adding a CSS style sheet to a theme folder, that style sheet is now available to all pages that use that theme. Once the theme has been applied, whether it's a Customization theme or a Stylesheet theme, the styles in the style sheet are available both to the skin files within the theme's folder, and within the page itself.

The same rules apply to CSS-styled server controls from a Customization versus Stylesheet theme perspective — if you apply a CSS style to an element in a theme and apply a different style to an element on a page, the result will vary according to which type of theme you have applied. If you apply a Customization theme, the theme defined in the skin file will overrule any styles or CSS classes specified in the .aspx page, whereas the opposite is true if you specify that your theme be used as a Stylesheet theme.

Applying Styling to a Site

In most situations, you will likely want to apply a consistent look and feel to all pages within a site. Although you could just specify that all of your pages in the site use the same theme, it's quicker and easier to specify the default theme for the site in a central location. In ASP.NET 2.0, you can add a value to the `Web.config` file for your site to specify the default theme for your pages. You will remember that

you used the `Web.config` file in Chapter 4 when you specified site access permissions for different user accounts. Because a `Web.config` file is the central location for all site-wide settings, this is where you can store default theme settings for your site. The basic syntax for this is as follows:

```
<?xml version="1.0"?>
<configuration>
  <appSettings/>
  <connectionStrings/>
  <system.web>
    <pages theme="myTheme" styleSheetTheme="myOtherTheme" />
```

You can specify both a Stylesheet theme and a Customization theme in the `Web.config` file. If a theme is specified in the `Web.config` file and no theme is specified in a page, the theme in the `Web.config` will be applied. Additionally, if your `Web.config` specifies a Customization theme for a site and you specify a Stylesheet theme for your page, the Customization theme from the `Web.config` will be applied. Here's a slightly amended order of application for themes, including the `Web.config` themes:

1. `Web.config` Stylesheet theme
2. Page Stylesheet theme
3. CSS styles
4. Element styles
5. `Web.config` Customization theme
6. Page Customization theme

> **If you want to completely control the appearance of an entire site, use a Customization theme in the `Web.config` file.**

In the next Try It Out, you quickly specify a site-wide theme for the pages in the small application you've been building in this chapter so far.

Try It Out Applying Themes to a Site

1. Right-click the Chapter05 folder and select Add New Item. In the dialog, create a new Web configuration file (`Web.config`) and click OK.
2. Add the following line of code (highlighted in bold) to the `Web.config` file and save the file:

```
<?xml version="1.0"?>
<!--
    Note: As an alternative to hand editing this file you can use the
    web admin tool to configure settings for your application. Use
    the Website->Asp.Net Configuration option in Visual Studio.
    A full list of settings and comments can be found in
    machine.config.comments usually located in
    \Windows\Microsoft.Net\Framework\v2.x\Config
-->
<configuration>
```

```
    <appSettings/>
    <connectionStrings/>
    <system.web>
      <pages theme="red" styleSheetTheme="blue" />
```

3. Remove all `Theme` and `StyleSheetTheme` attributes from all of the pages used in this chapter and run the application. All of the pages in the site will now be rendered in the red theme, but note in Figure 5-27 the result in the `ThemeDefault` page.

Figure 5-27

How It Works

The resulting output in the ThemeDefault.aspx page seems to be a bit of a mixture of two different themes, yet you specified that all pages in a site should use the red Customization theme. However, in the previous example, you added a CSS file and some additional style information to the blue theme, and because the blue theme is set as a Stylesheet theme for the site, and because there are no equivalents for these styles in the red theme, these styles are picked up from the blue theme and applied to the body text and the `"Unstyled label"` label control:

The first line of HTML code is part of the body of the page:

```
    Default page!<br />
```

So this is styled using the blue theme's `body` style from the `BlueStyleSheet.css` file:

```
body
{
   font-family:Arial;
}
```

The next item in the code for this page is the "Styled label" control, which has a SkinID of textLabel:

```
    <asp:Label ID="Label1" SkinID="textLabel" runat="server" Text="Styled label"
Font-Bold="True"></asp:Label>
```

Because this SkinID exists in both themes, the red theme is applied, because this theme is set to be the Customization theme in the Web.config file:

```
<asp:Label SkinId="textLabel" runat="server" Font-Names="Garamond" Font-Size="11pt"
ForeColor="DarkRed" />
```

Here's the line of code in the Web.config again:

```
      <pages theme="red" styleSheetTheme="blue" />
```

Remember that the theme attribute represents the Customization theme. However, the specified Customization theme in this case, the red theme, has no SkinID for a "bigLabel", so the blue theme is used instead:

```
    <asp:Label ID="Label2" SkinID="bigLabel" runat="server" Text="Unstyled
label"></asp:Label>
```

So the last item on the page is styled according to the blue theme:

```
<asp:Label SkinId="bigLabel" runat="server" CssClass="bigtext"></asp:Label>
```

One last thing to note — the Label control is still part of the body of the page, and because no additional font information has been specified for the control, it also inherits the CSS style for the body of the page from the blue theme.

The final example to look at in this chapter is that of the themes used in the Wrox United application. The following section takes a quick look at the themes and styling in the application.

Themes in Wrox United

The themes defined for the Wrox United site control the appearance of the team's site. Two themes are available for the site: a red theme and a blue theme. The normal, everyday theme is the red theme, and it reflects the team's home outfit in blocks of bold red and yellow. The other theme available to contrast with the red theme is the blue theme, which is designed mainly to show up the differences between two different themes being applied to a site. Figure 5-28 shows the site in its traditional Wrox Red colors.

The way that themes are applied in Wrox United is slightly different from the techniques that you've looked at in this chapter, because it relates to user preferences. As you saw in Chapter 4, you can add user accounts to a web site to enable users to log in to a site. Once a user has logged on to the Wrox United site, there is some code that enables that user to store personal information (the user's name, address, and so on), and to store personal preferences, such as the theme to apply to the site when the user logs on.

The code that handles the theme switching is explained in detail in Chapter 11, because it involves an understanding of several techniques that you've not yet met this far in the book. However, in the following Try It Out, you can see how the themes are applied to the Wrox United site, and it steps through the most interesting bits in the theme definitions for the Wrox United site.

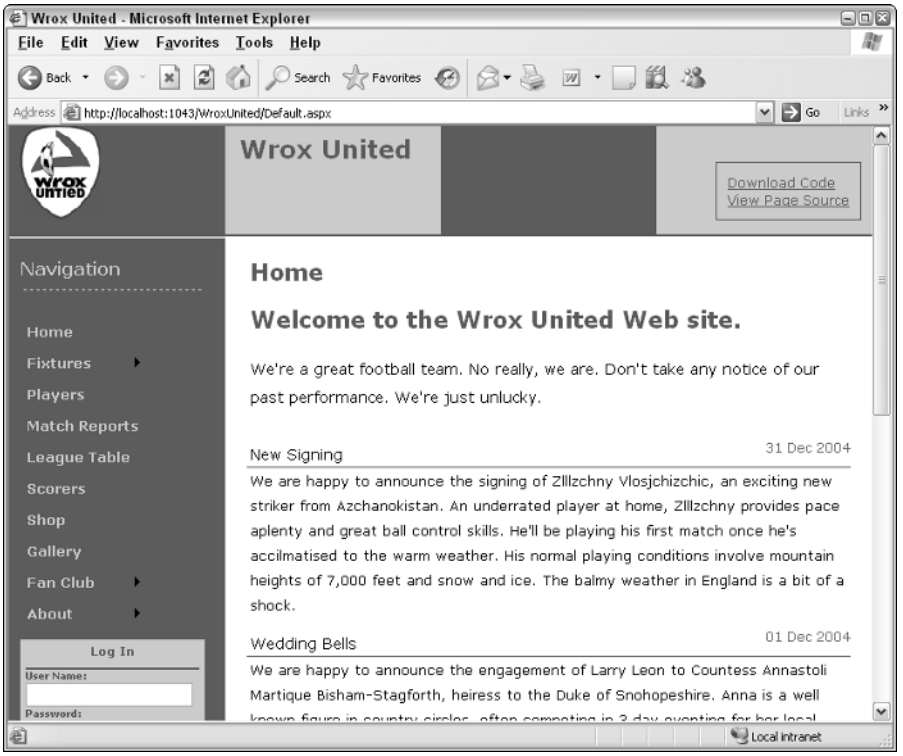


Figure 5-28

Try It Out — Using Themes in Wrox United

1. Open up your local copy of the Wrox United application — this should be stored within your `C:\BegASPNET2\WroxUnited` folder.

2. Press Ctrl+F5 to run the site and you'll be taken to the main front page in its default color scheme. In the login box near the bottom of the left-hand column, log in as the user `Lou`, password `lou@123`. In the box that appears below the login box, you need to click the Modify Account link, as highlighted by the hand-style cursor in Figure 5-29.

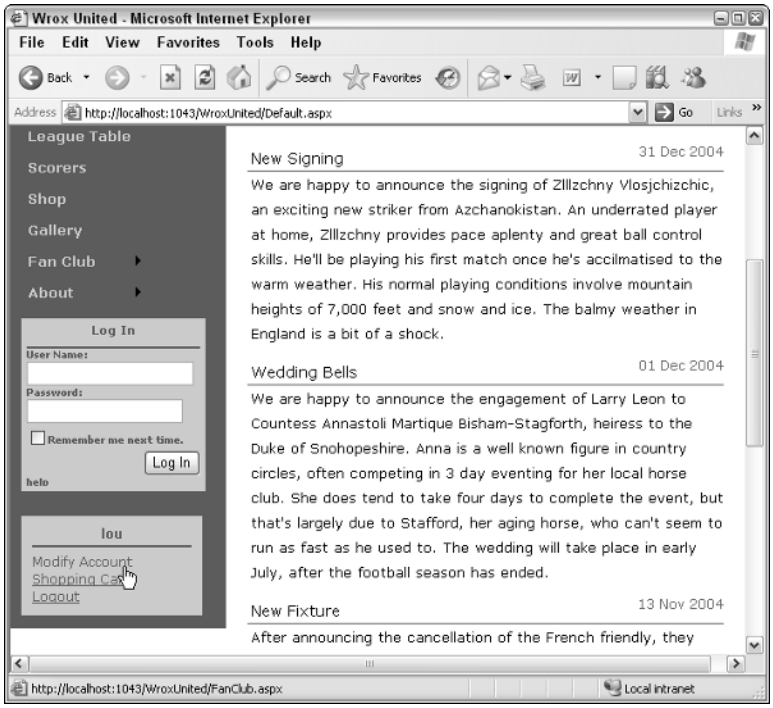


Figure 5-29

3. In the screen that appears (see Figure 5-30), select the Wrox Blue theme from the Theme drop-down list and click Save Changes.

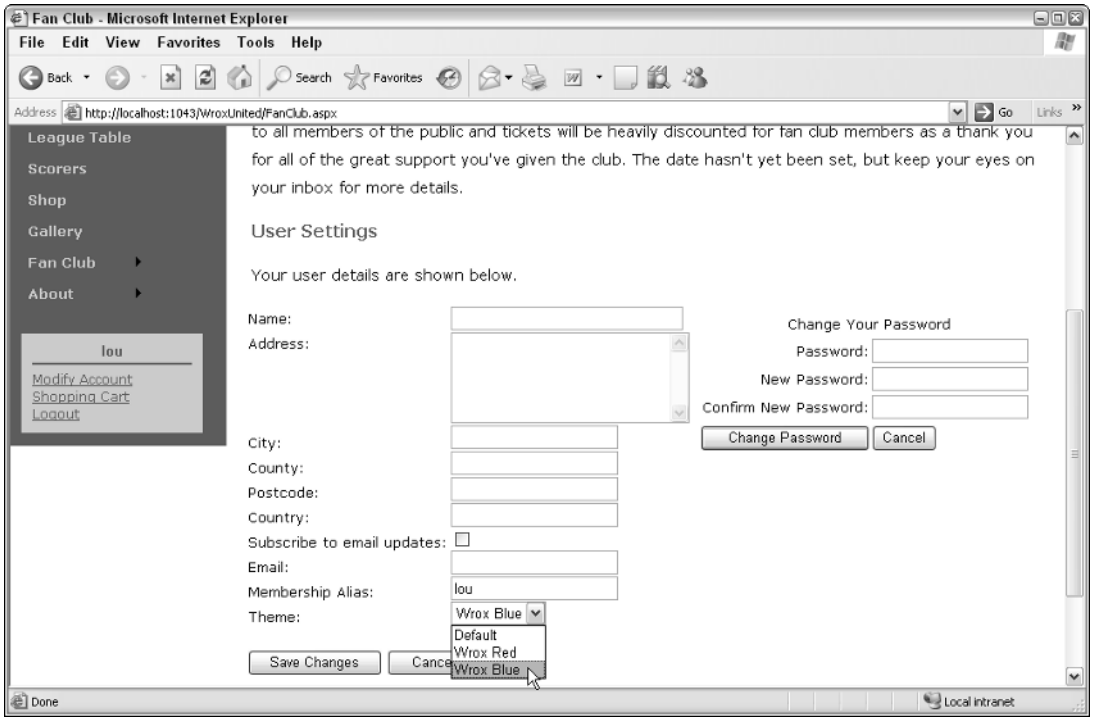


Figure 5-30

4. Click the Home link at the top of the menu at the side of the page to go back to the front page of the site and you'll now see the site rendered with the blue theme, as shown in Figure 5-31.

   You might not be able to see the difference that clearly in a printed book, but because it's quite easy to try out for yourself, give it a go and see the changes for yourself!

Figure 5-31

How It Works

This example has demonstrated the theme-switching capability of the Wrox United site, which is something you'll look at in a lot more detail in Chapter 11, but the important part of the exercise to concentrate on here is the styling of the site itself.

Many styles are in use on this site, so look at the Wrox Red theme first of all and see how the styling is applied to the elements on the page using this theme.

The Wrox United red skin (the WroxRed.skin file within the WroxRed Theme folder) is included with the rest of the code for the site (available at `www.wrox.com`). The following listing shows some of the styles defined in this skin file:

```
<asp:Label runat="server" ForeColor="#000000" BackColor="transparent"></asp:Label>

<asp:TextBox runat="server" ForeColor="#000000" BorderWidth="1px"
  BorderStyle="Solid" BorderColor="#ff0000" BackColor="Transparent"></asp:TextBox>

<asp:Button runat="server" BorderStyle="Solid" BorderColor="#ff0000"
  BorderWidth="1pt" ForeColor="#000000" BackColor="#ffe5e5"></asp:Button>

<asp:HyperLink runat="server" Font-Underline="True" BorderStyle="None">
</asp:HyperLink>
```

Notice that there are specific style definitions for `Label`, `TextBox`, `Button`, `HyperLink`, and `Calendar` controls, which means that every instance of a control of each of those types will be styled as defined in this skin file.

Here's the `TextBox` definition:

```
<asp:TextBox runat="server" ForeColor="#000000" BorderWidth="1px"
  BorderStyle="Solid" BorderColor="#ff0000" BackColor="Transparent"></asp:TextBox>
```

The `TextBox` has been styled so that it has a thin solid red border around it. Note that the value s pecified for the `BorderColor` attribute doesn't actually say red in English, but instead it uses the hexadecimal representation of a pure, bright red color.

> *The hash symbol (#) indicates that the color to be applied is provided as a hexadecimal value. The next two characters control how much red to add to the control, from 00 to FF. The next two characters control the level of green to apply, and the last two control the level of blue. The hexadecimal value 000000 represents a pure black (none of each color), whereas the value FFFFFF renders as white (all of every color).*
>
> *The hexadecimal counting system (sometimes known as Base 16) means that the hex value FF corresponds to the decimal value of 256. With 256 different values for each component, that enables you to choose from one of 16 million possible color values!*

The Wrox Red theme also has an associated CSS style sheet, `WroxRed.css`, which is also available in the code for download. The following is an extract from this file:

```
html, body {
  margin: 0;
  padding:0 5px 0 5px;
  background-color: #f00;
  color: #000;
}

title {
  color: #f66;
}

#nav {
  background-color: #f00;
  width: 20px;
  float: left;
  margin-left: -1px;
```

```
  padding: 10px;
}

#content {
  padding: 10px;
  margin-left: 230px;
  width: 100%;
}
```

The styles in use in this theme define some simple color and positioning for some of the elements used on the site. The `#nav` definition and the `#content` definition are used to match all elements on a page with an ID set to `nav` or `content` respectively, rather than specifying the `class` attribute, or specifying a specific element type to style.

Styling and Layout Best Practices

The concepts discussed in this chapter can be used for both good and evil. You can have as many style definitions in your site as you like, but if you have little or no sense of style, you could make a big mess of things. And style is nothing without layout — the two go hand in hand. Pages need to be structured sensibly so that any user can view and understand what you're trying to tell them. Now that you've grasped the basics of styling and presenting a site, the two concepts you need to learn about now are usability and accessibility.

Usability

Usability is all about keeping users on your site, and giving them the best possible user experience while they browse. Users want to see prompt responses to their requests, they want to be able to find what they want, and they want to be able to understand what the site is all about. A site that has fifteen fonts on it will appear cluttered, hard to read, and most likely look like it was put together by someone who'd never spent time reading content on a web site.

The goal of every web development team is to make a site as usable as possible, which means developers working together with designers to provide an attractive and intuitive user interface, which is where you can start to employ the techniques discussed in this chapter. The core principles of usability are as follows:

- **Learnability:** Design the user interface so that it takes a minimum of time for a first-time visitor to understand the design and use the site.
- **Efficiency:** Make the site efficient so that experienced users can accomplish tasks swiftly.
- **Memorability:** A user should be able to remember how to use the system next time they come to visit.
- **Bugability:** Squash those errors where possible, and if errors occur, make them user-friendly and recoverable.
- **Satisfaction:** Users should like and enjoy using your site.

Usability is an art that has been written about by many people, but the main site you should refer to when it comes to usability guidelines is `www.useit.com/`, which is the web site owned by Jakob Nielsen. I recommend that all developers spend some time looking in to this area and gain some key insights into making your sites really effective.

Accessibility

Accessibility is all about making sites *accessible* by all users. For example, web users who are partially sighted access the web with the assistance of a screen reader, which reads the contents of a web site aloud. Alternatively, these users could have their screens set to a much lower resolution, where most sites would be unable to fit on the screen. At another end of the spectrum, you could also find mobile users connecting to the Web using a Pocket PC device that's only capable of displaying 320×240 pixels of information at one time. The browsers used on different devices like Pocket PCs employ some great techniques for scaling images to make a site fit on a screen. You could also find yourself having to cater to users who have very limited-functionality browsers; perhaps browsers that don't allow the use of JavaScript for client-side code, or that don't display images on a page to save on bandwidth. If an image were missing from a page, it would be nice to know what the image was supposed to represent to give it some context in the absence of the image itself.

At the core of accessibility are some facts that will help you to make your sites as accessible as possible. For example, if you have a screen reader reading out your source code, you should always include an HTML `alt` attribute on your images, so that the screen reader can describe what the image represents. You should always provide code that can render your site on browsers that don't support HTML frames using the `<noframes>` element, and you should avoid, where possible, using many levels of nested HTML tables to lay out a site, because a screen reader will read out the contents of every cell and row.

Many different guidelines are available for making a site accessible, and the best place to start reading is the following site: `www.w3.org/WAI/`.

This site is the home page for the Web Accessibility Initiative and is packed full of useful and important advice.

Despite the existence of myriad resources, the vast majority of developers in the world have never given a second thought to making a site truly accessible. Many more have thought about it and made some changes to their site in an attempt to make it more accessible, but building truly accessible sites is actually quite difficult.

Take for example the Wrox United web site. This book has concentrated on teaching you how to build ASP.NET web sites. The main focus of our efforts was in teaching what is possible, the techniques you can use, and how you can get results quickly. To make this site truly accessible would take a fair bit more time, and perhaps that would be the topic for another book.

We strongly recommend learning more about building accessible web sites for any public site you develop, because it's actually illegal (though not often enforced) to only provide an inaccessible web site, as described in Section 508 (see `www.section508.gov`) in the U.S., and the Disability Rights Commission's (DRC) Disability Discrimination Act (DDA) Code of Practice (`www.opsi.gov.uk/acts/`

acts1995/95050--c.htm) in the UK. Prosecution for inaccessibility is quite rare, but because it's entirely possible to design accessible web sites, it's worth adding accessible web design to your skill set for both those with disabilities, and for your own professional reputation.

Summary

This chapter discussed all of the different ways of styling a page and its elements, and demonstrated numerous methods for controlling look and feel. The new skinning and themeing capabilities of ASP.NET 2.0 provide you with a great way to combine all available techniques into one easily applied package.

This chapter discussed the following:

- How to apply style attributes to elements.
- How to move style attribute information into `<style>` sections in a page, then into a separate CSS file.
- Creating ASP.NET themes and applying them to pages.
- The differences between Customization themes and Stylesheet themes.
- Integrating themes and CSS.
- Applying a consistent style to all pages in a site.
- The issues of usability and accessibility and why they are so important in today's Internet world.

The next chapter moves on to discuss something quite different; the issues of raising and handling events in code, as you are introduced to the concept of a postback-driven architecture.

Exercises

1. You have an ASP.NET `Label` control on a page. The label has a `font-italic="true"` attribute, and a `CssClass="maintext"` attribute:

```
<asp:label id="myLabel" CssClass="maintext" font-italic="true"
  text="This is a label"></asp:label>
```

   The page has an associated CSS style sheet (not associated with a theme) that defines a .maintext style class. This style class has the following attributes:

```
.maintext
{
  color: Navy;
  font-family: Verdana;
  font-weight: Bold;
  font-style: normal;
}
```

   How will the label appear when it is rendered?

2. You now add a `Theme="ExerciseTheme"` to the preceding page. You place the CSS style sheet from the previous exercise within the ExerciseTheme theme folder. How will the label control appear now?

3. You define a skin for all labels within the ExerciseTheme theme folder and specify the following attributes:

```
<asp:Label CssClass="maintext" runat="server" font-italic="false"></asp:Label>
```

How will the label appear now?

6

Events and Code

We've managed to avoid lots of code so far, but you can't get away from it completely, so now it's time to get your hands dirty. You're not only going to look at code, but also the event architecture of ASP.NET and how web servers work. The reason for this is simply because knowing how web servers process pages enables you to understand how the architecture of ASP.NET works. In turn this leads to understanding how and why the ASP.NET events work.

In particular, this chapter looks at the following:

- A high-level overview of the Internet HTTP protocol
- The problems brought by web servers and how the ASP.NET event architecture solves those problems
- How server-side code works, and how it is created and used
- How events relate to the controls placed on a page, and the various types of events that you can use

The chapter starts by looking at web servers and the HTTP protocol.

Web Server Architecture

HTTP stands for *HyperText Transfer Protocol*, and it's the method of communicating with web servers. The protocol defines the commands that web servers can accept, and how browsers interact with them. The key point is that a web browser requests a page from the server. The server processes that page and sends the results back to the browser. The browser only understands HTML or JavaScript. HTML is the language that describes the layout of text and images on the page, and JavaScript enables programming on the client, within the browser. It's the web server's job to ensure that only the required content is sent back to the client browser.

Chapter 3 briefly discussed the difference between static and active content, and went on to look at the HTML and server controls, so you've seen that server controls need to be processed on the server, and that they emit HTML for the browser. What you need to do now is look at how this process actually works: what happens when you fire up your browser and type a URL into the address box, what happens when you press a button on a page, how the web server keeps track of the pages, and so on.

HTTP works by having a set of commands that browsers send to a web server. The two most common of these commands are `GET` and `POST`. The `GET` command is what a browser sends when a web page is to be fetched — it's what happens when you type a URL into the browser's address bar and press Return; it simply means "get me this web page." The `POST` command is for when something is to be sent back to the web server — for example, when you fill in a form and press a button. In reality the `POST` command actually fetches a page, but it also sends the form data back to the web server.

You don't need to know the rest of the HTTP commands or how any of them work in detail, but it's useful to know the terms and to understand that HTTP is very simple.

HTTP Is Stateless

One of the things you have to understand about HTTP is that it is *stateless*, meaning that it retains no knowledge from one request to the next. So when you request a page from a web server, the page is sent to you, and the server immediately forgets everything about you; each request stands alone. HTML doesn't help much either, because it's simple a language for the representation of the contents of the page; like HTTP, HTML doesn't retain content. For example, consider a simple web page that has a text box and a button. In your browser you enter some text and press the button. The data you entered is sent back to the web server, the web server process the page (making changes as necessary), and the page is sent back to the browser to be redisplayed. However, because there is no retention of data, the text box comes back empty — it's as though the web server has forgotten your text.

Why is this a problem? Well, it poses some real issues when writing applications, because very often you want some form of data retention. For example, consider the checkout page at an online store, such as the one at the Wrox United online shop, as shown in Figure 6-1.

Figure 6-1

The checkout involves several steps, each of which requires users to supply some form of information: making sure they are logged in, checking their address, and authorizing payment. As far as HTTP is concerned, each step is a separate request from the user; the page loading is one request, pressing the Next button is another request, and so on.

When you fill in some details on a page and press a button, that information is posted back to the web server (the term *posted* derives from the actual HTTP `POST` command used). When you reach the last of the checkout steps, you need all of the information entered by the user, not just the data supplied with the last step. Because HTTP and HTML don't retain this information for you, you have to store it yourself. In non-ASP.NET environments this can be quite complex and time consuming, but luckily for us the server controls are clever; they retain their state across *postbacks*. This means you don't have to do anything special; if you press a button to post the information back to the server, when the page is refreshed the text boxes still have their data. This is one of the big differences between standard HTML and server controls, and is one of the reasons why we use server controls.

The server controls remove even more of a burden from us. Consider the checkout page shown earlier, which has several text boxes, and that's only one step; there's also the login details, plus the credit card details, plus the management of the steps themselves. Server controls are used for all of the text entry, but there is also a Wizard control, designed specially for use in situations like this. It manages the steps, creates the menu of steps on the left, and provides the Previous and Next buttons. All you have to do is define what you want within those steps. When you get to the last step everything the user has typed in is available, and the order can be processed.

Server-Side Events

So far you've seen a very simple view of what happens when you interact with a web server — you press a button and something happens. So what is it that actually happens on the server, in your ASP.NET page? Well, simply put, there are a number of events that run; some that always run, some that only run depending on what the user has done (which button they've pressed), and some that run due to other actions, such as data being changed. These events are ASP.NET's way of letting you know something has happened, and they allow you to take some action. For example, all ASP.NET pages have an event that runs when the page loads, and you can place code within this event to perform some action. Buttons have an event that runs when you click them, lists have an event that runs when you select a list item, and so on, and these events are what give you the power to control how the web page reacts to the user.

Before digging into the code, some terms need explaining. When an event happens it is called *firing* or *raising*. That is, the event is raised or the event is fired. Both terms are valid, and which you use is a matter of preference (I prefer raised, because fired always makes me think of a poor little event being stuffed into a canon at a circus before being launched into a tiny net to amuse the crowd). Both terms are used regularly in the .NET documentation and on various online sites and articles.

The code that is run when the event is raised is called the *event procedure* or *event handler*. Any code you put in here becomes part of the event procedure and runs when the event is raised. For example, consider a page with two buttons. Each of these buttons could have its own event procedure, while there is a separate event procedure for when the page loads, as illustrated by Figure 6-2.

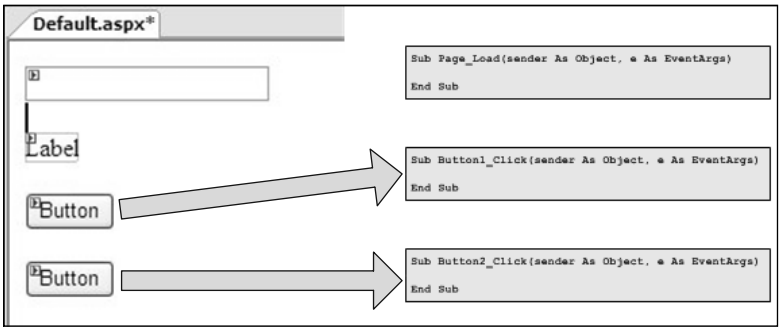


Figure 6-2

Figure 6-2 shows three event procedures. This first is the `Page_Load` event, which is raised by ASP.NET and allows you to prepare the page for the user, perhaps fetching data from a database. The other two events are generated by the user when a button is clicked; each button has its own event handler. For example, the first button might save some user-entered details, whereas the second button cancels user-entered details.

Adding Events to the Page

Adding events to ASP.NET pages is simple because Visual Web Developer (VWD) provides a way to do this for you. It allows you to select the page or a control and for the allowable events to be listed. You can then instruct VWD to create the event procedure for you. The first thing that needs to be discussed is where the events are created, because there are two places where events can be created. The first is in the same file as the ASP.NET controls, and this is called *code inline*. The second place to create events and code is in a separate file and this is called *code-behind*. Where the code is created depends upon a simple checkbox on the Add New Item dialog, as shown in Figure 6-3.

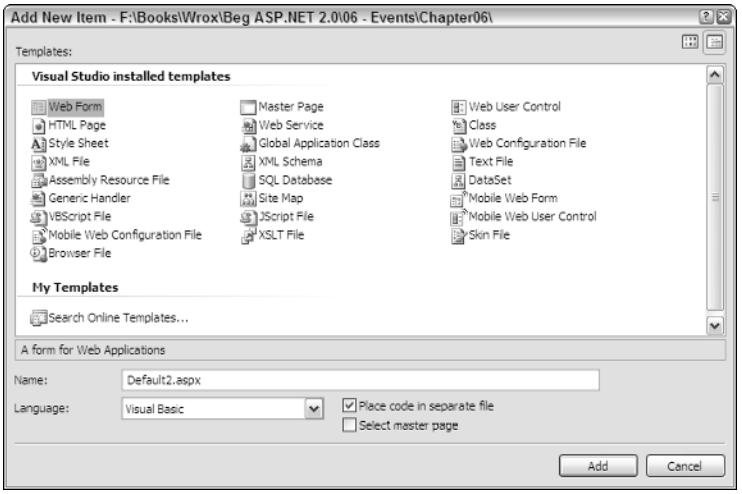


Figure 6-3

You can use either code inline or code-behind, because it doesn't make any difference to ASP.NET, but code-behind is the accepted standard, and all of the pages in the Wrox United application use code-behind, as do all of the examples in this chapter.

In the following Try It Out, you give events a go and add some events to a page.

Try It Out — Adding Page and Control Events

1. Start Visual Web Developer, and open the web site at `C:\BegASPNET2\Begin\Chapter06`. You should see a screen similar to Figure 6-4.

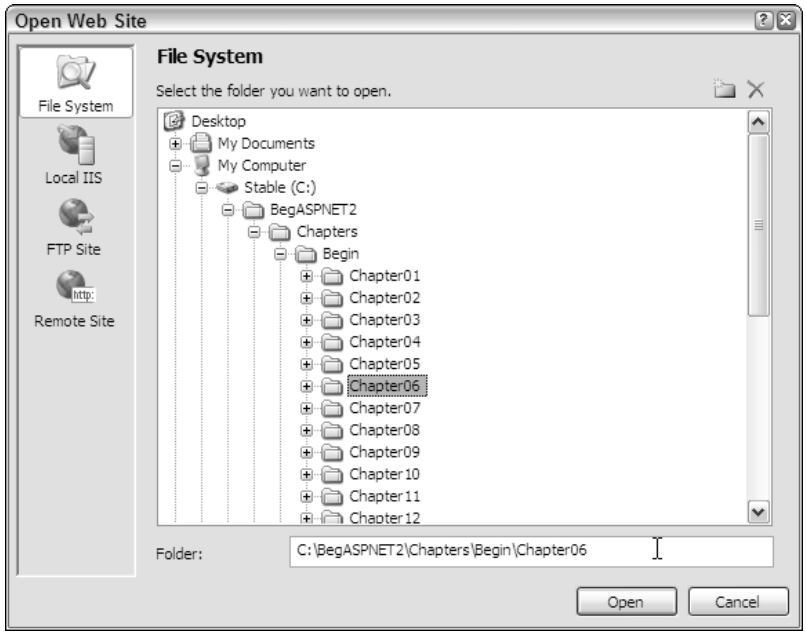


Figure 6-4

2. Open the `Default.aspx` file and switch from Source View to Design View.
3. Drag a `Label`, a `TextBox`, and two `Button` controls onto the page, so that it looks like Figure 6-5.

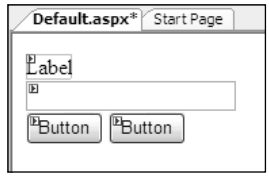


Figure 6-5

4. In an empty area of the page, double-click the left mouse button to load the code file associated with the page and create an empty event procedure for you, as shown in Figure 6-6.

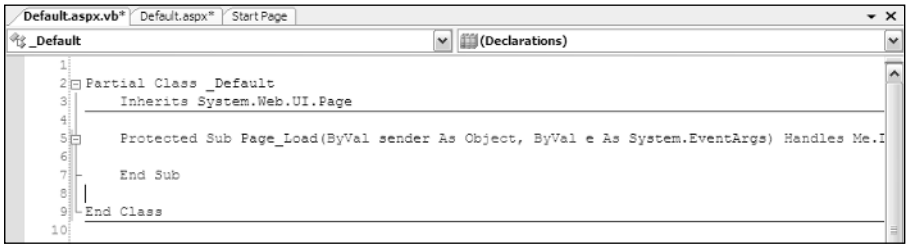


Figure 6-6

5. Switch back to the page design and double-click the first button, `Button1`. The event procedure for this button is created (see Figure 6-7), underneath the event procedure for the page.

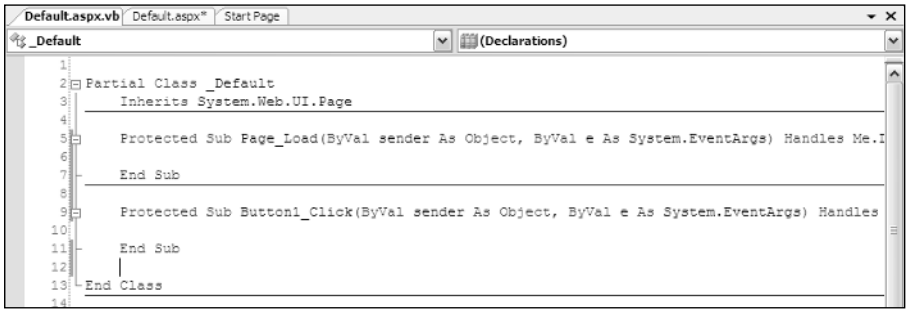


Figure 6-7

6. At the top of the code window, click the drop-down list on the left and select `Button2`. From the drop-down list on the right, select Click to add another event procedure to the file, as illustrated in Figure 6-8.

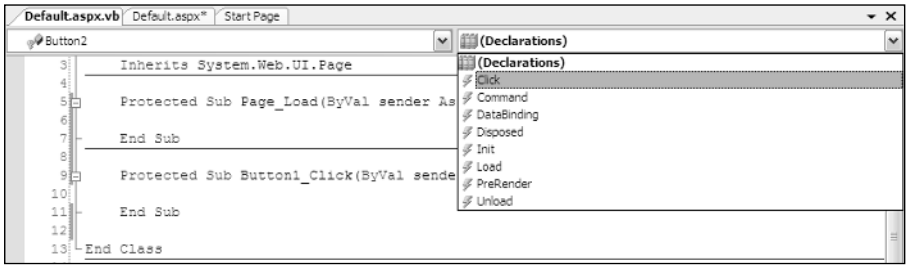


Figure 6-8

7. In the `Page_Load` event procedure, add the following line of code:

```
Label1.Text = "You entered " & TextBox1.Text
```

The event procedure will now look something like this (it may be slightly different because the following code has been wrapped to fit on the page):

```
Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs)
                       Handles Me.Load
  Label1.Text = "You entered " & TextBox1.Text
End Sub
```

8. In the `Button1_Click` event, add the following line of code:

```
TextBox1.Text = "You clicked button 1"
```

9. In the `Button2_Click` event, add the following line of code:

```
TextBox1.Text = "You clicked button 2"
```

10. Press F5 to run the example. Click OK if the Debugging Not Enabled dialog appears, accepting the default selection for adding a new `Web.config` file with debugging enabled. This is shown in Figure 6-9 and will only appear if debugging is not enabled, so clicking the OK button enables debugging and stops the dialog from appearing again. You may also receive another dialog or pop-up from a firewall if you have one running; this might be to warn you that a program is trying to access the Internet and if you have an option you should allow the access.

Figure 6-9

11. When the browser window appears you'll see a screen similar to Figure 6-10. Don't worry if the numbers after `localhost` are different, because VWD picks this number.

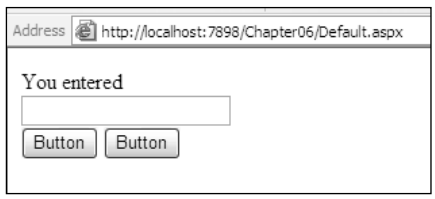


Figure 6-10

Notice that the label has the text you set in the `Page_Load` event, but nothing else.

12. Enter your name into the text box and click the first button. For example, I entered Dave because that's my name, so the figures show Dave. Now the label has the text you entered (as shown in Figure 6-11), but the text box has the text set from the `Button1_Click` event.

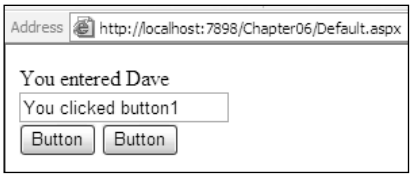


Figure 6-11

13. Now click the second button. Figure 6-12 shows that the label text has changed to what the text box contained in the previous step, and the text box contains the text from the `Button2_Click` event.

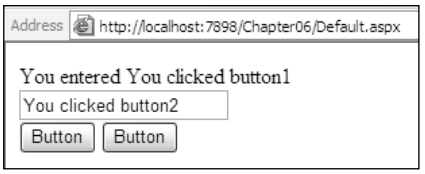


Figure 6-12

14. Now click the first button again, and you'll see something similar to Figure 6-13.

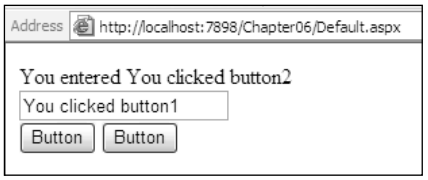


Figure 6-13

How It Works

Take a look at how this works, starting with the `Page_Load` event.

```
Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs)
                        Handles Me.Load
```

This is known as the *declaration*, and tells you lots about the procedure. It has three main areas: the bits before the parentheses, the bits within them, and the bits after them. So at the beginning of the line you have the following:

```
Protected Sub Page_Load
```

- `Protected` tells you about who can use the procedure. In this case it means that only other programs within the same class can use this procedure. You don't need to worry about this for now; Chapter 9 looks at this in more detail.
- `Sub` tells you that this is a subroutine, and that it doesn't return a value. That means ASP.NET can simply call this and not expect anything back.
- `Page_Load` is the name of the event procedure. The name of event procedures can be anything, but you'll find certain standard usages appearing that are descriptive of the actual event. The `Page_Load` event is very descriptive because this event procedure will be used whenever the page is loaded into ASP.NET for processing.

Next you have the middle section; these are the parameters. There are two parameters, separated from each other by a comma:

```
ByVal sender As Object, ByVal e As System.EventArgs
```

The parameters are simply variables that get passed into the event procedure by ASP.NET. Chapter 9 covers variables in more detail, so the actual syntax isn't explained here, but some details are worth knowing. By and large all events in ASP.NET have two parameters. The first, typically called `sender`, is the object that raised the event. In this case it is the actual page, because the page is saying "Hey, I've loaded and you can do your stuff now." For other events, such as those that buttons raise, the sender would be the button. The second parameter, `e`, is any additional information that the event procedure might need. For the `Page_Load` event there is no additional information, but later in the chapter you'll look at events where you do need some extra detail. Neither of these arguments is needed for your event procedure, but they are provided by ASP.NET in case they are required.

The last part of the event procedure indicates which event the procedure is handling:

```
Handles Me.Load
```

This is how you actually hook into the event handling. When the page loads it raises its `Load` event, and any procedure that handles that event will be called. If you didn't have this `Handles` statement, `Page_Load` would simply be a procedure, not an event procedure. So it's not the name of the procedure that's important, it's the `Handles` keyword and the name of the actual event; they tell ASP.NET that when the `Load` event of the page is raised, this procedure should be run. The use of `Me` simply indicates the current page.

Now that you've actually hooked your procedure into the event handling system of ASP.NET, you can run your own code:

```
    Label1.Text = "You entered " & TextBox1.Text
```

This line of code simply sets the text for the label to some static text plus whatever text was entered into the text box. Don't worry too much about what the ampersand (`&`) means — Chapter 9 looks at that sort of thing in more detail.

Here are the event procedures for the buttons:

```
Protected Sub Button1_Click(ByVal sender As Object, ByVal e As System.EventArgs)
                           Handles Button1.Click
  TextBox1.Text = "You clicked button 1"
End Sub
```

The declaration is very similar to the `Page_Load` one, apart from the name of the procedure and the event being handled. This time the event is the `Click` event on the button. Within the event procedure you simply set the text of the text box. The event procedure for the second button is similar, but with the obvious changes of the names and text.

Now look at what happens when the examples are run. When the page is first loaded, the `Page_Load` event procedure runs and the text for the label is set. However, because there is no text in the text box, the label only has "You entered" as its text. When you enter some text into the text box and click the first button, the page is loaded again, so the `Page_Load` event procedure is run, followed by the `Button1_Click` event procedure. So the text you entered into the text box is displayed in the label, and then the text box has new text set from within the `Button1_Click` event procedure. The important thing to note is that both event procedures run; the `Page_Load` event procedure will always be before event procedures for controls on the page.

This process is repeated as you continue to click the buttons.

The Postback Architecture

One of the problems you might have spotted is that the `Page_Load` event always runs, even when a button is clicked. There may be times when you want code to run when the page is first loaded, but not when buttons are clicked. For example, consider the previous example, where you displayed the contents of a text box in a label. When the page first loaded there was nothing in the text box so your label text was incomplete. The next Try It Out corrects this.

Try It Out — Checking for Postback

1. If you are still running the browser from the previous example, close it.
2. In Visual Web Developer, change the `Page_Load` event procedure so that it looks like this:

```
Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs)
                        Handles Me.Load
  If Page.IsPostBack Then
    Label1.Text = "You entered " & TextBox1.Text
  End If
End Sub
```

3. Save the page and press F5 to run it. Notice that the label text is `label` – this is the default text for a `Label` control and you didn't change it when you placed the `Label` on the page. Enter some text and click a button, and you'll see that the label now has text. Close the browser.
4. Now change the `Page_Load` event to this:

```
Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs)
                        Handles Me.Load
    If Page.IsPostBack Then
        Label1.Text = "You entered " & TextBox1.Text
    Else
        Label1.Text = "Enter some text and press a button"
    End If
End Sub
```

5. Save the page and press F5 to run it. Now you have this more useful, new text when the page first loads, and different text when a button is pressed.

How It Works

Having different text at the first page load from subsequent page loads works because the ASP.NET page has a property called `IsPostBack`, which identifies whether or not the page has been posted back to — that is, whether a button has been pressed. If so, `IsPostBack` will be true. If it's the first time the page has loaded — that is, a button has not been pressed — `IsPostBack` will be false.

In the first code change you only displayed text if `IsPostBack` was true — if a button had been pressed. The second code change had different text for the two different situations.

It is important to know that this postback design only works when you are dealing with a single page, because `IsPostBack` gets reset when you move to another page. Consider two pages, Page1 and Page2, each with a `Page_Load` event procedure and a `Button1_Click` event procedure for a button. They also have a hyperlink to each other, allowing you to jump between the pages. You start with Page1, the `Page_Load` event procedure runs, and `IsPostBack` is false. You press the button and the `Page_Load` event is run again, followed by the `Button1_Click` event; in both event procedures `IsPostBack` would be `True`. You click the link to jump to Page2 and the `Page_Load` event procedure on that page runs, and `IsPostBack` in the `Page_Load` event on Page2 is `False`. Now you click the link to jump directly back to Page1, where the `Page_Load` event runs once more, but this time `IsPostBack` is `False` as well. The use of `IsPostBack` only works when you remain on the same page, so don't think that "the first time the page is loaded" means the very first time. The following table might help to make this clear.

Action	Page	Control	Events	IsPostBack
Page loads	Page1		`Page_Load`	`False`
Button clicked	Page1	`Button1`	`Page_Load` `Button1_Click`	`True`
Navigate to Page 2	Page2		`Page_Load`	`False`
Navigate to Page 1	Page1		`Page_Load`	`False`

What Events Are Available?

In the first example in this chapter you created event procedures in different ways: by double-clicking the page and control, and by selecting the event from a drop-down list. The questions that might be

poised on your lips are what events are there, how can I find the events, and which events should I use? Well, the first two questions can be answered in the same way, and there are several places to look.

In order to find out what events are available, you can use the code editor window in Visual Web Developer. The left-hand drop-down list shows the controls on the page, as well as an entry for the page itself. Selecting the page or a control causes the right-hand drop-down list to be filled with the events for the selected control (see Figure 6-14 — you can't actually get both lists to drop down at once; we've done this to make it clearer to see). Selecting the event creates the empty event procedure, or shows the event procedure if it has already been created.

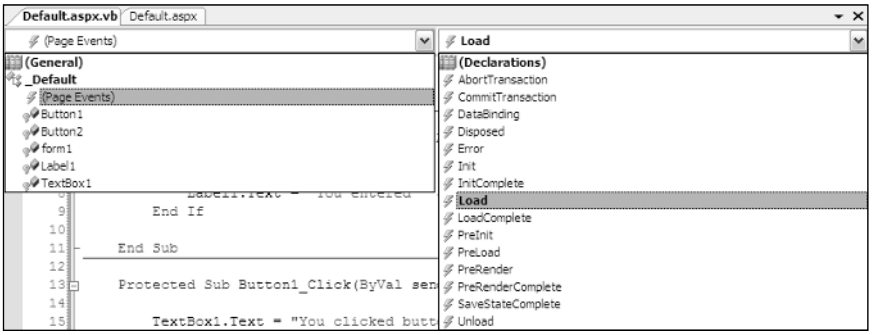


Figure 6-14

You can also use the Properties area on the page designer. Above the list of properties is an icon that looks like a lightning bolt; clicking this icon shows a list of events for the control, as shown in Figure 6-15. If you double-click in the space to the right of an event, the code window will be displayed and the event procedure created for you, or like the code window selection, you'll be shown the event procedure if it already exists. By and large the events you'll be interested in will be grouped under Action or Data.

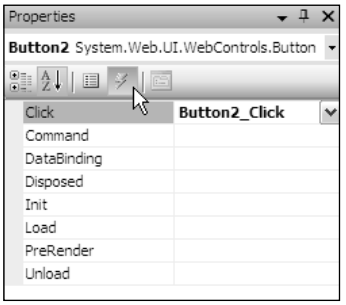


Figure 6-15

The other place to find a list of events is in the Help files, where details of each event and what they are used for is listed.

Which Events Should I Use?

If you start looking into the events that are available you'll soon realize that there are quite a few, and it's not always obvious which ones should be used. The following table details some of the most common controls and events; this isn't all of them, just the ones you'll find most useful.

Control	Event	Is raised when . . .

`Button`
`LinkButton`
`ImageButton`
	`Click`	The button is clicked.

`DropDownList` `ListBox`	`SelectedIndexChanged`	The selection on the list changes. This is useful for performing some action based on the new selection.
`CheckBox` `RadioButton`	`CheckChanged`	The status of the `CheckBox` or `RadioButton` changes. That is, when they either become checked or unchecked.
`CheckBoxList` `RadioButtonList`	`SelectedIndexChanged`	The selection on the list changes.
`Calendar`	`SelectionChanged`	The selected date is changed.
	`VisibleMonthChanged`	The month is changed.
`Login`	`Authenticate`	The user is authenticated.
	`LoggedIn`	The user has logged in.
	`LoginError`	There is an error during the login process.
`DataList`	`DataBound`	An item is taken from a database and bound to the list.
`GridView`	`RowDeleting`	The current row is being deleted.
	`RowUpdating`	The current row is being updated.
	`SelectedIndexChanged`	The selected row has changed.
`SqlDataSource`	`Deleted`	A row has been deleted from the set of data.
	`Inserted`	A row has been inserted into the set of data.
	`Updated`	A row has been updated in the set of data.
`Menu`	`MenuItemDataBound`	An item is being bound to the menu.

Some of these are fairly obvious in their usage. For example, you've already seen the `Click` event of the button, and you can see that all of the button type controls have that same event. So if you don't want to have a standard button, but want to maybe have an image instead, you still use the `Click` event. Give this a try in the following Try It Out, but this time you'll use a different method for hooking into the event.

Try It Out Manually Creating Events

1. If you have a running browser window, close it, and open `Default.aspx` in Visual Web Developer.
2. Create a Regular Folder called Images under the web site. You can use the right-click Add Folder menu on the web site for this, as shown in Figure 6-16.

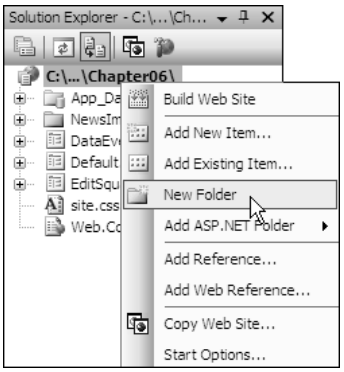


Figure 6-16

3. Copy `AddToCart.gif` from the Images folder of the Wrox United site and place it in the Images folder you have just created.
4. In Design View place an `ImageButton` on the form, and set the `ImageUrl` property to `~/images/AddToCart.gif`.
5. Select the `TextBox` and change the `Columns` property from `0` to `50`.
6. Switch to Source View and locate the `ImageButton` control. Change the declaration so that it looks like this:

```
<asp:ImageButton ID="ImageButton1" runat="server"
  OnClick="ImageButton_Click" ImageUrl="~/images/AddToCart.gif" />
```

7. Open the code file, `Default.aspx.vb`, and add the following code, just before the `End Class` statement:

```
Protected Sub ImageButton_Click(ByVal sender As Object, _
                    ByVal e As System.Web.UI.ImageClickEventArgs)
  TextBox1.Text = "You clicked the ImageButton at position" & _
                    e.X.ToString() & "," & e.Y.ToString()
End Sub
```

8. Press F5 to run the page. Click several times in the `ImageButton`, moving the cursor so that you click in a different position. Notice how the coordinates of where you click are shown in the text box.

How It Works

The important bit of how this works is in the Source View, where the `ImageButton` control is defined. Here you added the following to it:

```
OnClick="ImageButton_Click"
```

This tells the control that for the `Click` event you want to run the procedure called `ImageButton_Click`. It says `OnClick` because that's the convention for ASP.NET events. For each event there is usually a corresponding property that starts with `On` — this allows the events to be defined on the control as well as in the code. It's just two ways of doing the same thing. For the standard `Button` controls you used `Handles` on the end of the event procedure declaration, but for the `ImageButton` you used the `OnClick` property to define the event procedure.

Within the code file, the event procedure declaration is similar, but the second parameter is different from the type you've seen before:

```
Protected Sub ImageButton_Click(ByVal sender As Object, _
                    ByVal e As System.Web.UI.ImageClickEventArgs)
```

For the `Button`, the second parameter was `System.EventArgs`, but for the `ImageButton` it is `System.Web.UI.ImageClickEventArgs`. Remember that the second parameter can be used by ASP.NET to pass extra information into the event procedure, but for `Button` controls there was no extra information. For an `ImageButton` there is extra information, so the parameter is different — in this case it contains the `X` and `Y` coordinates of where on the image the mouse was clicked. You simply display these coordinates in the text box. You don't actually need these coordinates, but this is a great example of parameters having extra information.

A parameter name other than `System.EventArgs` *is actually a good indication that additional information may be available to you in the event procedure. You can find out what that information is by simply typing* `e.` *in the code window and looking at the IntelliSense that pops up.*

Events Aren't Triggered by Users Only

So far in this chapter the events you've seen have been explicitly generated by the user, by way of clicking a button. Some events, however, are generated in other ways. Some are indirectly generated by the user, perhaps by way of updating some data, and others are generated directly by ASP.NET. You can use the events regardless of how they are generated, and in this section you see how you can do this.

You're going to create some events from data in a database, and although data has not been covered yet, it's the events that are important. First, have a look at the news items on the Wrox United site (see Figure 6-17), found under the About➪News menu item.

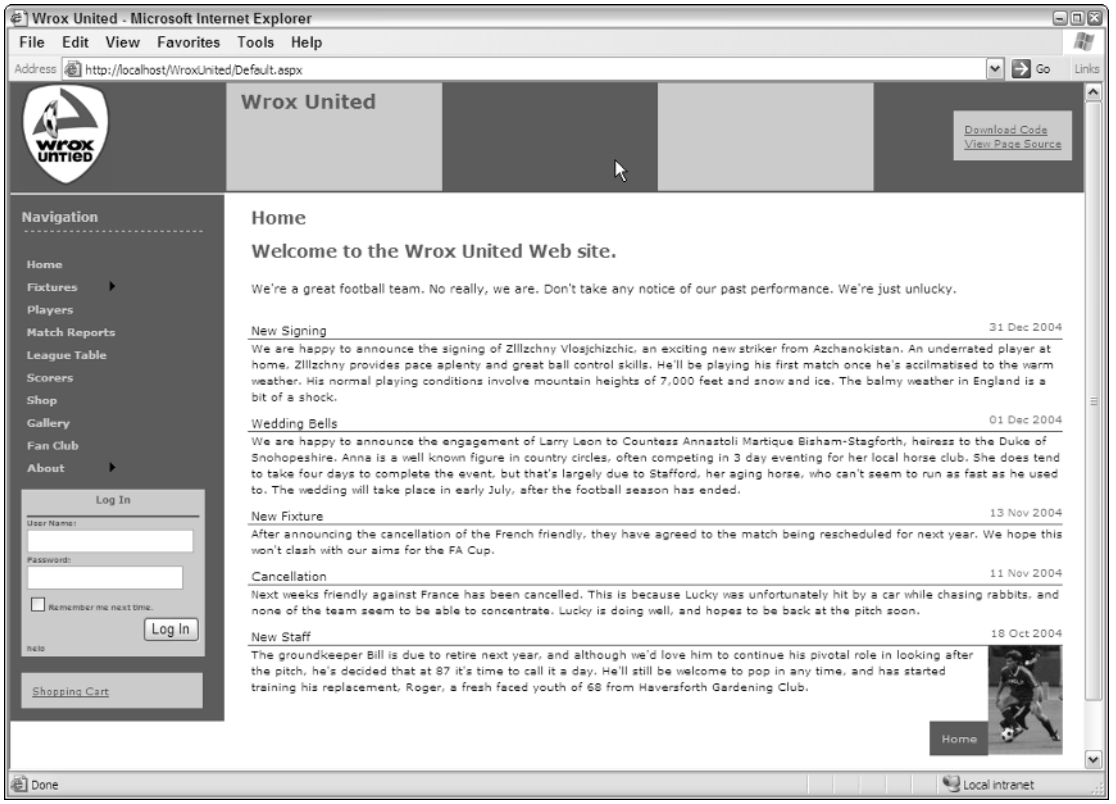


Figure 6-17

Here you can see that not all of the news items have a picture. In the following Try It Out, you see how the news items can be customized, by responding to events generated by controls that fetch data. You'll make sure that an image is only visible when there is a picture associated with the news item.

Try It Out Data Events

1. Close any open browser windows.
2. In Visual Web Developer open the `DataEvents.aspx` file from the Chapter06 web site.
3. Right-click the mouse button anywhere on the page, and select View in Browser from the menu that appears. You'll see a screen similar to Figure 6-18.

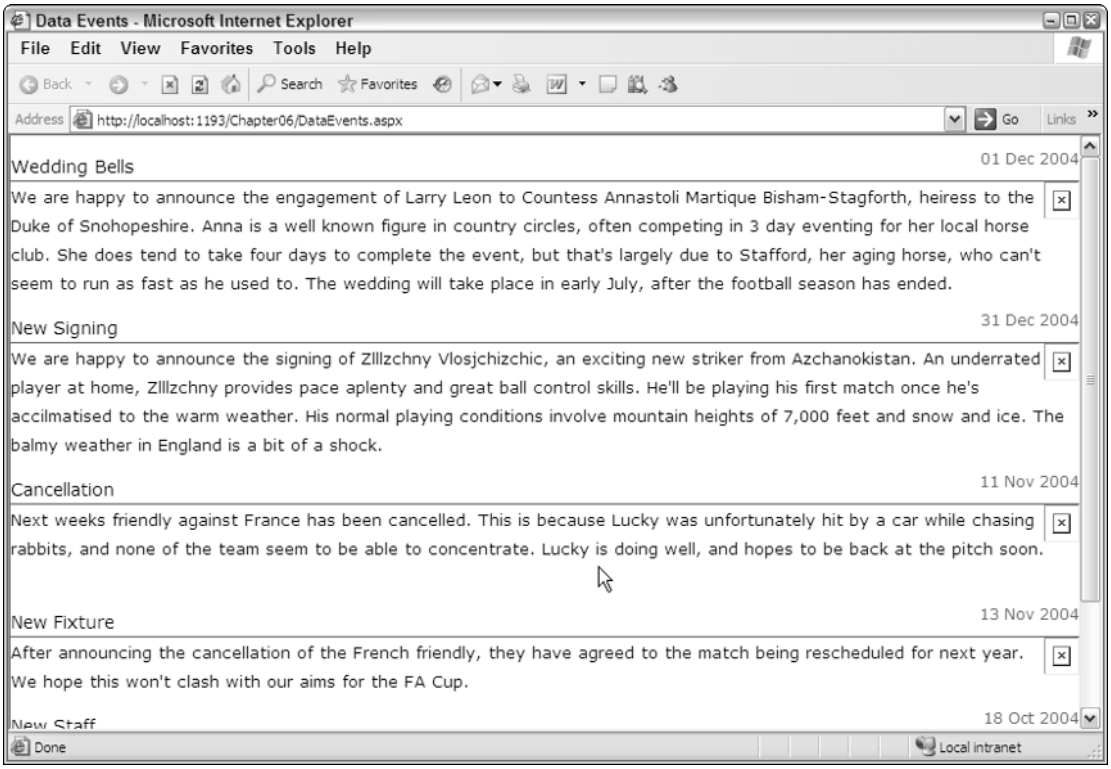


Figure 6-18

Notice that not all of the news items have images. For those that don't there is a small image with a red cross in it, indicating that the image is missing; this is the default. You need to modify the page to use events, so that if there is no image for the news item, that red cross isn't shown.

4. Close the browser and switch to Design View in Visual Web Developer.

5. Select the `DataList` control. There are only two controls on the page: `SqlDataSource` and `DataList`. The `DataList` control is bound to a database, so it shows Databound items — simply click anywhere on this control to select it.

6. From the Properties box, select the events and double-click into the `ItemDataBound` event. Don't enter any text, just double-click, and this will open the code editor and create the empty event procedure for you.

7. Add the following code in the empty event procedure:

```
Dim row As DataRowView
Dim img As Image

If e.Item.ItemType = ListItemType.Item Or _
   e.Item.ItemType = ListItemType.AlternatingItem Then

  row = DirectCast(e.Item.DataItem, DataRowView)

  If row("PictureUrl").ToString().Trim() = "" Then
     img = DirectCast(e.Item.FindControl("NewsImage"), Image)
    img.Visible = False
  End If

End If
```

8. Save the pages and switch back to the Design View of the page. Right-click the page and select the View in Browser menu item to view the page in the browser. Notice how the red cross images have disappeared.

How It Works

Before looking at the code you need to understand how HTML handles images. The image is created with an `img` tag, like so:

```
<img src="ImageName.gif"></img>
```

When the browser receives this HTML it displays the image, or that red cross if the image isn't found. When you use server controls for images, you use an `Image` control:

```
<asp:Image ImageUrl="ImageName.gif" runat="server" id="Image1"></Image>
```

This renders the same HTML as the first example. So if there's no physical file you get that red cross, which is exactly what's happening on this page; you need some way to not show the red cross image if there's no picture associated with the news story.

In the `DataEvents.aspx` page you use an `Image` server control, but the value for the `ImageUrl` property is fetched from a database. Databases are covered in the next two chapters, so it's not important to know how this works just yet. The important point is to realize that as each row of data (a news item) is fetched from the database it is bound to the `DataList`, which means that there will be an item in the `DataList` for each row in the table fetched from the database. Each row of data contains different bits of the news: the title, the description, and what you're really interested in for this example, the picture name. But not every news item has a picture, so you have to check to see if the database has a picture and if it doesn't, you make the `Image` control invisible. Take a look at the code that makes this possible.

First, you have the `ItemDataBound` event itself:

```
Protected Sub DataList1_ItemDataBound(ByVal sender As Object,
              ByVal e As System.Web.UI.WebControls.DataListItemEventArgs)
              Handles DataList1.ItemDataBound
```

This event is raised when a row from the database is bound to a server control. Like the `Click` event of the `ImageButton`, the `ItemDataBound` event of the `DataList` supplies extra information to the event procedure in the form of the second parameter. This contains information about the row being bound, and contains a property called `DataItem`, which itself contains three properties:

- `DataItem`: The actual data item from the database.
- `ItemIndex`: The index number of the item being bound. This starts at 0 and increments by one for each row.
- `ItemType`: The type of the item in the `DataList`. This will be one of the following: `AlternatingItem`, `EditItem`, `Footer`, `Header`, `Item`, `Pager`, `SelectedItem`, or `Separator`.

The `ItemType` is used to determine what type of row item you are on. For example, if data is being bound into the header row, the `ItemType` would be `Header`. For the actual rows in this example, the `ItemType` will be `Item` or `AlternatingItem` (for each row and every other row). So your code, shown here, simply checks the `ItemType`, so you only work with the rows you are interested in:

```
If e.Item.ItemType = ListItemType.Item Or _
   e.Item.ItemType = ListItemType.AlternatingItem Then
```

Next you can use the `ItemType` to access the actual data being bound to the `Image` control, so you can check to see if there is any data for the image. First, you extract the actual row of data — don't worry about the exact details of this code; data and data conversion are covered in the next few chapters. What's important to remember is that `e.Item.DataItem` is the actual data from the database for this row, and you check to see whether the `PictureUrl` column is empty:

```
row = DirectCast(e.Item.DataItem, DataRowView)

If row("PictureUrl").ToString().Trim() = "" Then
```

If the `PictureUrl` column is empty, you want to access the `Image` control and make it invisible. Here you again use `e.Item`, but this time to find the `Image` control (`NewsImage`), and set its `Visible` property to `False`:

```
img = DirectCast(e.Item.FindControl("NewsImage"), Image)
img.Visible = False
```

Several things in this example have not been explained fully because they are covered in more detail later in the book. Data binding and databases are covered in Chapter 7, and data conversion (using `DirectCast`) and the use of `FindControl` are covered in Chapter 9. You don't need to understand how these work at the moment, because the important thing is to know what is possible. In this case, you are seeing that an event is raised when an item from the database is bound to a server control. This event provides information about the underlying data and the row on the server control, thus giving you a lot of information.

This technique is also used on the menu. Chapter 3 looked at the navigation controls such as the `Menu` and `SiteMapPath` controls. One of the issues we have with the Wrox United web site is that we wanted the `SiteMapPath` on every page, which means that every page has to be in the `SiteMap` file as XML nodes. However, we don't want all of the pages to appear in the `Menu`. For example, we don't want users to navigate directly to the Checkout page, because we only want them to access it from the Shopping Cart page. The problem we have is that we can have an item that appears in the `SiteMap` and `SiteMapPath`, but that doesn't appear in the `Menu` — the navigation framework doesn't cater for that situation. So we have to cheat.

What we do is use the `MenuItemDataBound` event in the master page (`site.Master`), as shown here:

```
Protected Sub MyMenu_MenuItemDataBound(ByVal sender As Object,
                    ByVal e As System.Web.UI.WebControls.MenuEventArgs)

    Dim text As String = e.Item.Text

    If text = "Checkout" Or text = "Shop Item" Or _
       text = "Shopping Cart" Then
        e.Item.Parent.ChildItems.Remove(e.Item)
    End If

End
```

As each menu item is taken from the `SiteMap` file and bound to the menu the `MenuItemDataBound` event is raised. Within this event procedure we check to see if the menu text is one of the pages we don't want to show, and if it is we remove the item from the menu. This means that the item still retains its place in the navigation structure, but that it won't show on the menu.

So you can see that events raised by ASP.NET are extremely useful. Despite the fact ASP.NET takes care of the data binding and display of data for us, we still have access to what's happening. The next section looks at another example, where events are raised indirectly by the user.

Indirect Events

Indirect events are raised by ASP.NET, but because of some action that the user took. For example, have a look at one of the administration pages, where the team owner can change the players in the squad, as shown in Figure 6-19.

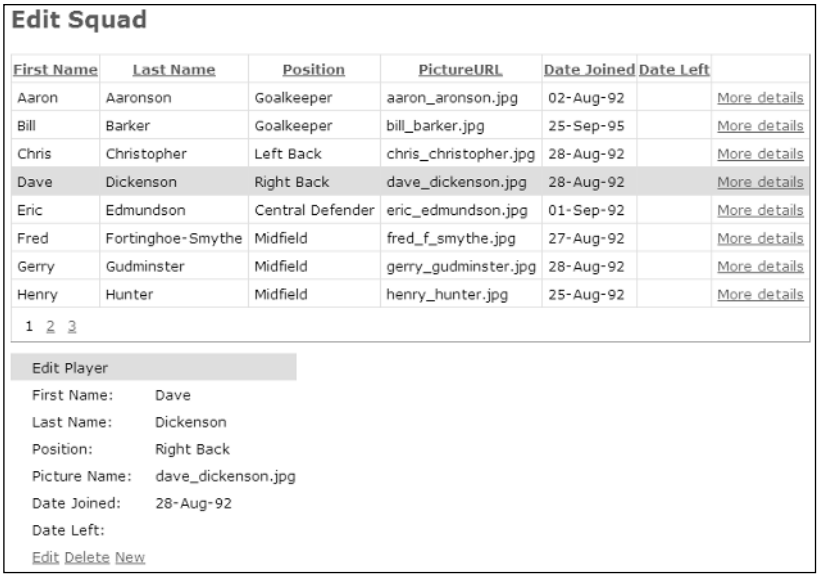


Figure 6-19

Here there are two visible controls: the `GridView` at the top, showing all players, and the `DetailsView` at the bottom where the player details are edited. One of the things you have to do is make sure that the `GridView` is updated when the player details are changed. The following Try It Out shows how you can do this.

Try It Out Indirect Events

1. In the Chapter06 web site in Visual Web Developer, open the `EditSquad.aspx` page.
2. Click the right mouse button and select View in Browser from the menu.
3. View the player details by clicking the More details link — pick Chris Christopher the Left Back.
4. Click the Edit link to allow the player details to be changed. Change his position from Left Back to Goalkeeper and click Update. Notice how the details show him as Goalkeeper, but the grid still shows him as Left Back, as in Figure 6-20.

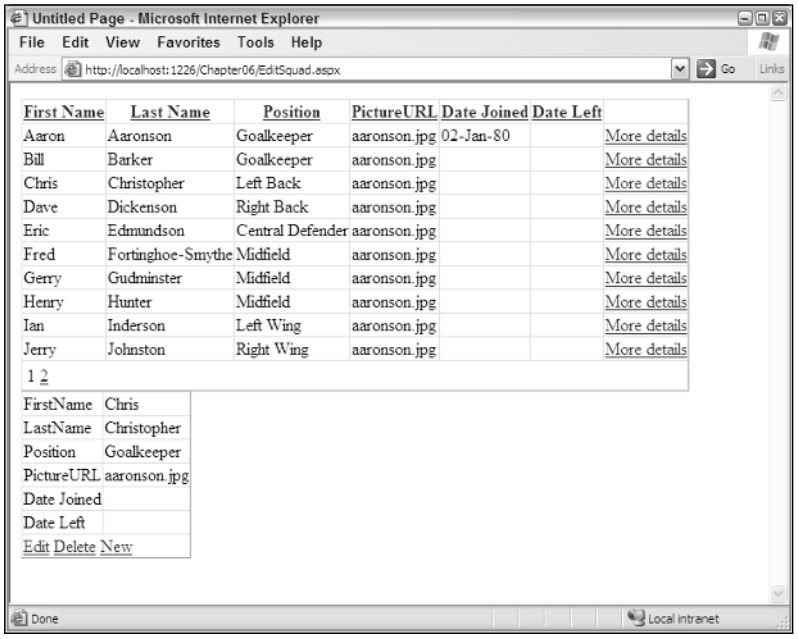


Figure 6-20

You need to change this to make sure that the grid is updated with the new details.

5. Close the browser window and return to Visual Web Developer.
6. Open the `EditSquad.aspx.vb` file, and from the drop-down list at the top-left of the page, select `DetailsDataSource`, and from the drop-down list at the top-right, select the `Updated` event.
7. Add the following line of code into the empty event procedure:

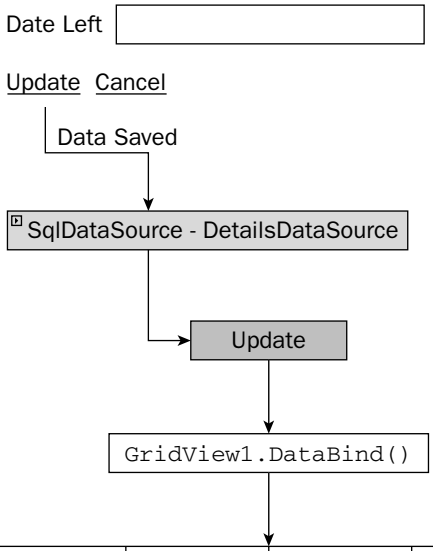
```
GridView1.DataBind()
```

8. Save and close the code file.
9. From the web page, view the page in the browser and repeat the update process, changing the Position of Chris Christopher to Striker. Notice that when you click Update to save the changes the grid also changes.

How It Works

This code is extremely simple, and even though it relies on data binding, it is easy to understand. The key is that the page uses a `SqlDataSource` object, which is responsible for fetching the data from the database and making it available to the grid to display. The `SqlDataSource` control is just like other ASP.NET server controls, except that it doesn't actually display anything. So although it's on the page, nothing is shown to the user.

As well as providing data for the grid to show, the `SqlDataSource` also deals with data edits — inserting new rows, and updating and deleting existing rows, and for each of these actions there are events. One of these events is the `Updated` event, which is raised when the data is updated. So when you click the Update link, the `SqlDataSource` updates the database, and then raises the `Updated` event. The code in the `Updated` event simply tells the grid to rebind its data — to fetch it again and redisplay it. So what you're doing is using multiple controls, with a chain of actions that result in an event, as seen in Figure 6-21.



FirstName	LastName	Position	PictureURL	Date Joined	Date Left	Date Left
Aaron	Aaronson	Goalkeeper	aaronson.jpg	02-Jan-00		More details
Bill	Barker	Goalkeeper	aaronson.jpg			More details
Chris	Christopher	Right Back	aaronson.jpg			More details
Dave	Dickenson	Right Back	aaronson.jpg			More details
Eric	Edmundson	Central Defender	aaronson.jpg			More details

Figure 6-21

You can see that although you can easily construct pages by just dropping controls onto a page and configuring properties, knowing how these controls work is important. Without knowing that the update of the `DetailsView` generated a similar event for the data source, you might spend time trying to work out which event on the `DetailsView` could be used to refresh the grid.

Canceling Events

So far in this chapter you've seen controls raise single events. Both the `Button` control and the `ImageButton` control raise a `Click` event, whereas other controls raise other events. One thing you have probably noticed is that the controls have quite a lot of events that could be raised, and you may not have realized that a single action can raise multiple events. For example, when updating data there is both an `Updating` and an `Updated` event. Likewise, there are pairs of events for adding new data (`Inserting/Inserted`) and for data being deleted (`Deleting/Deleted`). The present tense event (`Inserting`, for example) is raised as the action is occurring, whereas the past tense event (such as `Deleted`) is raised after the event. For example, when deleting a row, the `Deleting` event is raised just before the row is deleted, and the `Deleted` event is raised after the event is raised.

For some events, the fact that they are raised before the actual action takes place gives you the opportunity to cancel the event. For example, consider the `EditSquad.aspx` file, where the team owner can change the squad. One of the things the owner wants is to make sure that any players that left during the playing season remain in the database — so you can't delete players between August 20 and May 31. To enable this, you need to allow deletion of players, but not within those dates. Give this a go in the next Try It Out.

Try It Out — Canceling Events

1. Open the `EditSquad.aspx` file in the Visual Web Developer designer, and add a `Label` control at the very end of the page.
2. Set the `ID` of the `Label` control to `Message`, and clear the `Text` property.
3. View the code file for this page and create an empty event procedure for the `Deleting` event for the `DetailsDataSource`. You can use the drop-down menus at the top of the code file editor to do this, just like you did in the Try It Out for indirect events.
4. In the empty event procedure, add the following code:

```
Dim today As DateTime = DateTime.Now()
Dim startYear As Integer
Dim endYear As Integer
Dim seasonStart As DateTime
Dim seasonEnd As DateTime

If today.Month > 5 Then
  startYear = today.Year
  endYear = today.Year + 1
Else
  startYear = today.Year - 1
```

```
    endYear = today.Year
  End If

  seasonStart = New DateTime(startYear, 8, 20)    ' 20th August
  seasonEnd = New DateTime(endYear, 5, 31)        ' 31 May

  If today >= seasonStart And today <= seasonEnd Then
    e.Cancel = True
    Message.Text = "Cannot delete players during the season"
  Else
    GridView1.DataBind()
    Message.Text = ""
  End If
```

5. Save the file and from the right mouse menu select View in Browser.
6. Make sure your system date is set between August 20 and May 31.
7. Select a player and try to delete him. You'll see a message telling you that players cannot be deleted during the season, and the player is not deleted.
8. Change the system clock so that the date is out of season — that is, between June 1 and August 19.
9. Select a player and try to delete him. You may want to add a new test player just so that you can delete him, to save you deleting real squad members.

How It Works

This example relies on the fact that the `Deleting` event is raised before the actual action takes place, which gives you the opportunity to cancel the event. One of the keys to how this works are the parameters of the event procedure, the declaration of which is shown here:

```
Protected Sub DetailsDataSource_Deleting(ByVal sender As Object,
        ByVal e As System.Web.UI.WebControls.SqlDataSourceCommandEventArgs)
        Handles DetailsDataSource.Deleting
```

You can see that the second parameter provides extra information, but not only that it allows you to send information back to ASP.NET. One of the properties of the parameter `e` is called `Cancel`, and if you set this to `True`, the event will be cancelled and the action (the deletion) will not take place. Take a look at the code used to determine whether or not the player should be deleted.

You start with some declarations, which will be used to store date information:

```
Dim today As DateTime = DateTime.Now()
Dim startYear As Integer
Dim endYear As Integer
Dim seasonStart As DateTime
Dim seasonEnd As DateTime
```

The first line sets the variable `today` to the current date. The variables `startYear` and `endYear` indicate the year in which the season starts and ends, and `seasonStart` and `seasonEnd` are the actual dates for the start and end of the season.

To determine the start and end year you see if the current date is after May. If it is, you know that the season has ended, or is already under way, so the start year is the current year and the end year is next year. If the current date is before May, you are in the second half of the season, so the start year was last year and the end year is the current year:

```
If today.Month > 5 Then
    startYear = today.Year
    endYear = today.Year + 1
Else
    startYear = today.Year - 1
    endYear = today.Year
End If
```

Next you create the actual start and end dates of the season, using the start and end year already set:

```
seasonStart = New DateTime(startYear, 8, 20)    ' 20 August
seasonEnd = New DateTime(endYear, 5, 31)        ' 31 May
```

Now you check to see if the current date falls within the season start and end dates. If it does, you set the `Cancel` property of the parameter `e` to `True`, so when the event procedure ends the event action (the delete) will be cancelled. You also display a message to tell the user that players cannot be deleted during the season:

```
If today >= seasonStart And today <= seasonEnd Then
    e.Cancel = True
    Message.Text = "Cannot delete players during the season"
```

If you are outside of the season, then players can be deleted, so you simply clear any message. Because you haven't set the `Cancel` property of parameter `e` to `True` (it is `False` by default), the action will take place, and the player will be deleted:

```
Else
    Message.Text = ""
End If
```

So what you've seen here is that some events can be cancelled, which allows you to build logic into your applications, enabling you to control the actions that are run. This also means that events that you think will run might not. For example, it was mentioned earlier that some of these events are paired. So, as well as the `Deleting` event, there is a `Deleted` event, and if you cancel the `Deleting` event the `Deleted` event isn't run. The logic of this is shown in Figure 6-22.

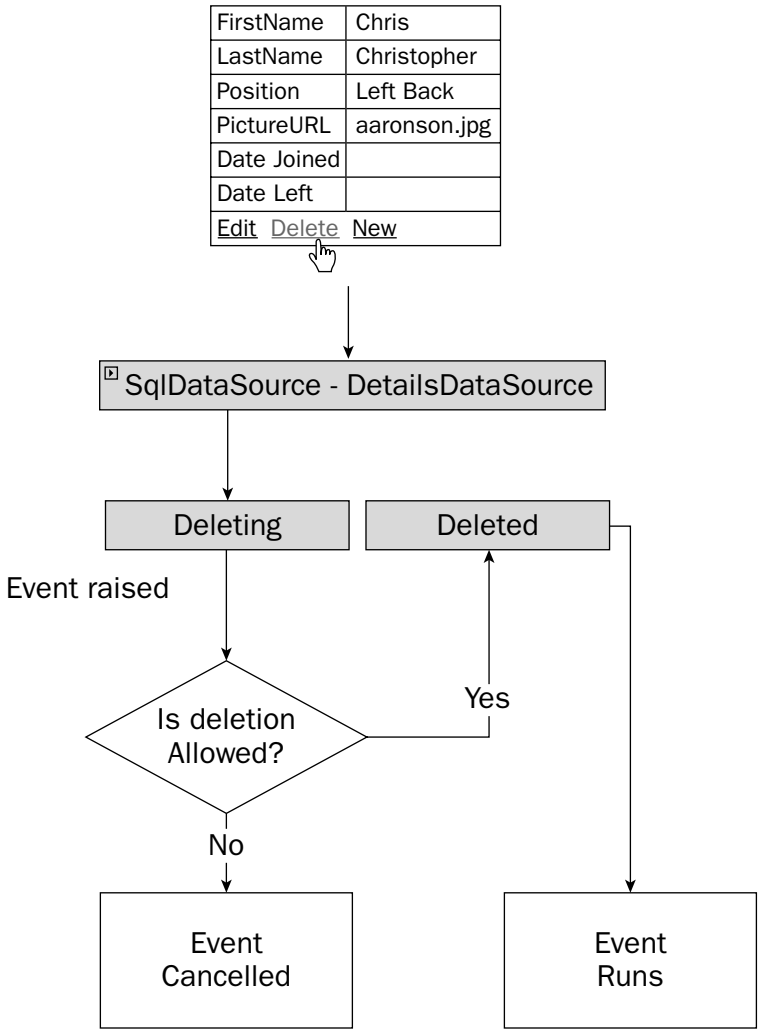


Figure 6-22

This process is also the same for inserted and updated items, where the `Inserting` and `Updating` event procedures are used. In all three cases you can set the `Cancel` property of the parameter to `True` to cancel the event.

Global Events

So far in this chapter you've seen that events are raised by controls or by pages, but there is a third type of event — an *application* event. Application events are raised by ASP.NET in response to certain conditions, and these are stored in the Global Application Class, `global.asax`, a code-only file.

The `global.asax` page has several events:

- `Application_Start`, which is raised when the application first starts. This is when the first user accesses the site and should be used to set any initial start conditions.
- `Application_End`, which is raised when the application stops.
- `Session_Start`, which is raised when a user starts a session. This is when the user starts accessing the site for the first time, and includes the time when a user closes the browser window and opens it again.
- `Session_End`, which is raised when a user session ends. This isn't when the browser window is closed, because sessions have a timeout — if there is no user activity within that time, the session ends.
- `Application_Error`, which is raised when an unhandled error occurs.
- `Profile_OnMigrateAnonymous`, which is raised when an anonymous user logs in, and allows migration of any Profile properties.

You can create a Global Application Class in the same way as adding normal Web Forms, and when created, the first four events in the preceding list will be created for you. They'll have no code, but will be ready for you to add code if you need it.

In the Wrox United application, none of the first four events are used, but the latter two are. The `Application_Error` event is covered in Chapter 15, which looks at error handling, and the `Profile_OnMigrateAnonymous` event is covered in Chapter 11, which looks at the Profile.

Summary

This chapter covered a lot about events, and you've seen that they can be raised under a number of different circumstances. First you looked at the ASP.NET page itself, where an event is raised when the page is loaded, which allows you to take some action before anything is shown to the user. Additionally, this chapter examined the following topics:

- The ASP.NET page has the `IsPostback` property that allows you to identify whether this is the first time the page has been displayed, or whether the user has clicked a button.
- Button controls, where an event is raised when the user clicks the button. You saw that similar types of controls (the `Button` and `ImageButton` controls) have similar events (the `Click` event).
- Events that are raised by ASP.NET itself, both directly (such as the binding of data from a database) and indirectly (such as updating database records). These events give you an opportunity to interact with the process of displaying or updating data, and allow you to fine tune the interface and provide user feedback.
- How some events can be cancelled, thus canceling any action they trigger, such as another event. In the example you saw that you can stop the deletion of data by using an event procedure.

Now that you've had a look at events, and especially some related to data, it's time to look at databases in more depth. The next chapter looks at some of the data controls and shows you how data can be fetched from the database and displayed for easy use by the user.

Exercises

1. In the Chapter06 project create a new Web Form called `Lists.aspx` and add a `ListBox` control to the page, and add three list items with values of `One`, `Two`, and `Three`. Add a `Label` control and a `Button` control to the page. In the `Click` event of the `Button`, display the selected value of the `ListBox` in the `Label`.
2. Modify Exercise 1 so that just selecting an item in the list posts back to the server (meaning you don't need to click the button). You'll need to add an event procedure to the `ListBox`, and in that event procedure you can use the same code from the `Click` event of the `Button` to display the selected value in the `Label`. Hint: The terms postback and automatic might be useful in your hunt for correct properties.
3. Modify the `EditSquad.aspx` example so that the `GridView` is refreshed when a new player is added to the squad. The technique is similar to the code you already have, but you'll need to use a different event. Remember that you can use the drop-down lists in the code view to find the events.

7

Reading Data

The hallmark of dynamic web application pages is the capability to use information from a database. No other capability so widely expands the horizons of functionality for the visitor. The majority of information in an enterprise is held in databases, so it is imperative that a web application representing a business interact with that data. A tremendous effort by the ASP.NET 2.0 development team has reduced the knowledge and lines of code needed to work with data. This chapter and Chapter 8 explain how to implement the data-based features.

This chapter covers several major ideas:

- The theory of using data in ASP.NET 2.0, including a brief overview of the theory and terminology of databases, an introduction to ASP.NET 2.0 data source controls and data-bound controls, and the role of VWD in creating data-based pages
- Data source controls
- Data-bound selection lists
- Various data-bound controls, including `GridView`, `DataList`, `Repeater`, `DetailsView` and `FormView`
- Data source controls with parameters
- Implementing multiple data controls that work together
- Working with XML data

By the end of the chapter you will have the tools and experience to use ASP.NET 2.0 the server side controls for data to present on your pages information that comes from a database.

Introducing Databases

Before starting on the ASP.NET 2.0 data controls, let's take a moment to consider sources of data. Data can be broadly divided into one of three categories. *Relational* data is organized into sets of tables according to rules of normalization. This category includes the data held in Microsoft Access, Microsoft SQL Server, Oracle, SAP, DB2, and MySQL. A second category of data resides in tree structures, such as XML files, the Windows registry, and the Windows file system. Last, data can be held in a wide range of miscellaneous types, such as Excel files, text files, or proprietary formats. This book (as per the vast majority of web site data interaction) discusses relational data and XML files.

Relational databases divide information into *tables*, and the tables contain *records* (also called rows). A record represents one instance of the topic of the table. A table contains multiple *fields*, or columns, that organize values by their type. For instance, a table of employees could contain a record for each employee. The table's columns may be NameFirst, NameLast, DateOfHire, and so forth. For each column there would be a value for each record. A group of tables makes a database in most management systems. In Microsoft SQL Server, which is used in this book, one or more databases together make an instance of the server. Typically, tables contain only the data. The description of how the data is organized, the names of fields, and restrictions all reside in a separate structure of the database called metadata.

XML files are different from relational databases. First, instead of tables, the data is organized into a tree with branches of the tree holding finer and finer points of data. Each set of data and each individual datum is contained in a node. For example, an Employees XML file would have an Employees node that would represent the main trunk. Then there would be a limb for each employee. From that limb would be branches for FirstName, LastName, and so on. Second, an XML file is self-describing in that the metadata is included with the data. Each piece of information has an HTML tag that acts like a container that states the description of that data. For example, a datum like "John" would actually be stored as `<NameFirst>John</NameFirst>`. Although the self-descriptors can make an XML file huge, they make it easy to understand the data without having the metadata information.

Almost all sources of data will have a system that controls who is allowed to use the data. The first step in security is authentication, wherein the system determines who is asking to use it. The topic of authentication is covered in detail in Chapter 4, so we won't spend much time on it here. Basically, there are two types of authentication: Windows Authentication (also known as Trusted Security) and SQL Authentication. The decision of which authentication to use is made when the database is installed. With SQL Server Express, you have the option of Windows Authentication or Mixed, which means you can use either Windows Authentication or SQL Authentication. SQL Server Express installs, by default, with Mixed Authentication. This book accepts the default of Windows Authentication.

> *This book mainly uses Microsoft's SQL Server. The product is sold with different sets of features, but for our use the simplest version (SQL Server Express) is adequate. Fortunately, Microsoft provides SQL Server Express free of charge, and automatically installs with the instructions given in this book for the setup. The beauty of SQL Server Express is that when you go to deploy your site to the public, all of your code will fit without modification into the full-featured SQL Server.*

Once you have been authenticated (you prove that you actually are who you say you are), there will probably be a set of rights and limitations for your use of the data. First are restrictions in how you can look at data. Database administrators (DBAs) generally restrict direct access to tables. Instead, data may only be available to you through a view or query that contains limited fields or records. Second, you

may have limits on how (or if) you can change data. Last, even if you have the right to change data there may be restrictions (called constraints) on how data can be changed. To use Wrox United as an example, you generally cannot delete a team that is listed in the schedule (thus leaving the schedule with the logical fault of a game without an existing team).

Using ASP.NET 2.0's Data Controls

Chapter 3 presented the idea that ASP.NET offers server-side controls. These controls contain code written by Microsoft that offers various behaviors, such as a drop-down list or a button. ASP.NET 2.0 has two sets of controls that are specific to working with data. The first set is *data source* controls that allow a page to connect to a source of data and to read from and write to that source. However, a data source control has no means to display data on an ASP.NET 2.0 page, which is where *data-bound* controls come into play. Data-bound controls display data to the user by rendering data onto a page. This chapter discusses data source controls and the reading behaviors of data-bound controls.

Almost all data source controls can work with almost all data-bound controls. This gives designers a mix-and-match solution. Pick the data source control that is optimized for the data and then pick a data-bound control that displays the information as desired.

Introducing Data Source Controls

ASP.NET 2.0 ships with several types of data source controls that are tailored to work with different types of data sources. These controls are as follows:

- The `SqlDataSource` control allows connections to most relational databases. The `Sql` in its name refers to databases that understand the SQL language. That includes almost every kind of database that holds its data in a relational format. Note that the `Sql` does not refer only to the Microsoft SQL Server database management system. `SqlDataSource` controls utilize one of several *providers* that are specific to different kinds of databases. The default provider is for Microsoft SQL Server. Another provider is for Oracle. Both of these are written in managed code, the most robust option in the .NET Framework. ASP.NET 2.0 contains an additional provider that can communicate with any database that is OLEDB-enabled (OLEDB is an acronym for Object Linking and Embedding for Databases). Because OLEDB is an old standard, that includes almost every other database management system including IBM DB2, MySQL, and SAP. However, the provider for OLEDB connections is not written in managed code. That means it does not meet all the requirements of being .NET technology, but it still can work with .NET. We can expect third parties to publish more data source controls and providers and can hope that they are in proper managed code.

If you begin writing more advanced scenarios you will discover that OLEDB data source controls are not part of the `System.Data` hierarchy. These controls actually reside in the `System.Web.UI.Controls` namespace. But this point does not arise for most scenarios where you can just drag data controls from the toolbar.

- The `AccessDataSource` control is a special case of the `SqlDataSource` control that contains a provider optimized for Microsoft Access.
- The `XMLDataSource` control allows connection to XML sources.
- The `SiteMapDataSource` control, a specialized form of the `XMLDataSource` control, is optimized for the specific architecture of the ASP.NET 2.0 web application site map (as you built in Chapter 2).
- The `ObjectDataSource` control connects to business objects you build yourself (discussed in Chapter 10).

Regardless of which data source control (and in the case of the `SqlDataSource`, which provider), the data source control will enable a set of behaviors for your ASP.NET 2.0 page. These include a connection to the database and enablement of behaviors such as reading and writing data. These behaviors will be available to data-bound controls that display data and receive input from the user.

> **If you are familiar with older version of ASP, the ASP.NET 2.0 data source controls instantiate ADO.NET objects. Therefore, ADO.NET provides the underlying technology for data access. The creation and manipulation of ADO.NET objects for most scenarios is now handled automatically (and correctly and efficiently) by the higher-level data source control objects.**

In summary, the data source controls create the background infrastructure needed to use data. However, they do not create any rendering on the web page (see the next section for those capabilities). Rather, they make the data behaviors like reading and writing to data stores available to data-bound controls.

Introducing Data-Bound Controls

Data-bound controls provide the link between the data source controls and the user. They take the data and behaviors of the data source control and render it to the visitor. This division of labor works very well. You can select any data source control and link that to any of the data-bound controls. With just a few exceptions, it is a mix-and-match scenario.

Data-bound controls encapsulate remarkable amounts of behavior. For example, the `GridView` control can not only display data in a table, but it offers sorting, selecting, paging through sub-sets, and one-click transition to data editing. If your needs extend beyond these capabilities, you can write custom code hooked into events exposed by the `GridView` control.

There is one constraint on the compatibility of data source controls and data-bound controls. Each control is optimized for tabular data, tree data, or custom class data. For example, XML data is organized as a tree and thus best accessed with the `XMLDataSource` control and displayed in `Menu` or `TreeView` data-bound controls. SQL Server data is organized into tables and thus accessed with the `SqlDataSource` control and displayed in `GridView` (tables) or `DetailsView`. List type data-bound controls can display either source of data. You can twist the controls to cross-utilize types of data, but in general it is best to stick to their intended purpose.

Four general groups of data-bound controls ship with ASP.NET 2.0. Because there is overlap in their functionality, this chapter spends some time differentiating them. First you will look at their renderings, then a comparison chart, and finally a guide to selecting the correct data-bound control for your purposes.

> **Note that other controls, such as text boxes, can be data-bound. However, these independent controls are best connected to data in context of a template within one of the controls just mentioned. This topic is discussed in detail in *Beginning ASP.NET 2.0 Databases* from Wrox, ISBN 0-7645-7081-1 or 0-4717-8134-7.**

The trick with data-bound controls arises in the selection. It can be confusing in the first attempts to get the correct control for your purpose. To help, the following sections organize the data-bound controls into four groups. Later in the chapter you will practice using each of them in a series of exercises.

Tabular Controls

Tabular controls produce the classic HTML table listing the data of records, albeit with opportunity for significant enhancements. These controls show multiple records in rows and one or more fields from each record as columns. The `GridView` control shows one value (datum) in each cell in a table layout. The `DataList` and `Repeater` controls behave in the same way, and render each cell with all of the fields for one record. Figure 7-1 shows how these controls will look in a browser.

Comparison of field placement within table cells for GridView and DataList

GridView

FixtureDate	Opponents	FixtureID
10/16/2004 12:00:00 AM	Mellingham	1
10/31/2004 12:00:00 AM	Fulchester Rovers	3

DataList

FixtureDate: 10/16/2004 12:00:00 AM Opponents: Mellingham FixtureID: 1	FixtureDate: 10/31/2004 12:00:00 AM Opponents: Fulchester Rovers FixtureID: 3

Figure 7-1

The `GridView` control offers the most behaviors, as it can read, edit, and select records. The `DataList` control allows reading and editing, whereas the `Repeater` is a read-only control. The name of `DataList` is a bit confusing because you have a separate set of `List` controls that are optimized for selecting a record. The `DataList` is a display control in a tabular format.

Single Record Display Controls

Single record controls (`DetailsView` and `FormView`) display one record at a time. You can think of them as a deck of playing cards in a pile face up. At any moment all of the cards are there, but you can only see the top one. You have to navigate down through the deck to see other cards (see Figure 7-2 for an example of the `DetailsView` control). Single record controls have navigation features to permit the visitor to go to the next record, jump to a specific record, or fly to the first or last record. The `DetailsView`

control provides some default layout when you create the control, whereas the `FormView` control creates a blank slate upon which you create the entire layout. Both of these data-bound controls support reading, editing, and the creation of new records.

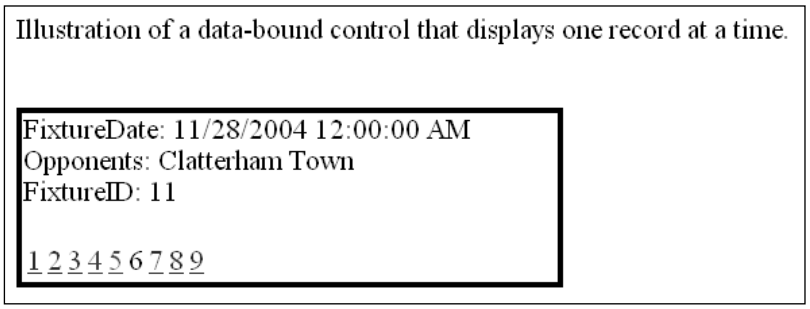


Figure 7-2

Selection List Controls

Selection list controls are optimized to accept a user selection. These two controls display just one field from each record and stand by for a mouse-click. As shown in Figure 7-3, `ListBox` controls (right side of figure) are by default expanded, whereas `DropDownList` controls (left side of figure) display a single row until the user expands. As you would expect, these controls are display-only with no capability to change data.

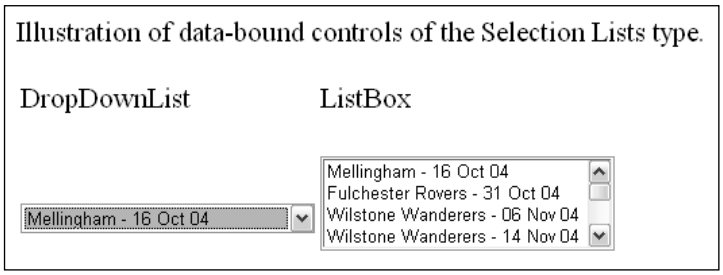


Figure 7-3

Tree Controls

Tree controls have been optimized to handle data that are stored in nodes rather than tables. The `Menu` control provides a slide-out dynamic so that when you pass your mouse over a menu choice the submenu slides out. The `TreeView` control gives the user the option to expand or collapse nodes (see Figure 7-4). The `Menu` control is on the left of Figure 7-4, and the `TreeView` control is on the right. The `SiteMapPath` control offers a navigation trail that automatically updates based on the current page.

The differences among the data-bound controls discussed are summarized in the following table.

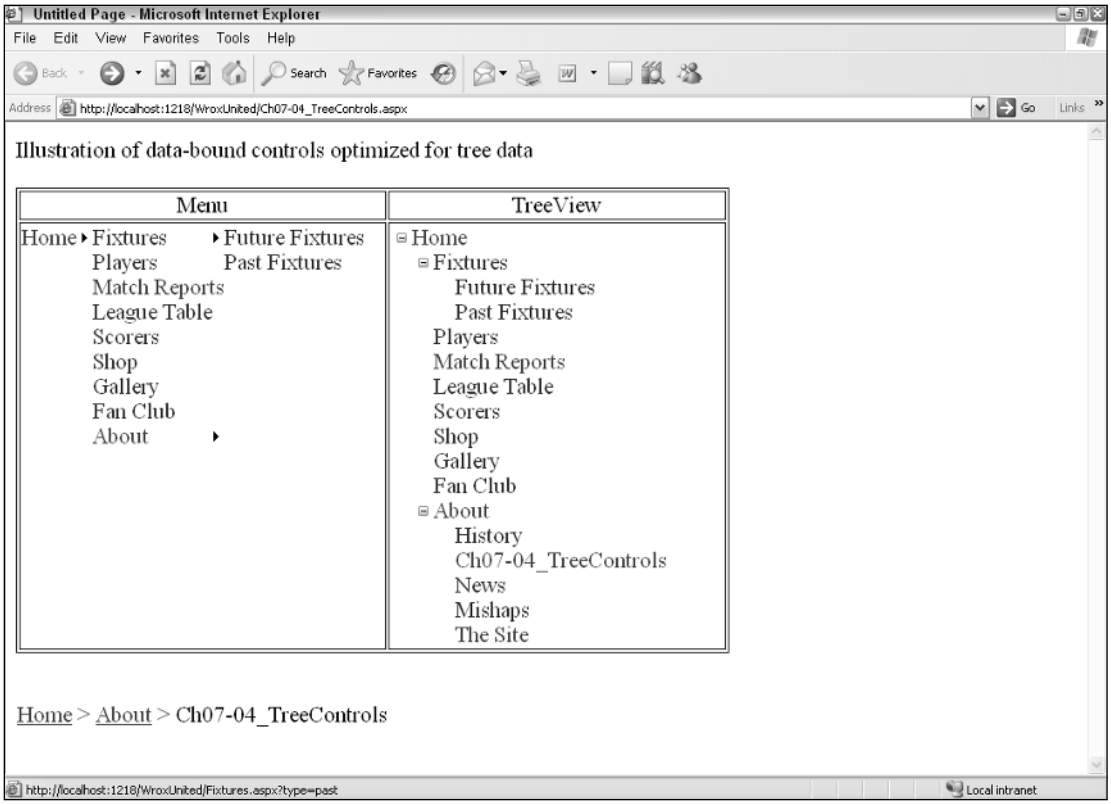


Figure 7-4

Control	Primary Data Structure	Capabilities	Description and Primary Uses
`GridView`	Table	Read and edit	Separate column for each field Each field value in its own cell Display multiple records in a grid Edit existing records
`DataList`	Table or Tree	Read and edit	All fields in one cell One cell equals one record Display multiple records in a grid Create new record for `GridView`
`Repeater`	Table or Tree	Read only	All fields in one cell One cell equals one record Display multiple records in a grid Create new record for `GridView`

Table continued on following page

Control	Primary Data Structure	Capabilities	Description and Primary Uses
`DetailsView`	Table or Tree	Read, edit, create	Display single records Default structure provided Edit existing records Create new records
`FormView`	Table or Tree	Read, edit, create	Display single records No default structure Edit existing records Create new records
`DropDownList` and `ListBox`	Table or Tree	Read only	List of a few fields Invites a user selection Display data for user selection
`SiteMapPath`	Tree	Read only	List page names between home and current page Used to identify current position in site
`Menu`	Tree	Read only	Displays top-level nodes with option to expand one sub-node at a time Used to display a menu where there will be one selection
`TreeView`	Tree	Read only	Displays top-level nodes with option to expand one or many sub-nodes Used to display multiple sub-nodes at once

Data Source Controls and Data-Bound Controls Work Together

As discussed in the previous two sections, ASP.NET 2.0 offers two families of controls for working with data: data source controls and data-bound controls. This section takes a moment to look at how they work together. The data source control handles the behind-the-scenes connections to the data as well as a set of behaviors such as editing, sorting, and paging. The data-bound control presents the data and behavior to the user in actual renderings to the page.

The two controls you use on your page should match in type. Tabular-type data-bound controls such as `GridView` and `FormView` should be sourced by table-type data source controls such as the `SqlDataSource`. Tree-type data-bound controls should be sourced by an XML data source. Lists can be sourced by either type. Having said that, there are some exceptions. Some tree sources can be used with tabular data-bound controls. This combination generally requires an InfoPath statement that narrows the scope of information that is harvested from the tree source of data. Examples of InfoPath statements are presented later in this chapter.

A data-bound control must have a property that sets its source to the data source control. In addition, for many behaviors there must be some coordination of properties between the pair of controls. For example, if editing is to be enabled, the data source control must have that option turned on and the data-bound control must also have its editing features enabled. As the controls are demonstrated later in the chapter you will see more details of how data source and data-bound controls work together.

Configuring Data Controls with VWD

When you place a data source control on your page (in Design View) VWD will lead you through a wizard to configure the various properties of the control. This procedure is remarkably cognizant of all the details to work with data on a page.

You can add data interactions using VWD at several levels. If you like to create controls one at a time, you can drag a data source control and walk through its wizard, then drag a data-bound control and connect it to the data source control. Alternatively, you can start with a data-bound control, and its wizard will step you through creating a data source control. You can even work at a higher level by opening the database explorer, selecting several fields, and dragging them to the page. VWD will then create both the data source controls and data-bound controls for you.

VWD also offers tools for editing data controls that already exist on the page. The properties window offers a very graphical user interface for changing settings. If you are working with code in Source View you can move the insertion bar within a data control tag and press the space bar to get a list of the appropriate attributes in IntelliSense.

Last, VWD offers a very useful tool within wizards for building the SQL statements needed to display or modify data. Instead of you typing (and commonly mistyping) the names of fields and the SQL keywords, the wizard offers a drag-and-drop interface with checkbox options. When you click Finish, VWD builds the SQL statement for you.

The tools of VWD greatly speed the development of data pages. However, you may find that some of the default settings and tags created by VWD are not to your liking. Particularly for beginners, the number of tags created by VWD can be overwhelming (like long lists of parameters). Advanced designers will want to substitute validation controls for the basic text boxes created by VWD. So although VWD will do a large amount of the page construction for you, most designers follow on with tweaks or partial rewrites. You will see an example in a Try It Out later in this chapter.

Data Source Controls

This section moves from the theory to the practice by adding data source controls to a page. As mentioned in the previous section on VWD and data controls, a data source control is most easily created by adding a data-bound control to a page and letting the VWD wizard set up the data source control for you. However, at times you will have to create the data source control yourself, so you will walk through that process here. The first step, of course, is to decide which data source control to use based on your type of data. For a first discussion you can look at a SQL Server Express data source (as used in this book).

The Basic Properties of Data Source Controls

Data source controls require several attributes. The obvious are an ID and the `runat="server"`. You must also specify which database on which server to use and your log on name and password for authentication. These data are held in a connection string. Next you must specify which records and fields to read from the data source. The data source control also requires a provider that describes how to interact with the database (the default provider for the `SqlDataSource` control is the provider for Microsoft SQL Server). In this case VWD walks you through these specifications in a wizard.

In this chapter you mostly work on a `Fixtures.aspx` page that will list Wrox United's schedule. In this Try It Out you add the data source control using the VWD wizard and then examine the source code that the IDE created for you.

Try It Out Data Source Control

1. Open the web site for the chapter (C:\BegASPNET2\Chapters\Begin\Chapter07) and create a Web Form called `Fixtures.aspx` in the site's root using the web form template with the site master page and with code in a separate page. Switch to Design View and type **Fixtures** in the content panel.
2. From the Data section of the toolbar (see Figure 7-5), drag a `SqlDataSource` control to the middle of the content pane. You may have to scroll down to see the new control. Open the smart task panel and click Configure Data Source.

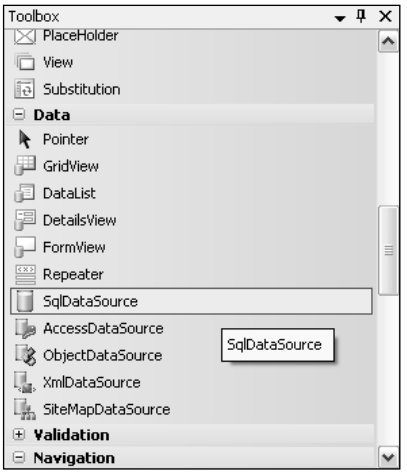


Figure 7-5

3. Click the small arrow at the top right of the control to open the smart task panel (as shown in Figure 7-6) and click Configure Data Source. A wizard will start and in the first dialog click New Connection.

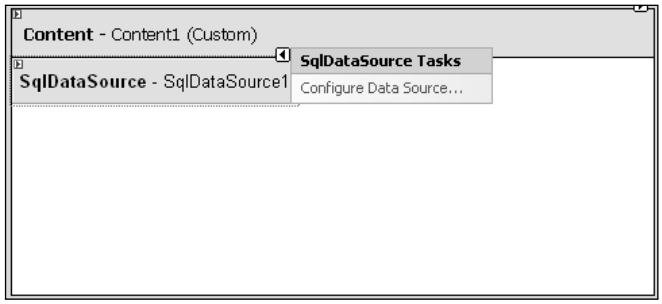


Figure 7-6

4. Set the data source to Data Source for a Microsoft SQL Server Database file. For the Database File Name, browse to your `App_Data` folder and select `WroxUnited.mdf`. Stick with the default Windows Authentication as shown in Figure 7-7. Click the Test Connection button to be sure the file was spelled correctly and all is in working order. Click OK to close the window.

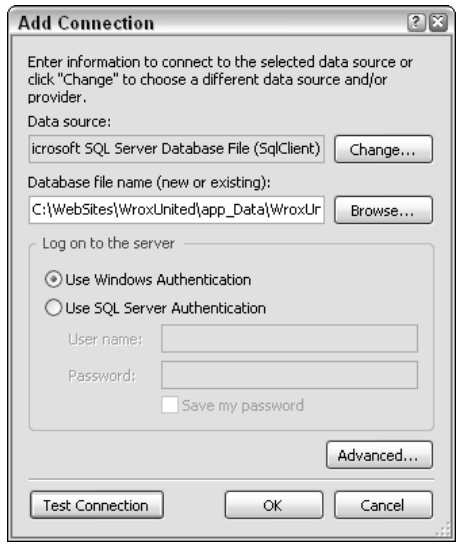


Figure 7-7

5. Click Next and, for this example, do not save the connection in the application file.
6. Click Next and in the next dialog box accept the choice to specify columns from a table. From the drop-down list select the Fixtures table. Then select all of its fields by checking the asterisk (*) choice in the columns panel. See Figure 7-8 for an example.

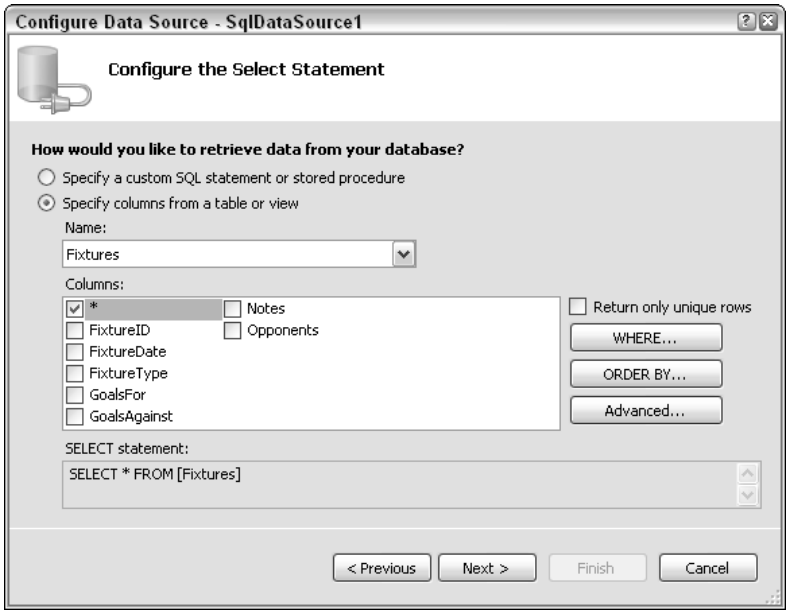


Figure 7-8

7. Click Next and in the last step of the wizard you will have an opportunity to test your query. You should see several records and fields appear in the panel as in Figure 7-9.

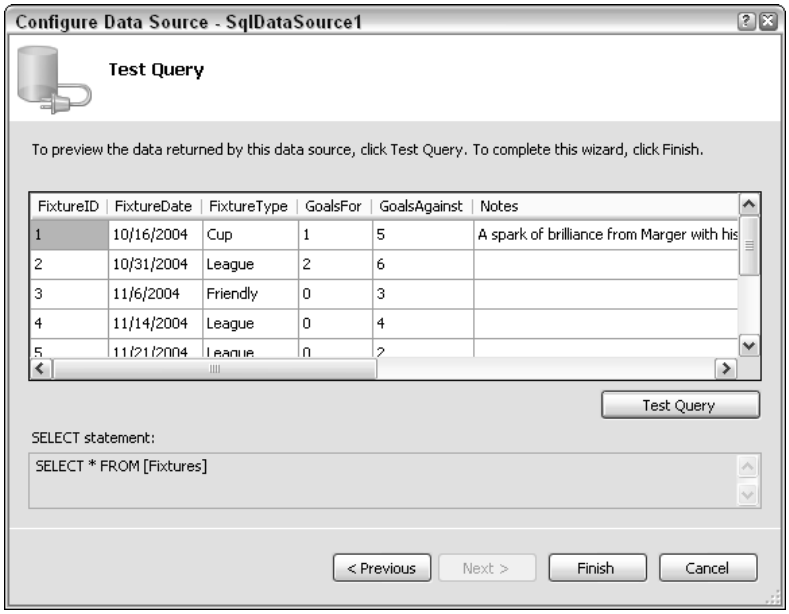


Figure 7-9

8. Click finish, and run the page and observe that although you have created a data source control there is no rendering. That will come when you add a data-bound control.

9. Close the browser and click Source View in VWD. Take a look at what VWD built for you in the `SqlDataSource` control. The `Fixtures.aspx` page will appear as follows in Source View. Instead of `(local)\SQLExpress` your server may be identified with a period (full stop) as `.\SQLExpress`:

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="Fixture.aspx.vb" Inherits="Fixture" title="Untitled Page" %>

<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">

<asp:SqlDataSource ID="SqlDataSource1" runat="server"

ConnectionString="Data Source=.\SQLEXPRESS;
AttachDbFilename=C:\BegASPNET2\Chapters\Begin\Chapter07\App_Data\WroxUnited.mdf;
Integrated Security=True;
User Instance=True"

        providerName="System.Data.SqlClient"

        SelectCommand="SELECT * FROM [Fixtures]">

</asp:SqlDataSource>

</asp:Content>
```

How It Works

In this Try It Out you used VWD to create a `SqlDataSource` control for you. Note how easy it was to drag the control and then answer the series of questions in the wizard. VWD typed each of the properties listed earlier in the section. The basic ID and runat are there. Then you see a connection string holding the name of your server and database identified with the AttachDbFilename. You requested in the wizard to use Windows Authentication and so VWD wrote the connection string with Integrated Security. That means you will allow Windows to certify who you are by using the name and password with which you logged in to Windows. Last, when you picked your data source to be a Microsoft SQL Server data file, VWD added a property to the data source control that sets the provider to use the `System.Data.SqlClient`.

Hiding the Connection String

In the preceding Try It Out you placed the data of your connection string in the page. This leads to two problems. First, if the name of your server or database changes you would have to change the connection string in every page. Second, if you were using SQL Authentication you would have to present credentials (name and password). Although the connection string is never sent to the browser, it should still make any developer nervous to ever have that confidential authentication information on an ASP page.

Both of these problems can be solved by moving the connection string from the pages into a single entry of the `Web.config` file, and then referring to the entry rather than writing out the entire connection string in the page. This change can be made by simply accepting the offer to "save the connection string in the application configuration file" in the second page of the Data Source Configuration wizard.

In this Try It Out you replace the data source control of `Fixtures.aspx` with a new data source control configured to use a connection string stored in the `Web.config` file.

Try It Out Hiding Connection Strings

1. Open your `Fixtures.aspx` page in Design View and delete the `SqlDataSource1` control.
2. Now drag a new `SqlDataSource` control to the content panel of the page. As before, click Configure Data Source.
3. As before, make a new connection to the `WroxUnited.mdb` in the `App_Data` folder. Click test and OK. Click Next to move to the Save Connection String... panel.
4. This time leave the check on (as default) to save the connection string to the application configuration file and give it the name WroxUnited (see Figure 7-10). Click Next.

Figure 7-10

5. Continue with the rest of the wizard as before; use the fixtures table and select all of the columns. Click Next, test the query, and click Finish. Save the page.
6. In the end your data source control will appear as follows in the `Fixtures.aspx` page:

```
<asp:sqldatasource id="SqlDataSource1" runat="server"
    connectionstring="<%$ ConnectionStrings:WroxUnited %>">
    SelectCommand="SELECT * FROM [Fixtures]"
</asp:sqldatasource>
```

7. Meanwhile, an addition has been created in `<connectionstrings>` section of the `Web.config` code (line break modified for clarity in code listing below):

```
<connectionStrings>
     <add name="WroxUnited"
connectionString="Data Source=.\SQLEXPRESS;
AttachDbFilename=|DataDirectory|WroxUnited.mdf;
Integrated Security=True;
Connect Timeout=30;
User Instance=True"/>
providerName="System.Data.SqlClient" />
</connectionStrings>
```

How It Works

Take a look at the `Fixtures.aspx` page in Source View and focus on the data source control. Notice that it now lacks the actual values for the connection string. Instead, you get a pointer to `connectionString` (which is understood to mean in the `Web.config` file) and within the connection strings to Wrox United.

Open the `Web.config` file. Slide down to the section on `connectionStrings`. The tag `<add>` indicates another connection string within the section. Following the name you see the same information that you provided on the page in the previous Try It Out.

Details of the Connection String and Provider

The most complex parts of the data source control are the `connectionString` and the `provider`. The previous examples present the simplest case. The connection string has three parts when connecting to a SQL Server data source:

- First is the data source that means the name of the SQL server. A period (full stop) means the local server:

```
<connectionStrings>
     <add name=
      "WroxUnited" connectionString="Data Source=.\SQLEXPRESS;
```

- Second is the name of the database file to attach:

```
        AttachDbFilename=|DataDirectory|WroxUnited.mdf;
```

Or alternatively:

- AttachDbFilename= C:\BegASPNET2\Chapters\Begin\Chapter07\App_Data\ WroxUnited.mdf;
- Last is the type of security to use:

```
Integrated Security=True;User Instance=True"/>
 </connectionStrings>
```

If you use another relational database manager (such as Oracle or MySql) you must specify a `provider` as follows. The `provider` for SQL Server is the default, so you did not have to use a provider in the Try It Outs of this book. But for other sources you must use the following syntax. The `Sql` in `SqlDataSource` means that the control can be used with any SQL-compliant data source (not only Microsoft SQL Server).

But if you use a data source other than Microsoft SQL Server, you must specify a provider for that source so that the named provider can override the default provider:

```
<asp:SqlDataSource ID="SqlDataSource1" Runat="server"
 providerName="System.Data.OracleClient"
```

ASP.NET 2.0 can use virtually any source of data, including OLEDB- or ODBC-enabled systems. Access files can be used for lightly loaded local sites, but complexities emerge when the MDB file has a security scheme. Extensive discussion of the permutations, advantages, and syntax are presented in several chapters of our sister book, *Beginning ASP.NET 2.0 Databases*.

Data-Bound Controls

Keep in mind the basic model of ASP.NET 2.0 for using data. Two controls must be on the page: a data source control and the data-bound control. The remainder of this chapter focuses on the various data-bound controls. It starts with selection lists; moves on to the `GridView`, `DataList`, and `Repeater`; the two single-record-display controls (`DetailsView` and `FormView`); and finally the tree view for hierarchical data. Along the way we will pause to look at how multiple data-bound controls can be used to set parameters for each other.

Data-bound controls can be added to a page (in Design View) using VWD in three ways:

- Add the data-bound control *after* adding a data source control and point to the existing data source control.
- Add the data-bound control directly *without* an existing data source control, and let the VWD wizard guide you through setting up a data source control.
- Add the field names directly from the Database Explorer to the page, and let VWD set up both an appropriate data-bound control and a data source control.

This list increases in terms of ease as you move down the list, but decreases some of your options. For example, a direct drag-and-drop of field names automatically creates a `GridView`, whereas in the second option you could create a `DropDownList`.

Data-Bound Selection Lists

Data-bound lists present the user with a set of data from the database and imply a request that the user select from the list. ASP.NET provides four types of lists for user selection: `DropDownList`, `ListBox`, `RadioButtonList`, and `CheckBoxList`. The items in the selection list can be added either by hard coding (static) or from a data source control (dynamic). After the user makes a selection the value is available to your code or to other controls on the same page, or even controls on different pages.

> **It is easy to confuse the topic of this section (lists that request a user selection) with the control named `ASP.NET DataList`, which presents data without expectation of user selection. `ASP.NET DataList` is covered later in the chapter.**

All four of these selection controls support a pair of properties that are easily confused. The first is the `DataTextField` property, which determines the text that the user will see. Related, but different, is the `DataValueField` property that will hold the value that is used internally in your site to process the user's selection. For example, the `DataTextField` control may show a combination of a customer's full name and city. But that long and mixed value is not useful to select the single customer from your Customers table. So you set the selection list control's `DataValueField` property to be the customer ID number, and that neatly fits into your code to narrow the orders you receive to those for that one customer ID. When using different fields as sources for the list control's `DataText` and `DataValue`, both fields must be included in the list of fields obtained by the appropriate data source control.

One additional property is of importance for all of the selection lists. `AutoPostBack` will automatically post back to the server when the list selection changes. This is critical if there is code in the post back event that you want to execute to reflect the user's selection, such as re-rendering a `GridView` to show a limited set of records based on the user's selection from a list box.

Items can be added to a list in three ways. The first way adds items using individual ASP.NET 2.0 tags. The second way binds the list to an array of values. Finally, the items can be read from a data source.

Adding List Items with Individual ASP.NET 2.0 Tags

When the items remain relatively static (for example, a list of states or provinces) you use hard coding to add items. Although the code can be long, it will execute faster than opening up a connection to a data source. Note that in some cases, although the original list of items may be static (the list of states), the items to appear in the selection list may be dynamic (only those states with customers). Items can be added with simple `<asp:ListItem>` tags as shown in the following code. In this example you create a drop-down list for users to pick a player position. You want the user to see the full name of the position (such as Left Back), so that is the `Text` property. After the user makes a selection you, as a programmer, will want to actually work with your code for the position, so that is the `Value` property. Also note that you can set a default selection on the Central Defender position. For example, in the following code listing the first item in the list will be for the Goalkeeper. The word `Goalkeeper` will appear in the list box as text while the value of `GK` will be the value you can work with if the user selects Goalkeeper. (The concepts of `DataTextField` and `DataValueField` are covered a bit later.)

```
<asp:DropDownList id="DropDownList1" runat="server">
    <asp:ListItem Value="GK">Goalkeeper</asp:ListItem>
    <asp:ListItem Value="LB">Left Back</asp:ListItem>
    <asp:ListItem Value="RB">Right Back</asp:ListItem>
    <asp:ListItem Value="CD" Selected="True">Central Defender</asp:ListItem>
</asp:DropDownList>
```

Binding List Items to an Array

A more sophisticated method for adding static items employs an array. You create an array in the `Page_Load` event, and then set the array as the data source for the list. Finally, you perform a *binding*. Binding, in ASP.NET 2.0, refers to the act of bringing data into a control. For example, when you bind a `ListBox` to a data source control the information from the data source is actually brought into the `ListBox` control. This is one of the few places in ASP.NET 2.0 where you use the version 1.x technique of performing binding as a distinct line of code. In most cases in version 2.0 the data controls automatically perform binding as needed. You carry out the steps as follows:

```
<%@ Page Language="VB" %>
<script runat="server">
  Public MyStates() As String = {"AK","AL","AR"}

  Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs)
    DropDownList1.DataBind()
  End Sub
</script>

<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
    <title>Untitled Page</title>
</head>
<body>
    <form id="form1" runat="server">
    <div>
        <asp:DropDownList ID="DropDownList1" runat="server"
         DataSource="<%# MyStates %>"
        >
        </asp:DropDownList>
```

The first shaded line creates a variable named `MyStates` and fills it with three values. The third shaded line identifies that array (`MyStates`) as the one to be bound to `DropDownList1`. The second shaded line instructs the ASP.NET 2.0 page to, at the time of page load, actually perform the binding; that is, bring the values in `MyStates` into `DropDownList1`.

When you support variation in the items to be displayed, the population of the selection list should be based on a data source control. The selection list will have a property of `DataSourceID` with the value of the ID of the data source control. Then there are values for the `DataTextField` and `DataValueField`, which are set to fields included in the `SelectCommand` of the data source control.

Adding List Items from a Data Source

In many cases the items of a list will be stored in a database, so it makes sense to populate the list from the database rather than creating an array or individual tags as shown in the previous sections. Because of ASP.NET 2.0's mix-and-match design of data source and data-bound controls, you can populate the list from a data source control. You just have to follow the VWD wizard to identify what data source to use to supply the information to the `ListBox`.

On the page you want visitors to be able to limit the view of games to just one month. In this Try It Out you start with a page that hard-codes the months, then move to a dynamic binding. Note that the teams play games from October to December. You start with static binding for September to December. Then you improve the page to dynamically bind to the actual dates in the database of games.

Try It Out — Selection List Bound to a Data Source Control

1. Early in this chapter you created a Fixtures.aspx page. Open it in VWD.
2. Add some text similar to **Please pick a month**, and then drag a `ListBox` control from the Toolbox onto the content area. You will probably have to scroll down to see it, as in Figure 7-11.
3. Because code-behind is used in this book, you have to write your code in a separate file. At the top of the Solution Explorer click the View Code icon (right-most icon in Figure 7-12) to open the editor panel.

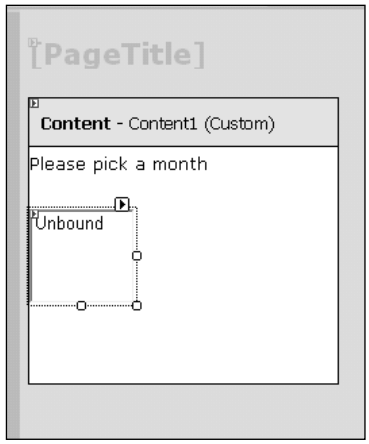


Figure 7-11

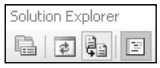


Figure 7-12

At the top left of the editor panel, expand the drop-down list and click the Page Events object, and at the top right expand the drop-down and select Load as shown in Figure 7-13.

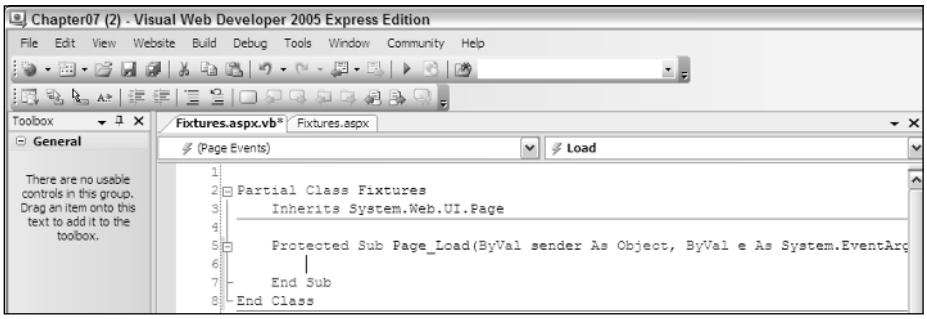


Figure 7-13

4. Add the following shaded lines to the `Page_Load` event. Note that around the list of numbers are braces ({}), not parentheses. Also note that the declaration of the array occurs *before* the `Page_Load` Sub:

```
Partial Class Fixtures
    Inherits System.Web.UI.Page

    Protected ListOfMonths() As Integer = {9,10,11,12}

    Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) _
                            Handles Me.Load
        ListBox1.DataBind()
    End Sub
```

5. Now direct the `ListBox` control to use your array for its source of data. Switch from the `Fixtures.aspx.vb` code page back to the `Fixtures.aspx` page and switch to Source View. Select the `ListBox` and modify its properties so that it will get its list of items from the data source control, as shown in the shaded lines (same for VB or C#, because this is outside the script):

```
<body>
    <form id="form1" runat="server">
    <div>
        <asp:ListBox ID="ListBox1" runat="server"
         DataSource="<%# ListOfMonths %>"
        >
        </asp: ListBox>
    </div>
    </form>
</body>
```

6. Save and test the page in your browser by pressing F5. At this point the list does not do anything beyond show the months (see Figure 7-14).

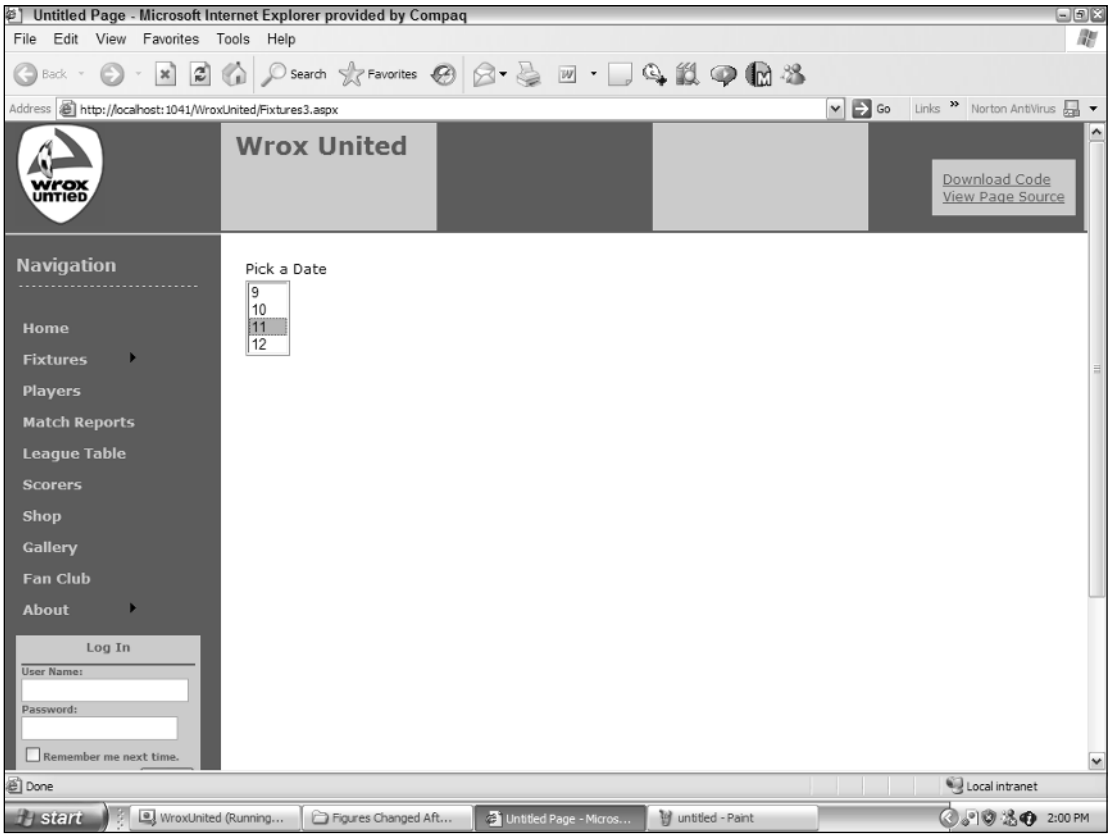


Figure 7-14

7. But what if the team plays in January or February or you observe that there are no September games even though you have the ninth month in your list box? You want the pages to offer new choices in the list box automatically (dynamically). Now you will improve the `ListBox` control by binding it to the list of fixtures.

8. Drag a `SqlDataSource` control from the toolbar onto the fixtures page (the .aspx page, not the code page), as shown in Figure 7-15. You will probably have to scroll down to see it, then open its smart task panel and configure its data source. Select the WroxUnited and click Next.

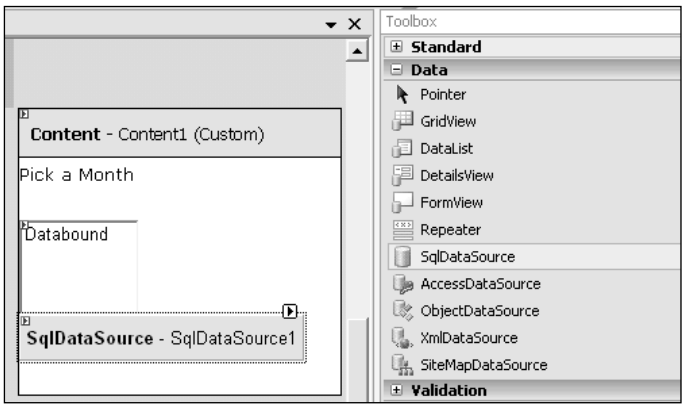


Figure 7-15

9. Specify a custom SQL statement and click Next. Type in the following statement:

```
SELECT DISTINCT MONTH(FixtureDate) AS FixtureMonth FROM Fixtures
```

10. Click Next, Test Query, and finally, click Finish.

11. Now change your `ListBox` control in the Properties window by performing the following actions: Eliminate the `DataSource` value; add a `DataSourceID` value of `SqlDataSource1`; set both the `DataTextField` and `DataValueField` to `FixtureMonth` (see Figure 7-16). Recall that if the Properties window is not already visible (usually in the bottom right of your screen) you can bring it back by pressing F4.

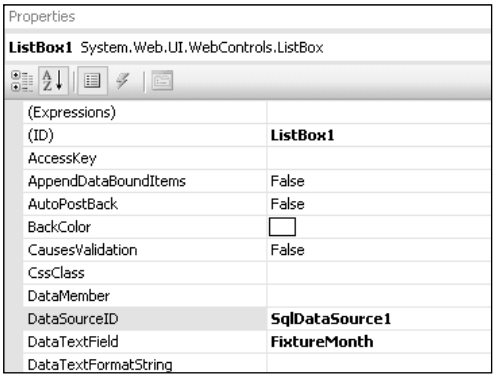


Figure 7-16

12. Last, in Source View, remove some lines in the code page that are no longer needed. Delete the lines shaded here:

```
Protected ListOfMonths() As Integer = {9,10,11,12}

Protected Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) _
                        Handles Me.Load
    ListBox1.DataBind()
End Sub
```

13. Run the page. Now the `ListBox` control only shows the months with games; 9 is left out. Months will also automatically change if the Wrox United schedule adds games in another month.

How It Works

Adding a `ListBox` control is easy with VWD's drag-and-drop functionality. In the hard-coded technique you created an array of integers and filled it with what you expected would be useful values. Then down in the `ListBox` properties you specified that the items of the list (its `DataSource`) should come from the values returned by a read of the array `ListOfMonths`. Last, back up in the code, you added a line to the `Page_Load` event that instructs ASP.NET 2.0 to actually bind the data of the array to the data-bound control.

Two problems exist with this technique. First, it uses the ASP.NET version 1.1 technique of binding by explicit command. Although that works (and is the only technique for hard-coded arrays) it does not utilize the automatic binding features of version 2.0. Second, if Wrox United changes the months in which it plays, then your list box choices are out of synch.

In the second technique you created a new data source control that will read the actual months that are currently in the games list. However, those months are stored as full dates (such as 12/21/04). So you use a SQL function called `MONTH` to extract the number of the month from the date. And because more than one game is played in a month, you add the `DISTINCT` term to give you just one of each value. (These kinds of SQL tricks are discussed in Wrox's *Beginning SQL*.) Now you do not need the lines to create or fill the array and you can also chuck out the binding line (ASP.NET 2.0 will do it for you when you use an ASP.NET 2.0 data source control).

Notice the subtle but important difference between two properties of the `ListBox` control. `DataSource` is used when you are binding by explicit command to an ASP.NET version 1.1 source of data. `DataSourceID` is employed when you use ASP.NET 2.0 automatic binding to a data source control.

The GridView Control

The `GridView` data-bound control provides the classic display of tabular data. Each row represents one instance or record, and each column holds one field of data. A cell within the table displays a value that is appropriate for its intersection of record and column. By default, `GridView` displays all of the columns that are provided by the data source control, but you'll see how to show the user only a subset. The biggest advance in tabular data display comes when you activate two simple features of the `GridView` control: sorting and paging. *Sorting* allows the user to re-order the records according to taste. *Paging* allows you, as the designer, to specify the number of records to show at one time and then provide the user navigation tools to jump to different sets of records. Both of these features took hundreds of lines of

codes to get right in earlier versions of ASP.NET, so they are huge timesavers that you get for free with ASP.NET 2.0.

Like all data-bound controls the `GridView` control must have a data source control to provide the values. `GridView` was optimized to work with the data source controls optimized for tabular data, for example `SQL`, `Access`, and `Data` controls, as opposed to the tree data of an `XML` source control.

Adding a GridView Control

Of course, VWD reduces control implementation to simple drag and drop. You can add a `GridView` control in VWD one of three ways. The techniques in the following list increase in the number of steps required as you go down the list; drag-and-drop a field is quickest, adding the controls independently requires the most steps. However, in every case you can go back and edit a `GridView` control's properties in Design View, or even modify the source code directly:

- From the Data Explorer window, select and drag field names to create a `GridView` control and automatically create a data source control — with no questions asked.
- From the toolbar, drag a `GridView` control to the page and let VWD walk you through the setup of a new data source control.
- From the toolbar, first add a data source control then drag on a `GridView` control and use the nascent data source control.

Regardless of which technique you use, once the `GridView` control is on the page its smart task panel will open, as shown in Figure 7-17. Click the Auto Format option to quickly apply a set of colors, borders, and cell sizes. Note the first choice, the ability to remove a prior auto-formatting.

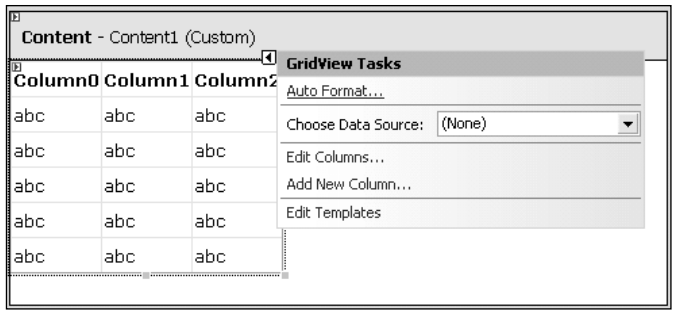


Figure 7-17

You can add or remove columns with three techniques. The easiest way is to use the smart task panel and click Edit Columns. Expand the entry for BoundField, select a field, and click Add. From the box below you can select a field and click the X button to delete (see Figure 7-18).

A second technique, while you have the Fields dialog box open, is to click the option in the bottom-left corner to Auto-Generate fields. This option will display all fields.

And last, you can switch to Source View and hand-edit the list of fields.

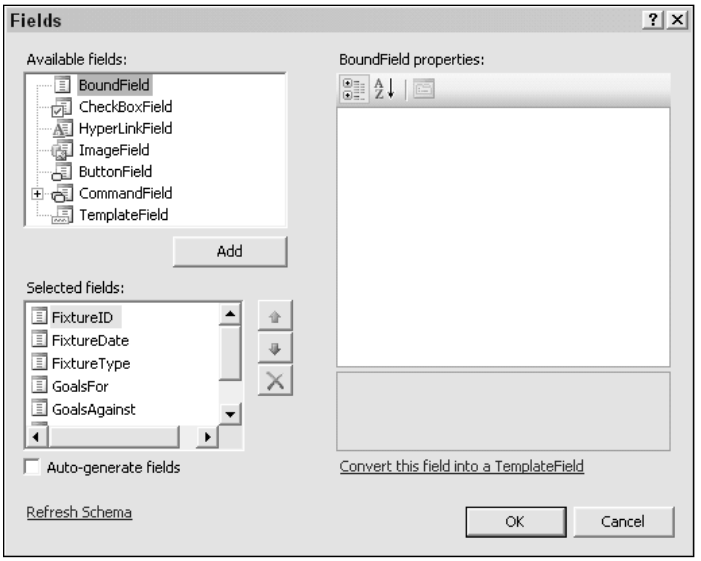


Figure 7-18

Before moving on, take a look at the code that VWD builds for a `GridView` control. Note that a data-bound control such as `GridView` will always have a `DataSourceID` property that points to the data source control providing the data. Note that the `DataSourceID` property points to a data source control and is used here. A similarly named property, the `DataSource`, is used in more advanced scenarios. First, display of all fields by including setting the `autogeneratecolumns` property to `True`, as follows:

```
    <asp:gridview id="EmployeesTable" runat="server"
        datasourceid="EmployeesDataSource"
        autogeneratecolumns="True"
    </asp:gridview>
```

The following syntax would only display three of the fields because you set the `autogeneratecolumns` to `false` and instead, have a set of tags called `<Columns>`. Within those tags you add an `<asp:BoundField>` tag for each field. Note that ASP.NET 2.0 uses the terms *columns* and *fields* interchangeably here.

```
    <asp:gridview id="EmployeesTable" runat="server"
        datasourceid="EmployeesDataSource"
        autogeneratecolumns="False"
    </asp:gridview>
        <Columns>
            <asp:BoundField HeaderText="Hired Date" DataField="DateHire"
            </asp:BoundField>

            <asp:BoundField HeaderText="First Name" DataField="NameFirst"
            </asp:BoundField>

            <asp:BoundField HeaderText="Last Name" DataField="NameLast"
            </asp:BoundField>
        </Columns>
    </asp:gridview>
```

Adding Paging and Sorting to a GridView Control

Designers faced an onerous task prior to ASP.NET 2.0 when they had to implement paging and sorting. The ASP.NET 2.0 design team took it upon itself to offer these features fully coded and ready to use. Select a `GridView` control and open its smart task panel by clicking the small triangle at the top right of the control to see checkboxes to turn on paging and sorting as shown Figure 7-19.

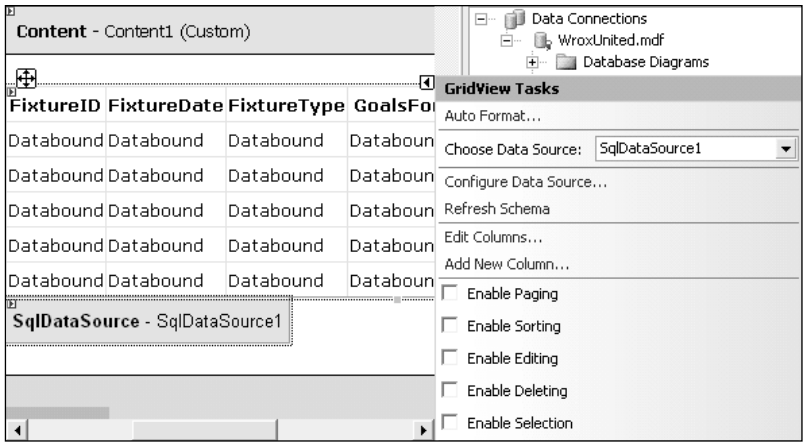


Figure 7-19

Turning on paging and sorting requires two prerequisites. First, the `GridView` control must have its `DataSourceID` set to a valid data source control on the page. Second, that data source control must have its `EnablePaging` and/or `EnableSorting` properties set to `True`. The logic is that when a user requests a sort by clicking on a `GridView` control, the `GridView` passes the request down to its data source control. The data source control revises the data and sends the new information back to the `GridView` control, which re-renders. Sorting also requires that fields have a header value so there is a target for users to click.

Checking sorting enables sorts on all columns. Note that when the page is running, a user can click a second time on a column's header to change the direction of the sort. Individual columns can be sortable or not by going to Source View and removing the `SortExpression` property. In the following snippet built by VWD the `Date` field is not sortable but the `Name` field will sort because after the sort option was checked, VWD added a `SortExpression` property to the `Name` field (the shaded line):

```
<asp:GridView ID="GridViewSemiSortable" runat="server"
    AllowSorting="True"
    AutoGenerateColumns="False"
    DataSourceID="SqlDataSource1">
    <Columns>
        <asp:BoundField DataField="Date"
            HeaderText="FixtureDate" />
        <asp:BoundField DataField="Name"
            HeaderText="FixtureType"
            SortExpression="FixtureType" />
    </Columns>
</asp:GridView>
```

Paging requires additional design elements to offer navigation tools to the user. As soon as the paging option is checked, the `GridView` control has an additional panel for `PagerSettings` in the Properties window, as shown in Figure 7-20.

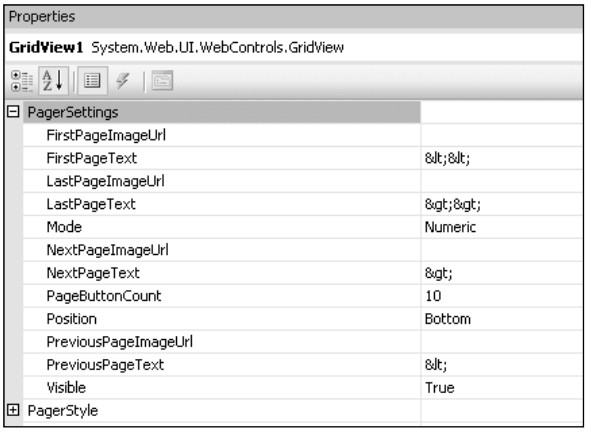


Figure 7-20

The last entry is a setting for the number of records to show at once (`PageSize`). For navigation, the highest-level property is `Mode`, wherein you can select one of four custom sets of tools that are self-describing, and explained in the following list. Selecting one of these sets of tools automatically sets the remainder of the properties for `PagerSettings`:

- `NextPrevious`: Displays only the Next and Previous options.
- `Numeric`: Displays a list of page numbers, with the number of pages to display set by `PageButtonCount`.
- `NextPreviousFirstLast`: Displays only the Next, Previous, First, and Last options.
- `NumericFirstLast`: Displays the numbers of pages and also the two terminal buttons.

Of course, you can go beyond the option packages and set any property as desired. A common modification is to substitute site-specific images for the tools. We also recommend you look carefully at the text properties. Sometimes the default words do not clearly relay the intention; for example, the term "last" when working with dates could mean the last record added in time, the last event to occur, or the last page that you viewed.

In the following Try It Out you add a `GridView` of games. Each row will be a record from the Fixtures table, that is, one game. Columns will hold information such as the date and opponent of the game.

Try It Out — Adding a GridView Control to Fixtures.aspx

1. Open your `Fixtures.aspx` page and use Source View.
2. Switch to (or open with Ctrl+Alt+S) the database explorer. Expand the WroxUnited.mdf, then expand Tables, and finally expand Fixtures, as shown in Figure 7-21. Select all of the fields and

drag them to the content section of the `Fixtures.aspx` page. VWD does all of the heavy lifting. Wait for it to finish and then run the page. Admire your work and close the browser.

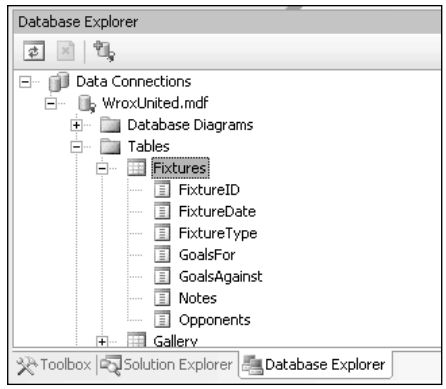


Figure 7-21

3. Next you modify which fields are displayed. Looking at the scores, it might be just as good to delete those. Be sure the browser is not displaying the page, because that will lock it in VWD. Select the `GridView` and open its smart task panel. Click Edit Columns and in the bottom left, select the GoalsFor, and click the X button to delete as shown in Figure 7-22. Repeat for the GoalsAgainst column. Click OK when you are finished.

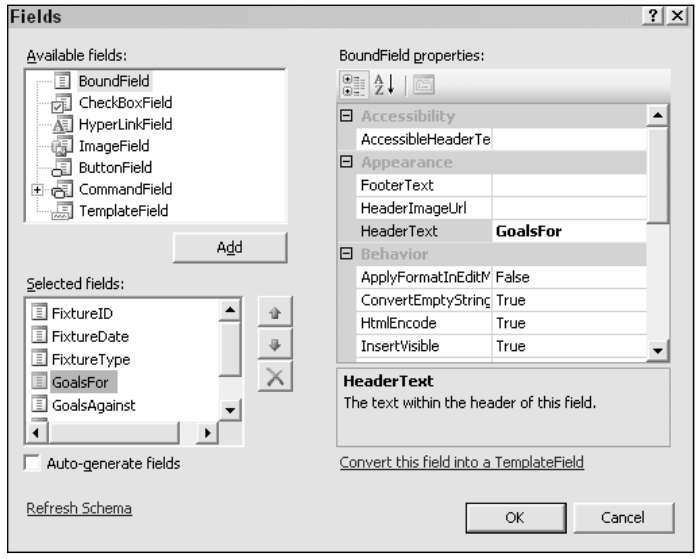


Figure 7-22

4. Now you can go back and enable paging. In Design View, select the `GridView` and open its smart task panel. Turn on the checkbox for Enable Paging and then close the panel. Look in the property window to find the `PageSize` property that you will set to two (Wrox United doesn't get invited to many games). Also note the section of `PagerSettings`. Set the mode to NumericFirstLast. Again, run in the browser, play with paging, and then close the browser.

5. You finish by enabling sorting. Open the smart task panel and check Enable Sorting.

   Because the Notes field is not logical for sorts, turn off sorting for that one field. Switch to Source View, and within the `GridView` control find the `BoundField` for Notes. Delete the entire property of `SortExpression="Notes"`. Save the file and check it in your browser.

How It Works

Adding a `GridView` control is simplicity itself with the help of VWD. This example demonstrated removing columns with the Edit Columns feature and it is just as easy to add columns. Turning on paging is as simple is checking the option, followed by setting properties for the control in the properties window. The `PageSize` property is obvious, but other settings are under the `PagerSettings` group. Turning on sorting was easy. Removing the sort option from one column was similarly easy. All you had to do was go to Source View and delete that field's `SortExpression` property.

The DataList and Repeater Controls

The `GridView` control displayed data with each cell holding one piece of information (for example, the first name of employee 6). ASP.NET 2.0 offers the alternative of a table where all of the fields for one record are in one cell (one cell holds first name, last name, ID, and date of hire, all for employee 6). Two data-bound controls render one record per cell: `DataList` and `Repeater`. The only difference is that the `DataList` control has a default formatting and templates whereas the `Repeater` control requires more setup by the designer.

Creating a `DataList` control is similar to creating a `GridView` control. You can drag and drop the data-bound control from the toolbar and a let VWD walk you through creation of a new data source control, or you can add the data source control by hand and then add the data-bound control. The `DataList` control's properties support the capability to set the Layout Repeat Direction so that records are ordered to increase horizontally across the page or vertically down the page, as well as the number of columns.

Templates offer the capability to lay out the space within a cell. For example, if you want a different set of fields in each `DataList` cell, want to change the cell's background to pink, and want to add a logo to each cell, you can modify the template. The exercise that follows walks you through changing a template.

Templates are invaluable, but there are several confusing points. First, templates by themselves do not display data. Rather, templates contain data-bound controls, such as labels, that do the actual display of data. Second, there are multiple templates for a given space. A `DataList` cell can have an Item Template (the normal display for data), an Alternating Item Template (to create every other record with a different color), a Selected Template (to change the appearance when selected), and an Edit Item template (to change the appearance during editing). Each of these templates is designed independently, as you will see. The third point of confusion is that you must enter into a specific template editing mode in order to make the changes; you cannot change a template by just selecting and modifying fields in Design View.

After editing a template you must explicitly end the template editing mode. Last, ASP.NET 2.0 uses the term *style* in context of templates. Styles primarily provide the properties for appearance (color, borders, and so forth), whereas the template primarily provides the layout of fields (but can also specify appearance). If a color or border is set in both the style and the template, the template will take precedence. It may seem that this is a minefield, but once you have worked with templates (as in the next exercise) you will find the template feature is well designed.

With an understanding of templates, we can go back and make two notes. First, templates are also available in the `GridView` control and work the same way. Second, the difference between a `DataList` control and a `Repeater` control is that the `DataList` control has a set of default templates, whereas the `Repeater` control is a blank space in which you must build all of the templates.

In this Try It Out you practice using a `DataList` to display pictures from Wrox United matches. You will create a simple page that shows all of the pages and name it Gallery-All. Later in the chapter you will create a more complex version as your final `Gallery.aspx`.

Try It Out — The DataList Control

1. Create a simple ASP.NET 2.0 Web Form page named Gallery.aspx using our site.master and with the code placed in a separate page. Save it and then save it again as Gallery-All.aspx. Also, for this exercise you will need some images that we supply in the download. Check if you have already imported the MatchImages folder in from the download (C:\BegASPNET2\WroxUnited). If not, import it by right clicking on the root of the site in Solution Explorer and using Add Existing Item. In the end you should have below the root a folder named Images and within there a series of GIF and JPG files including AddToCart.gif, ArrowFirst.gif and logo_white.jpg.
2. Start by dragging a `DataList` control from the Data section of the Toolbox to the content area. Open its smart task panel, as shown in Figure 7-23, and click Choose Data Source. Click New Data Source for the wizard to create a data source control.

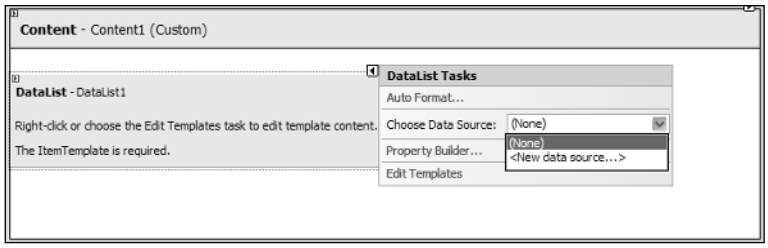


Figure 7-23

3. Select Database as the source and leave the name as SqlDataSource1. Click OK. Use the WroxUnited.
4. From the Gallery table check off just five fields: `PictureURL`, `FixtureID`, `UploadedByMemberName`, `Notes` and `PictureURL`, and then test the query. At this point VWD automatically creates the data source control and sets it as the source for the `DataList` control.

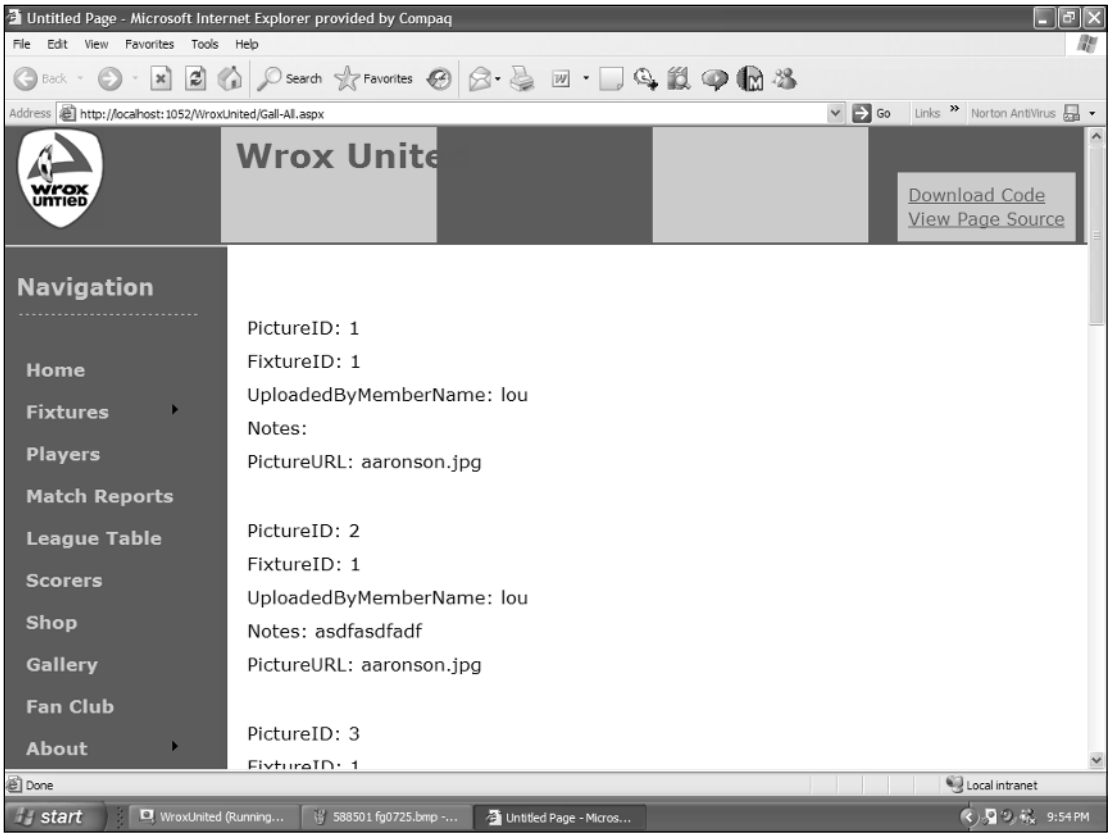


Figure 7-24

5. Run the page in your browser to test (see Figure 7-24), noticing that you don't have the pictures yet. Close the browser.

6. Now you need to actually get the pictures displayed. Be sure your browser is closed and then in Design View select the `DataList` control, open its smart task panel, and click Edit Templates to see a screen similar to Figure 7-25. Select and then delete the line that has the text `PictureURL` and a `Label` control.

7. From the toolbar, drag an `Image` control into the space left by the old `PictureURL` field. On the `Image` control's smart task panel click Edit Data Bindings, and select the property `ImageURL` to bind to the field `PictureURL`, as shown in Figure 7-26.

   The resulting source code follows. If you test the page in your browser, you'll notice that you are still not there. The `Image` control still does not have a URL that actually points to an image:

```
<asp:image id="PictureImage" runat="server"
  ImageUrl='<%# Eval("PictureURL")%>'
</asp:image>
```

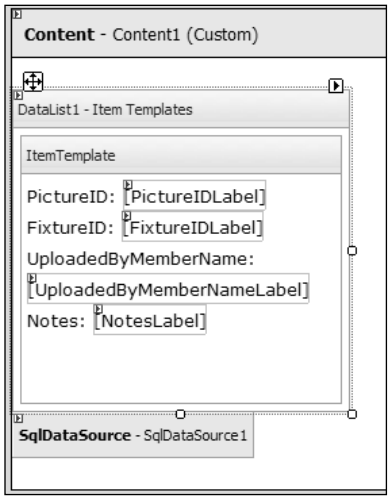


Figure 7-25

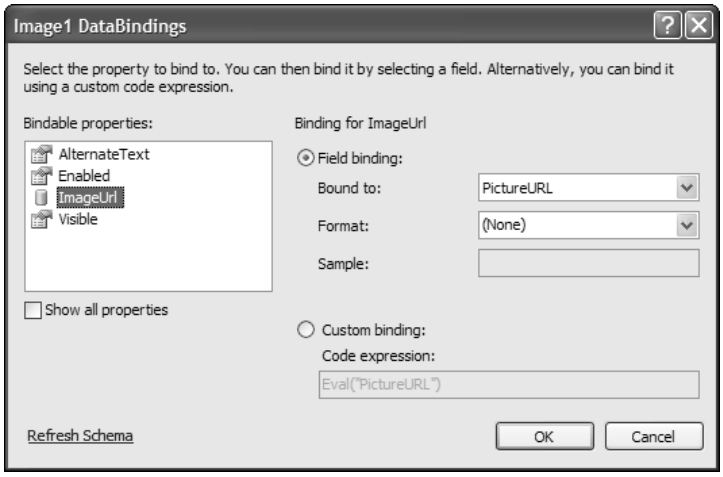


Figure 7-26

8. To get this to work you must identify not only the name of the image file but also its path (folder). Switch to Source View and add the following argument to the `imageURL` property:

```
<asp:image id="PictureImage" runat="server"
  ImageUrl='<%# Eval("PictureURL", "~/MatchImages/{0}") %>'>
</asp:image>
```

9. Check your page in the browser (see Figure 7-27), shout "Eureka!" and then close the browser.

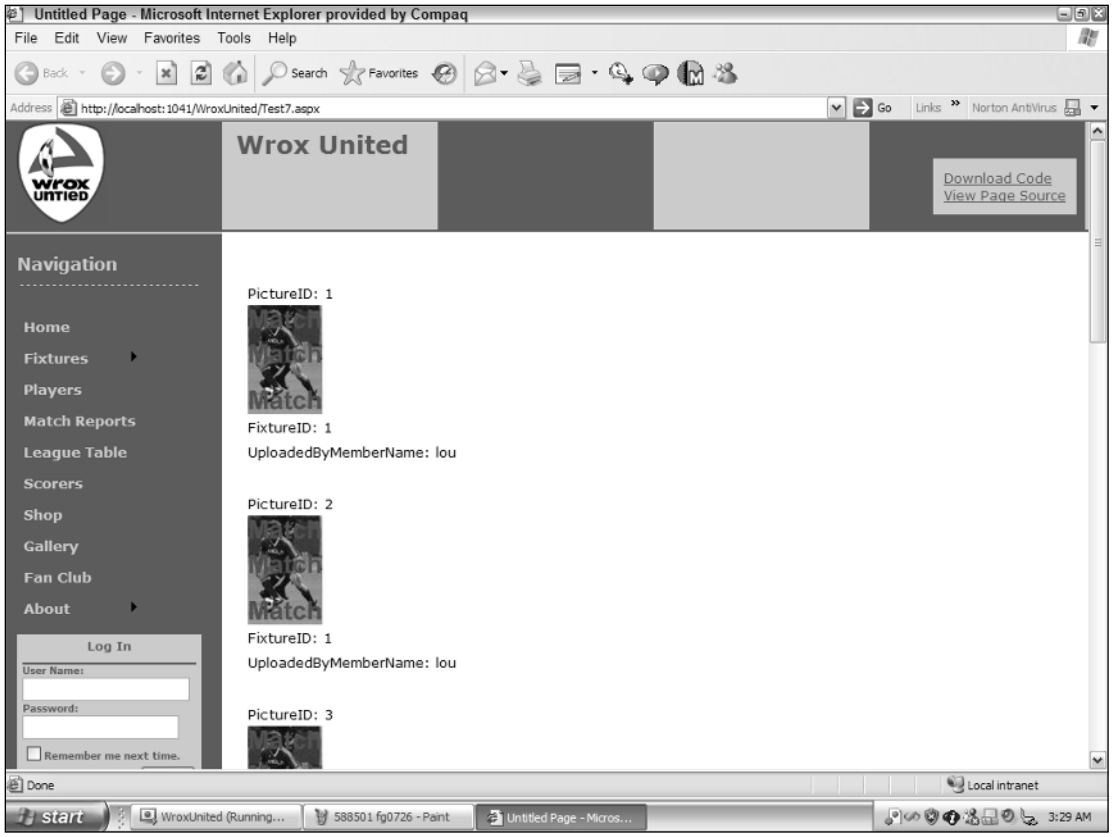


Figure 7-27

10. Now make some modifications to the `DataList`. Back in Design View, change the layout of the `DataList` control. Select the `DataList` control (see Figure 7-28), and in the Properties window change `RepeatColumns` to `3` and the `RepeatDirection` to Horizontal.

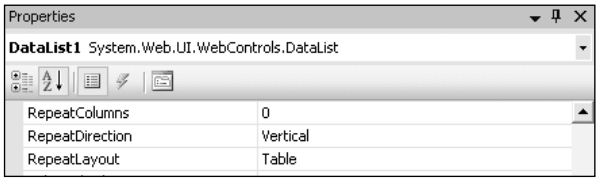


Figure 7-28

11. You'll finish with a little practice on templates. In Design View select the `DataList` control and open its smart task panel. Click Edit Templates and, by default, you will be editing the Item template, shown in Figure 7-29.

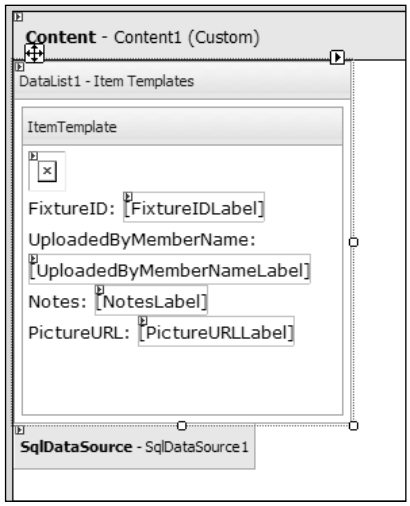


Figure 7-29

12. Delete the text "Notes:", but keep the label that shows the notes.

13. In the layout move the `FixtureID` up higher in the template and the Member Name lower in the template. Edit the text `UploadedByMemberName` by adding some spaces between the words so it is easier to read. Delete the text and label that refers to the PictureURL. These actions are shown finished in Figure 7-30.

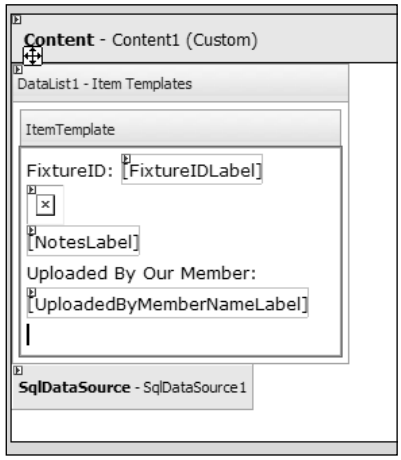


Figure 7-30

14. In the `DataList` control's smart task panel (probably still open), click End Template Editing. The page will look as follows in Source View:

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="Gallery-AllTest.aspx.vb" Inherits="Gallery_AllTest" title="Untitled
Page" %>
<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">

<asp:DataList ID="DataList1" runat="server" DataSourceID="SqlDataSource1"
RepeatColumns="3" RepeatDirection="Horizontal">
        <ItemTemplate>

            <asp:Image ID="Image1" runat="server" ImageUrl='<%# Eval("PictureURL",
"~/MatchImages/{0}") %>' /><br />

            <asp:Label ID="NotesLabel" runat="server" Text='<%# Eval("Notes")
%>'></asp:Label><br />

            FixtureID:
            <asp:Label ID="FixtureIDLabel" runat="server" Text='<%#
Eval("FixtureID") %>'></asp:Label><br />

            Uploaded By Member:
            <asp:Label ID="UploadedByMemberNameLabel" runat="server" Text='<%#
Eval("UploadedByMemberName") %>'></asp:Label><br />
        </ItemTemplate>

</asp:DataList>

<asp:SqlDataSource ID="SqlDataSource1" runat="server"
 ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
 SelectCommand="SELECT [PictureURL], [Notes], [UploadedByMemberName], [FixtureID]
FROM [Gallery]">
</asp:SqlDataSource>
</asp:Content>
```

15. Run the page to see the results of your work in your browser (see Figure 7-31).

How It Works

After the fifth step you had produced a page with names of picture files, not the actual images. This was because when VWD made the `DataList` control's default template it saw there was text in the `PictureURL` field so it created a `Label` control, as follows:

```
...
<asp:DataList ID="DataList1" runat="server" DataSourceID="SqlDataSource1"
RepeatColumns="3" RepeatDirection="Horizontal">
        <ItemTemplate>
            <asp:label ID="label1" runat="server"
                Text='<%# Eval("PictureURL") %>'>
            </asp:Label>
```

In the next step you changed the control from a `Label` to an `Image` control, as shown in the following code. This gave you an image but left the image rendered as a red x, meaning that the image could not be found.

```
<asp:Image ID="Image1" runat="server" ImageUrl='<%# Eval("PictureURL") %>' />
```

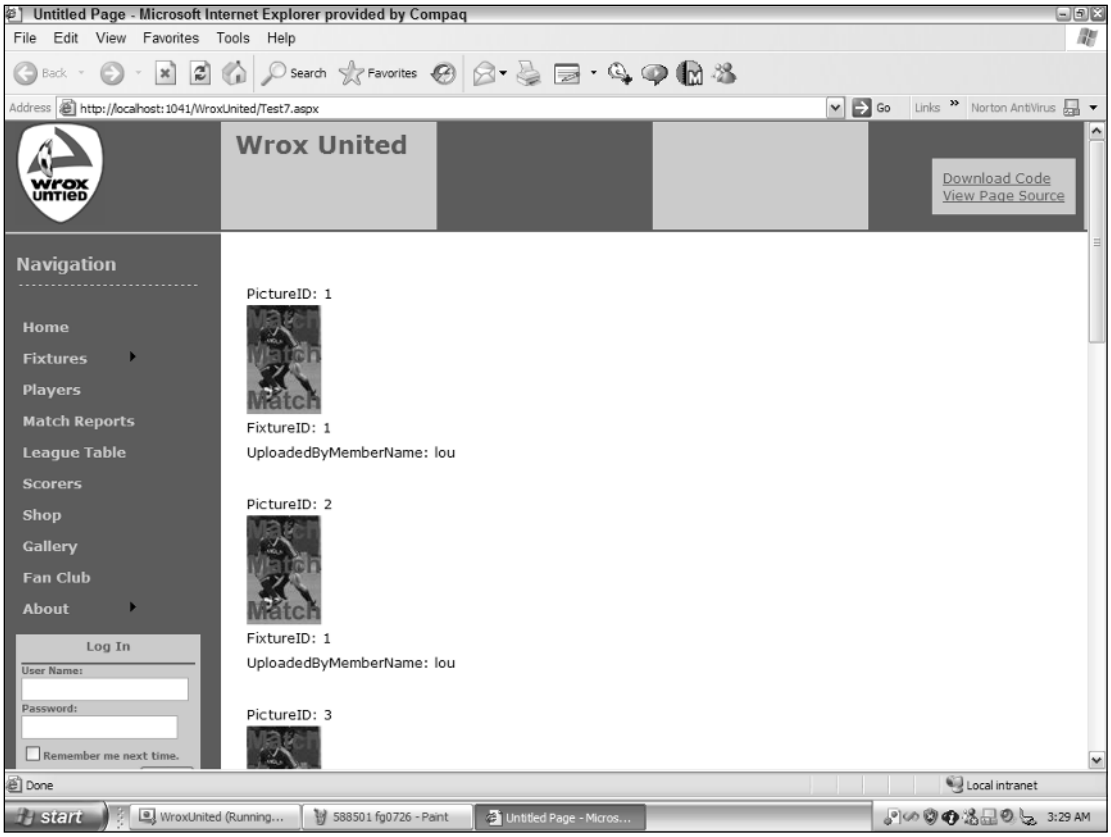


Figure 7-31

The problem is that an ASP.NET 2.0 page will, by default, look for an image file in the same folder as itself. The images are kept in a different folder named MatchImages. So, you can use a feature of the `Eval` method to add the relative path to the name of the picture file. You add a second argument that embellishes some text onto whatever value is provided by the database. In this case you added the path. There are two new tricks in this syntax. First, in the formatting argument you use a tilde (~) that means the root of the site. When you deploy the site to another server you will not have to change all of the paths. Second, the syntax `{0}` indicates the place to plug in the value that comes from the database. So syntax such as the following will be translated into `C:\BegASPNET\WroxUnited\MatchImages\aaronson.jpg` for the first record before it is used as the `ImageURL`:

```
<asp:Image ID="Image1" runat="server"
 ImageUrl='<%# Eval("PictureURL", "~/MatchImages/{0}") %>' />
```

You finished the exercise by getting some practice with editing templates. Remember that you must shift into Edit Templates mode prior to making changes to the controls in a template that actually present the data. If you become perplexed by the unresponsiveness of VWD when you attempt to select or modify the `Label` and `Image` controls, you have forgotten to enter Edit Templates mode. You saw how fields could be selected and then deleted or moved.

The DetailsView and FormView Controls

The three data-bound controls you have studied so far (`GridView`, `DataList`, and `Repeater`) display more than one record at a time. An alternative pair of data-bound controls display just one record at a time: `DetailsView` automatically creates a set of templates, whereas `FormView` is a blank slate upon which you build templates as desired. These are useful controls when you want to focus the user's attention on one record or need more screen real estate to display many fields for one record. They are also the preferred controls for adding or editing a record.

Like many other data-bound controls, `DetailsView` and `FormView` can be added to the page either directly, in which case VWD kicks off the wizard to create a data source control, or can be added after a data source control is already on the page.

> **As you will study in Chapter 8, only `DetailsView` and `FormView` can accept the addition of new records. `GridView`, `DataList`, and `Repeater` can change, display, and modify existing records, but not create new records.**

Both the `DetailsView` and `FormView` controls rely on templates as described in the previous section. After creating the control, open the smart task panel and click Edit Templates. The appearance will change as you enter Template Edit Mode. Figure 7-32 shows the default mode.

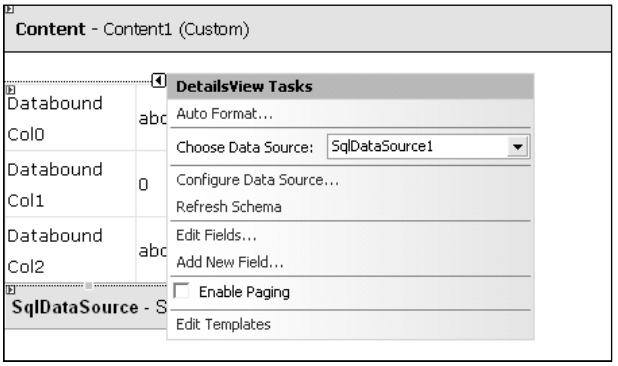


Figure 7-32

Figure 7-33 depicts the Template Edit mode where fields can be added, removed, or rearranged.

When displaying only one record you have to make a decision whether or not to allow navigation from record to record. If you are showing details of a record selected in a `GridView` control, you would not want the user to be able to navigate off to other records because that would cause a loss of synchronization with the `GridView`. But if the `DetailsView` is standing alone you can turn on paging with the checkbox in the smart task panel. The same Navigation Mode options are available as discussed for the `GridView`, such as `Numeric`, `FirstLast`, and `PreviousNext`.

In this Try It Out you practice looking at the information of one Wrox United match at a time using `DetailsView`.

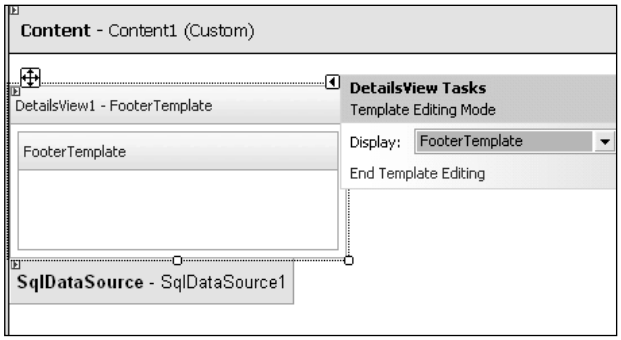


Figure 7-33

Try It Out Using DetailsView and FormView

1. Create a new page in the root of your site named Fixtures-Stacked using the master page and putting the VB code in a separate file. Switch to Design View.
2. Drag a `DetailsView` control from the Toolbox onto the page, as shown in Figure 7-34.

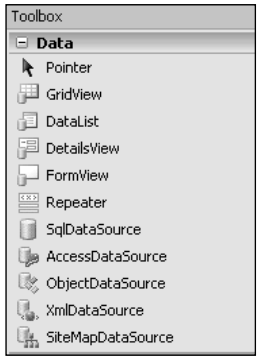


Figure 7-34

3. In the `DetailsView` control's smart task panel, choose its data source to be a new data source from Database with an ID of `SqlDataSource2` and using the existing Wrox United connection string. Be sure to name it SqlDataSource2 because you will add a SqlDataSource1 later. Include all of the fields from the Fixtures table.
4. Before testing the page, you need to enable paging from the `DetailsView` control's smart task panel. In addition, in the Properties window, configure the Pager Settings / Mode to use `NumericFirstLast`.
5. With the `DetailsView` control selected, in the Properties window change the `LastPageText` property to "Last Game of the Season" and `FirstPageText` property to "First Game of the Season." Also, select the DetailsView control and make it wider by dragging its right edge to the right.

The results are as follows:

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="Fixtures-Stacked.aspx.vb" Inherits="Fixtures_Stacked" title="Untitled
Page" %>

<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">

<asp:DetailsView ID="DetailsView1" runat="server"
    AllowPaging="True"
    AutoGenerateRows="False"
    DataKeyNames="FixtureID"
    DataSourceID="SqlDataSource2"
    Height="50px" Width="350px">
        <PagerSettings
            Mode="NumericFirstLast"
            FirstPageText="First Game of the Season"
            LastPageText="Last Game of the Season"
            />
        <Fields>
            <asp:BoundField DataField="FixtureID" HeaderText="FixtureID"
InsertVisible="False"
                ReadOnly="True" SortExpression="FixtureID" />
            <asp:BoundField DataField="FixtureDate" HeaderText="FixtureDate"
                SortExpression="FixtureDate" />
            <asp:BoundField DataField="FixtureType" HeaderText="FixtureType"
                SortExpression="FixtureType" />
            <asp:BoundField DataField="GoalsFor" HeaderText="GoalsFor"
                SortExpression="GoalsFor" />
            <asp:BoundField DataField="GoalsAgainst" HeaderText="GoalsAgainst"
                SortExpression="GoalsAgainst" />
            <asp:BoundField DataField="Notes" HeaderText="Notes"
                SortExpression="Notes" />
            <asp:BoundField DataField="Opponents" HeaderText="Opponents"
                SortExpression="Opponents" />
        </Fields>
    </asp:DetailsView>

    <asp:SqlDataSource ID="SqlDataSource2" runat="server"
        ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
        SelectCommand="SELECT * FROM [Fixtures]">
    </asp:SqlDataSource>
</asp:Content>
```

6. Run the page in your browser to observe that only one match is shown at a time (see Figure 7-35).

How It Works

The key point of this exercise is to create and view a presentation where one record is shown at a time, like the top playing card in a deck. You can use either the `DetailsView` or `FormView`; you chose `DetailsView` because it does an automatic default layout for you.

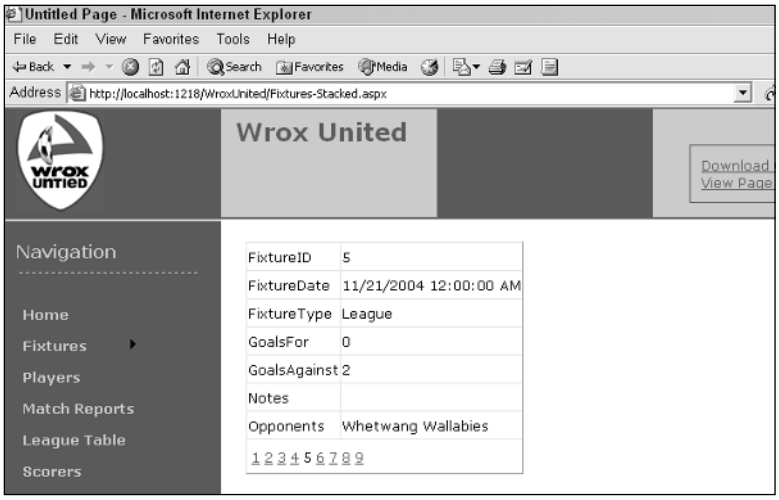


Figure 7-35

The modifications you made to the `DetailsView` control were almost the same as those for other data-bound controls in earlier exercises. To move through the records of games you enabled paging by checking the appropriate box in the control's smart task panel. To enhance the user experience you specified a specific set of navigation tools in the Properties window of the control and modified their text to present a more logical user interface.

Data Source Controls with Parameters

So far in this chapter you have created pages with fixed sets of data. With parameters you can determine, dynamically, what data to display in a data-bound control. In ASP.NET 2.0, a *parameter* is a tag that holds a data that can be used when a control carries out its task. For example, a parameter could hold a date, and that date is used to determine which game to show in a data-bound control. This section starts with a simpler case where you will look at how you can pass a parameter between pages. In the next section you will use parameters to enable two controls to work together. As with all of ASP.NET 2.0, the implementation is made even easier with tools in VWD. You will start with a simple page that picks up a value from a querystring and uses it to find one record of a table.

> **A querystring is field name and value added to a HTTP request, as shown in the italic part of the following URL (the text following the question mark):**
> `www.WroxUnited.com\PlayerInformation.aspx?PlayerLastName=Smith`**.**

When you created data source controls earlier in the chapter you saw how to add only certain columns from a table in the dialog step titled Configure the Select Statement, but the wizard button captioned WHERE was not discussed (see Figure 7-36).

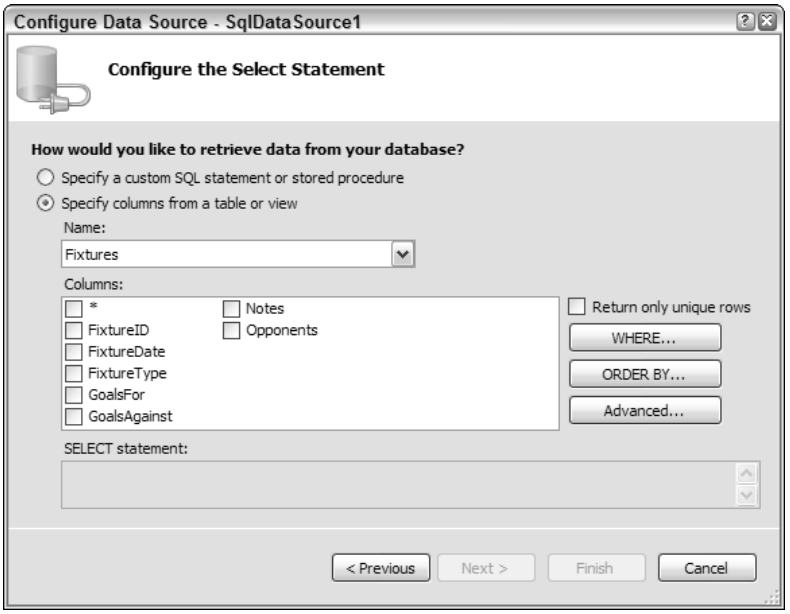


Figure 7-36

If you click the WHERE button of the wizard you get a dialog box that leads you through the options to limit the data set to only certain records. This step selects which column to use in the process of limiting records. Then the "source" drop-down list offers the choice of getting the data from a querystring. That opens a section for parameter properties. In the case shown in the shaded box above you would enter `PlayerLastName`. These steps add a section to the data source control called `SelectParameters`, as shown in the following shaded code. `SelectParameters` is one type of parameter; you will encounter others later in the book.

```
<asp:SqlDataSource ID="SqlDataSource1" runat="server"
ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
SelectCommand=
 "SELECT * FROM [Players] WHERE ([PlayerLastName] = @PlayerLastName)">
   <SelectParameters>
      <asp:QueryStringParameter Name="PlayerLastName"
         DefaultValue="XXX" QueryStringField="PlayerLastName" Type="String" />
      </SelectParameters>
</asp:SqlDataSource>
```

In this code, first notice in the shaded section that a `<SelectParameters>` is added. This is similar to a variable that will be filled by ASP.NET 2.0 with the value of `Smith` that comes in when you specify a querystring, as your did earlier. Then notice in the `SELECT` command that VWD has made the `WHERE` clause equal to a name starting with an at (@) sign. The at symbol means a parameter and in this case the parameter that holds the player's last name. Each time the page is opened or refreshed it will search the querystring for a PlayerLastName value. Typing all of these would be a waste of time; you will instruct VWD to do it for you in the next exercise.

In this Try It Out you modify the previous Try It Out. Instead of presenting a `DetailsView` control with all of the games stacked up, you will present just one game. That one game will be determined by a game identifier (`FixtureID`) in the querystring.

Try It Out Data Controls with Parameters

1. Make a copy of Fixtures-Stacked as follows. In Solution Explorer select `Fixtures-Stacked.aspx`. Right-click and select Copy. Right-click the root of the site and select Paste.

   Look in the list of files for `Copy of Fixtures-Stacked.aspx`. Rename the copy to `Fixtures-One.aspx`.

2. Select the `DetailsView` control and dis-enable paging.

3. Select the `SqlDataSource` control, open its smart task panel, and click Configure Data Source.

4. Click Next to keep the current connection, and go to configuration of the Select Statement. There is no need to change the table source or fields. Click the WHERE button to detour to the Add WHERE Clause box (see Figure 7-37).

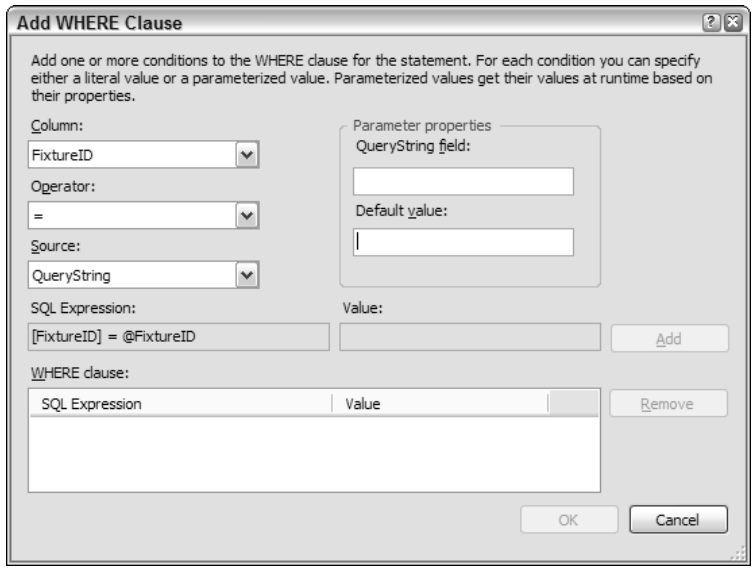


Figure 7-37

5. Select `FixtureID` from the drop-down list of columns.

6. Accept an operator of equals and set the source to querystring. In the parameters properties panel set the `QueryString` field to `FixID` (type in the name) and a default of `1`. Click Add and then click OK. Click Next and test. Notice that before the test runs, VWD gives you a chance to input by hand the value that will be in the querystring. Try the default of `1`, and then also test various numbers between. (See Figure 7-38.) Click Finish and read on.

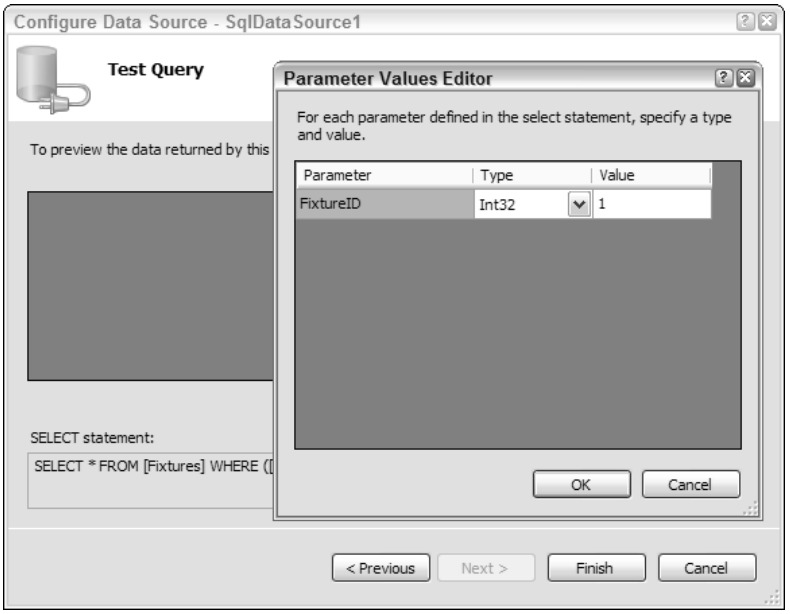


Figure 7-38

7. VWD registers that there was a change to the data source feeding the `DetailsView` control. It will give you a chance to rebuild the data-bound control to be synchronous with the new settings of the data source control. Agree to the update. You can also perform such a synchronization at any time by clicking the Refresh Schema choice in the smart task panel. Your file source code will end up as follows.

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="Fixtures-One.aspx.vb" Inherits="Fixtures_One" title="Untitled Page" %>
<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">

    <asp:DetailsView ID="DetailsView1" runat="server"
        AutoGenerateRows="False"
        DataSourceID="SqlDataSource2"
        Height="50px" Width="447px">
        <PagerSettings
        Mode="NumericFirstLast"
        FirstPageText="First Game of the Season"
        LastPageText="Last Game of the Season"/>
    </asp:DetailsView>

    <asp:SqlDataSource ID="SqlDataSource2" runat="server"
        ConnectionString="<%$ ConnectionStrings:ConnectionString2 %>"
        SelectCommand="SELECT [FixtureDate], [FixtureType], [GoalsFor],
[GoalsAgainst], [Notes], [Opponents] FROM [Fixtures] WHERE ([FixtureID] =
@FixtureID)">
        <SelectParameters>
```

```
            <asp:QueryStringParameter DefaultValue="1" Name="FixtureID"
QueryStringField="FixID"
                Type="Int32" />
        </SelectParameters>
    </asp:SqlDataSource>
</asp:Content>
```

8. Now you can test the page by running it. By default game number 1 will be displayed. In your browser's address bar try changing the URL from . . . `/WroxUnited/Fixtures-One.aspx` by adding a querystring to get . . . `/WroxUnited/Fixtures-One.aspx?FixID=3` and click the GO button of your browser (as shown in Figure 7-39).

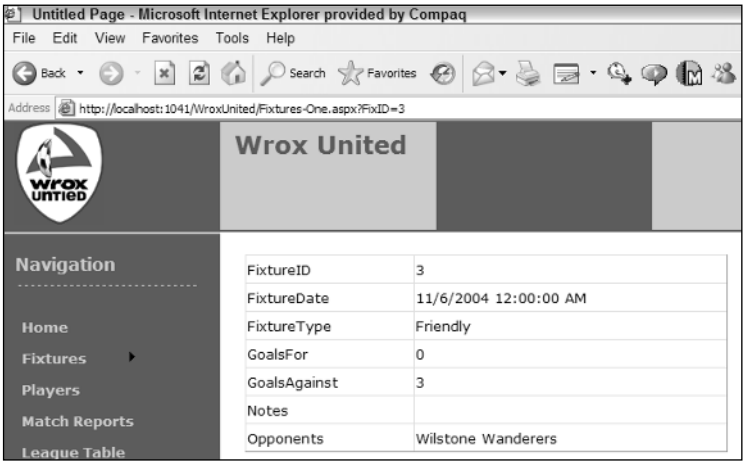


Figure 7-39

How It Works

You did a rather elaborate procedure to make the copy. You might be tempted to just open the original and Save As with the new name. But with a Save As you do not get a copy of the code-behind page nor do you get a change in the .aspx page's reference to the code-behind file. Copying, pasting, and changing the name in Solution Explorer instructs VWD to take care of the details.

First, you disabled paging because with only one record in the stack there is no need for navigation. Then you revised your `SelectCommand`. Even though you already have your `SqlDataSource` control configured, you can restart the wizard and modify the control. This eliminates the possibility of introducing typos by editing in Source View.

In prior exercises you did not use the WHERE button and so VWD built for you a `SelectCommand` that returned all of the records. In the Add WHERE Clause step you selected a column (which means field) that was going to be scanned for matches. You wanted your matches to be exact, so you selected the equals operator. Then you selected a source of `QueryString`. This means that the value of which fixture to display (the parameter) can be found in the querystring. Under parameters properties you set the name of the value in the querystring to be `FixID`. Don't forget to click the Add button in the Add Where Clause window — it is easy to overlook.

VWD keeps an eye on the data source control for each data-bound control. When you finish your revision to the data source control VWD warns you that you better synch up any data-bound controls using that source. You can also do that synch explicitly with a click on the Refresh Schema button of the smart task panel.

All of these changes have left the page ready to accept an ID of a game in the querystring. The value must have the name of `FixID`. Your data source will take that value (or `1` if there is no `FixID`) and use that in the `SelectCommand` to find the records with a matching `FixtureID`. Only that game will be shown. When you test the page you only have to remember the syntax to attach a value to a URL. After the page name type a question mark to begin parameters. Then type the parameter name, an equals sign, and the parameter's value.

Multiple Data Controls Working Together

The previous section described a crude way to use parameters by typing them into the URL. The enlightened way is to use one data-bound control to create the parameters for another data-bound control. These are termed ControlParameters. This section demonstrates two very common cases. In the first case, a `DropDownList` control determines which record or records to display in a `GridView` control. In the second case, a selection in a `GridView` control determines which record for which the page should show more fields in a `DetailsView` control. These are called master-child scenarios. A selection in a master data-bound control establishes the value for a `WHERE` clause in the data source control of the child data-bound control. In almost all cases there must be separate data source controls for the master and child data-bound controls.

In the master control you only need one special property. If the master control is a `ListBox` or `DropDownList` control, the `AutoPostBack` property must be set to `True` so that when a selection is made from the master, ASP.NET 2.0 will invoke a refresh of the page and the resulting change in the record will be shown in the child control. Keep in mind that `ListBox` and `DropDownList` controls have two field parameters. The first is the field to display (`DataTextField` property), and the second is the field that is used in page code (`DataValueField` property). This allows a last name, for example, to be displayed to the user in the list box but the more useful value of, for example, PlayerID to be used in SQL statements. If the master control is a `GridView` you can open its smart task panel and Enable Selection to get VWD to build a new column with select buttons for each record. When clicked, ASP.NET will react to the selection of that record, as you will see.

In the child control you must set a parameter into the `WHERE` clause of the child control's data source control. In the previous section you set the parameter to a field of the querystring using the Add WHERE Clause dialog of the Configure Data Source Control wizard. You can use the wizard again, but this time when you get to the Add WHERE Clause panel you set your column equal to a value from a control (not a querystring). The wizard presents a list of controls from which you can select. Within the selecting control you determine which value to use, normally the SelectionValue.

In the following Try It Out you practice two combinations of controls. In the first you use a `GridView` selection to show additional fields in a `DetailsView` control. In the second you use a `DropDownList` control to show only certain records in a `GridView`.

Try It Out Multiple Controls Working Together

1. Now you will build your final version of `Fixtures.aspx`. Move your existing Fixtures.aspx to a folder that you create and name OldPages. Because the steps are so quick and easy (and it is a good review) you will start from scratch. Add a new item to the site named `Fixtures.aspx` using the Master page with VB code in a separate file. Switch to Design View.

2. Open Database Explorer, navigate to WroxUnited.mdf ➪ Tables ➪ Fixtures. Select only the fields for `FixtureID`, Fixture`Date`, and `Opponents` (using Ctrl+Click), and drag them to the page. VWD will crank for a few seconds and then give you a `GridView` with its smart task panel open. Enable Selection as shown in Figure 7-40. Note that VWD has already added the column of Select buttons.

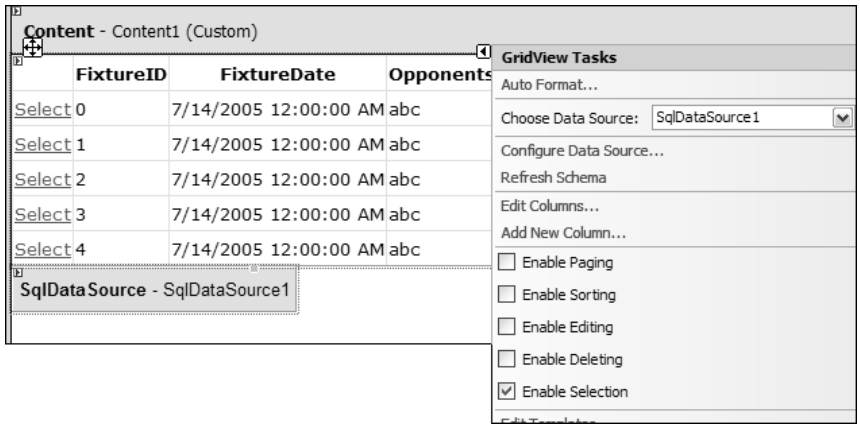


Figure 7-40

3. Go to the bottom of the content holder and drag a `DetailsView` control from the Toolbox. Choose a data source of New and configure the database with an ID of `SqlDataSource2` and continue using the connection string named WroxUnited that you use in all of this chapter. Specify to get data from the Fixtures table and select all the fields.

4. Click the WHERE button and select the column of `FixtureID`. Set the operator to equals and select Control from the Source drop-down (see Figure 7-41).

5. Now in the parameter properties, set the `ControlID` to `GridView1` and the default value to `1`. Don't forget to click the Add button (not done yet in Figure 7-41). Click OK, Next, and then the Test Query button (a value of 1 is fine), and finally, click the Finish button.

6. Drag the `DetailsView` control to be wider. Save and view it in your browser (see Figure 7-42). Select various matches from the `GridView` and see their notes below the `GridView` in the `DetailsView` control.

7. Now you will improve the Gallery page by only showing pages from one match. In Solution Explorer, make a copy of `Gallery-All.aspx` to the root. Change the copy's name to `Gallery.aspx`.

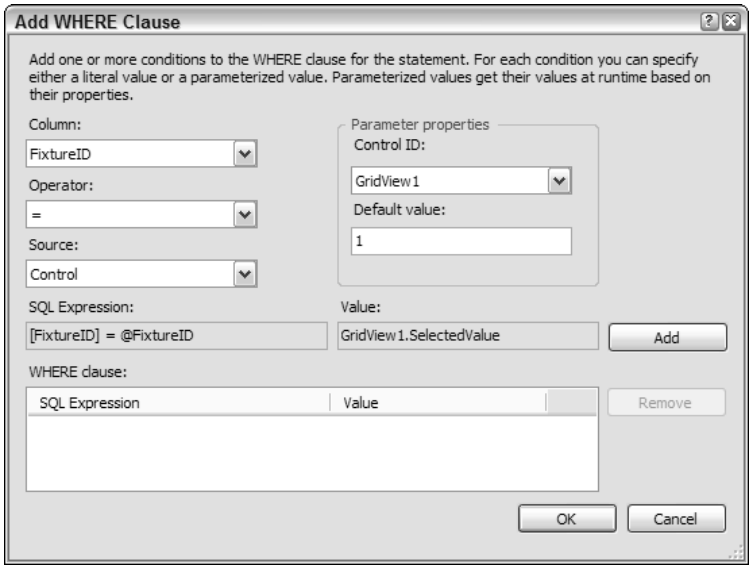


Figure 7-41

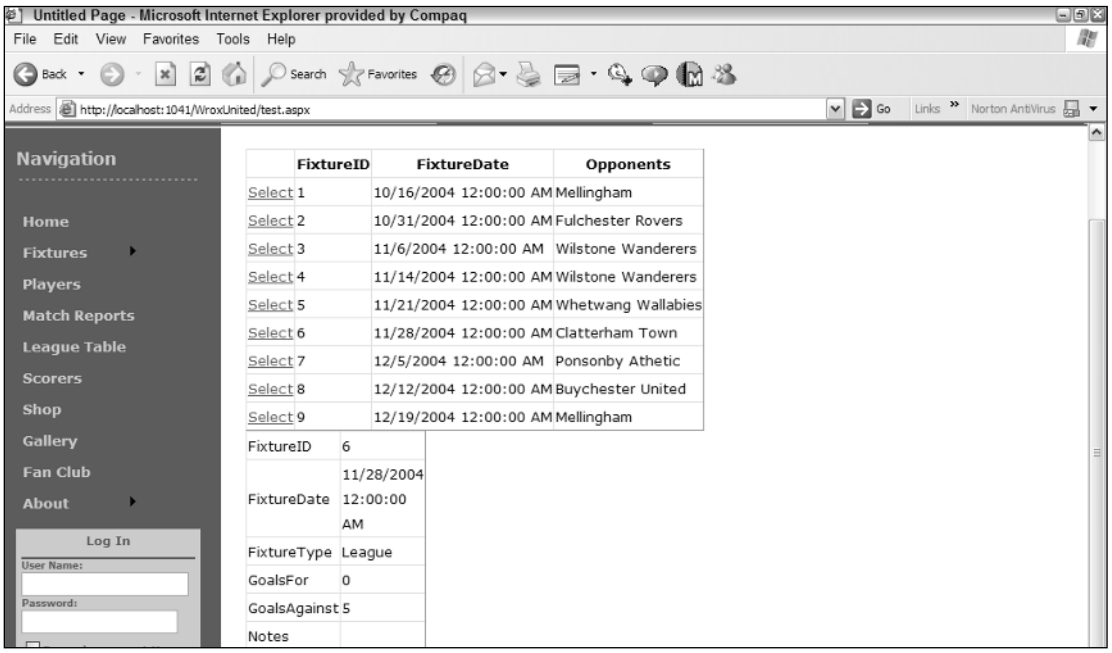


Figure 7-42

8. Open `Gallery.aspx` and add a few line breaks and then a `DropDownList` box to the top of the page. Configure its data source to a new source of type Database and name it SqlDataSource3. Use the `WroxUnited` and from the Fixtures table select the `FixtureID`, Fixture`Date`, and `Opponents`.

   Click ORDER BY and sort on `FixtureDate` ascending. Click OK, Next, and then test the query and finish. This brings you back to the Choose a Data Source window, and you will display (for now) the Opponents and set the value to `FixtureID`. Click OK. While the `DropDownList` control is still selected, turn on Enable AutoPostback from the smart task panel.

9. Open the smart task panel for the `DataSourceControl1` (used by the `DataList`) and start its Configure Data Source wizard. Step through to the `WHERE` clause. Set the Column of `FixtureID` to equal a control with the `ControlID` of `DropDownList1` and a default value of `1`. Don't forget to click the Add button and click OK. Finish the procedure with clicking Next, and then test query (a parameter value of 1 is fine) and finish. Refresh the data-bound control when prompted. You will see the result shown in Figure 7-43 in your browser (albeit all the photos to date have been from game 1) and code in Source View.

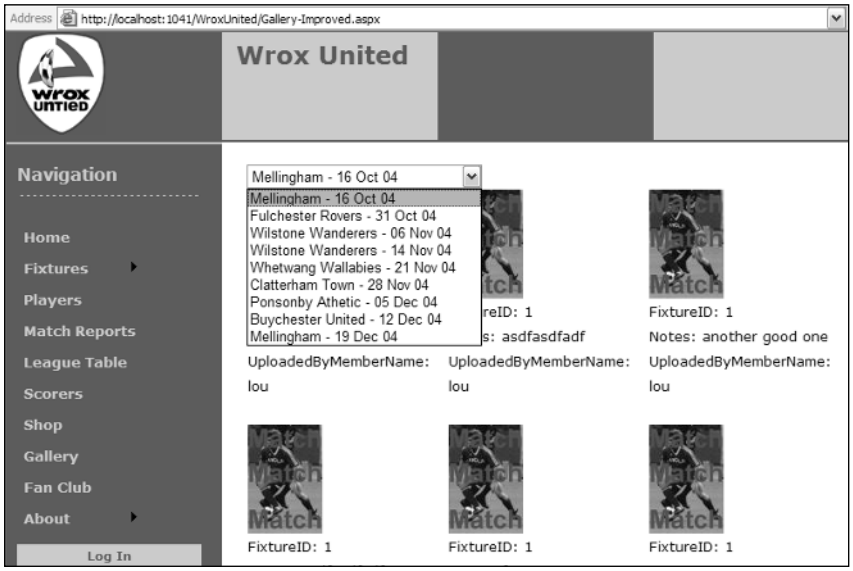


Figure 7-43

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="FixFinal.aspx.vb" Inherits="FixFinal" title="Untitled Page" %>

<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">
<asp:DropDownList ID="DropDownList1" runat="server"
AutoPostBack="True"
DataSourceID="SqlDataSource3"
 DataTextField="Opponents"
DataValueField="FixtureID">
</asp:DropDownList>
```

```
<asp:SqlDataSource ID="SqlDataSource3" runat="server"
ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
        SelectCommand="SELECT [FixtureID], [FixtureDate], [Opponents] FROM
[Fixtures] ORDER BY [FixtureDate]">
</asp:SqlDataSource>

<asp:GridView ID="GridView1" runat="server"
AutoGenerateColumns="False"
DataSourceID="SqlDataSource1"
 EmptyDataText="There are no data records to display.">
</asp:GridView>
<asp:SqlDataSource ID="SqlDataSource1" runat="server"
ConnectionString="<%$ ConnectionStrings:WroxUnitedConnectionString1 %>"
DeleteCommand="DELETE FROM [Fixtures] WHERE [FixtureID] = @FixtureID"
InsertCommand="INSERT INTO [Fixtures] ([FixtureDate], [Opponents]) VALUES
(@FixtureDate, @Opponents)"
        ProviderName="<%$ ConnectionStrings:WroxUnited.ProviderName %>"
        SelectCommand="SELECT [FixtureID], [FixtureDate], [Opponents] FROM
[Fixtures] WHERE ([FixtureID] = @FixtureID)"
        UpdateCommand="UPDATE [Fixtures] SET [FixtureDate] = @FixtureDate,
[Opponents] = @Opponents WHERE [FixtureID] = @FixtureID">
        <DeleteParameters>
            <asp:Parameter Name="FixtureID" Type="Int32" />
        </DeleteParameters>
        <UpdateParameters>
            <asp:Parameter Name="FixtureDate" Type="DateTime" />
            <asp:Parameter Name="Opponents" Type="String" />
            <asp:Parameter Name="FixtureID" Type="Int32" />
        </UpdateParameters>
        <SelectParameters>
            <asp:ControlParameter ControlID="DropDownList1" DefaultValue="1"
Name="FixtureID"
                PropertyName="SelectedValue" Type="Int32" />
        </SelectParameters>
        <InsertParameters>
            <asp:Parameter Name="FixtureDate" Type="DateTime" />
            <asp:Parameter Name="Opponents" Type="String" />
        </InsertParameters>
    </asp:SqlDataSource>

    <asp:DetailsView ID="DetailsView1" runat="server"
AutoGenerateRows="False"
DataKeyNames="FixtureID"
         DataSourceID="SqlDataSource2"
Height="50px" Width="492px">
        <Fields>
            <asp:BoundField DataField="FixtureID" HeaderText="FixtureID"
InsertVisible="False"
                ReadOnly="True" SortExpression="FixtureID" />
            <asp:BoundField DataField="FixtureDate" HeaderText="FixtureDate"
SortExpression="FixtureDate" />
            <asp:BoundField DataField="FixtureType" HeaderText="FixtureType"
SortExpression="FixtureType" />
            <asp:BoundField DataField="GoalsFor" HeaderText="GoalsFor"
SortExpression="GoalsFor" />
```

```
            <asp:BoundField DataField="GoalsAgainst" HeaderText="GoalsAgainst"
SortExpression="GoalsAgainst" />
            <asp:BoundField DataField="Notes" HeaderText="Notes"
SortExpression="Notes" />
            <asp:BoundField DataField="Opponents" HeaderText="Opponents"
SortExpression="Opponents" />
        </Fields>
</asp:DetailsView>
<asp:SqlDataSource ID="SqlDataSource2" runat="server"
ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
        SelectCommand="SELECT * FROM [Fixtures] WHERE ([FixtureID] = @FixtureID)">
        <SelectParameters>
            <asp:ControlParameter ControlID="GridView1" DefaultValue="1"
Name="FixtureID" PropertyName="SelectedValue"
                Type="Int32" />
        </SelectParameters>
</asp:SqlDataSource>
</asp:Content>
```

10. You'll finish up with a trick to resolve the problem of the user not knowing which match to select in the `DropDownList` when the same opponent is listed several times. Change the `SelectCommand` of the `DropDownList` data source control (`SqlDataSource2`) and the `DataTextField` of the `DropDownList` as follows:

```
<asp:DropDownList ID="DropDownList1" runat="server"
    DataSourceID="SqlDataSource2"
    DataTextField="FixtureCombo"
    DataValueField="FixtureID"
    AutoPostBack=true >
</asp:DropDownList>

<asp:SqlDataSource ID="SqlDataSource2" runat="server"
    ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
    SelectCommand="SELECT [FixtureID], (Opponents + ' - ' + CONVERT(varchar,
FixtureDate, 6)) As FixtureCombo  FROM [Fixtures] ORDER BY [FixtureDate]">
```

How It Works

Both of these pages are logical extensions of what you did in earlier exercises. As before, you changed the `SelectCommand` (using VWD's Configure Data Source wizard) so that there is a `WHERE` clause that gets its value from a parameter. In the previous Try It Out the parameter came in with the querystring, but on these two pages the parameter comes from another control.

In the first case the `GridView` filled the parameter with the ID of the record for which the Select button was clicked. That value was then used by the data source control in its `WHERE` clause. An important (and frequently overlooked) step is to set the `DropDownList` control to `AutoPostBack`.

In the final step you wanted to display more than one field in the `DropDownList` control. You can achieve that goal by using a SQL statement that creates a new field by concatenating values from existing fields. The following code brings together the opponent's name, the literal text of spaces, a hyphen, and a converted format of the game date to create a field called `FixtureCombo`:

```
        SelectCommand="SELECT [FixtureID], (Opponents + ' - ' + CONVERT(varchar,
FixtureDate, 6)) As FixtureCombo  FROM [Fixtures] ORDER BY [FixtureDate]">
```

Note how a plus sign (+) is used between each section of the string of text. The opponent value comes from the database in a form ready to use. The `FixtureDate` also comes from the database. But it comes in a date format that is not what you want. So you convert it to a type called `varchar`, which is a string of characters. You then put together the two parts with a dividing section of text that consists of a space, a hyphen, and another space.

Working with XML Data

XML has solidified as the standard format for information on the Web. XML files (or streams of data) are self-describing (each value has a label) and hierarchical in that every item of data has a parent except the topmost tag. Typically an XML file will have its highest-level tags that merely state the kind of information held, like Players. Then there would be a set of tags called "player" for each member of the team. Within there would be further, lower-level tags describing that player. Each item is called a node, for example, one player. Additionally, XML is case-sensitive. XML files can be created, read, and revised using ASP.NET 2.0. In the following Try It Out, you create an XML file using VWD.

The league has issued a few changes to Wrox United's 2007 schedule:

Game Number	Date	Home	Visitor
1	2007, October 21	Wrox United	Clatterham
2	2007, October 22	Mellingham	WroxUnited
3	2007, October 22	Wrox United	Fulchester

Try It Out Creating XML Data

1. Right-click the root of your site and add a new item of the type XML file and name it Schedule2007. Normally you would store an XML file in `App_Data`, but for this exercise that creates some rights problems when viewing in your browser.
2. At the beginning of the file VWD will automatically add the tag for the XML version. Go to the end of the file and type in `<Games>`. Notice that VWD automatically adds the closing tag for `<Games>`. These tags are the highest level and describe the entire contents of the XML file.
3. Now you will create a node for the first game. Inside the `<Games>` tags, create a `<game>` tag (note that this is singular). Now add a `Number="1"` inside the opening `<Game>` tag as per the code listing after the next step.
4. Inside the `<Games>` tag, add three pairs of child tags with values for the team names and the date as follows:

```
<Games>
  <Game Number="1">
    <Date>2007/10/21</Date>
    <Home>WroxUnited</Home>
    <Visitor>Clatterham</Visitor>
  </Game>
</Games>
```

5. Now add the other two games in the same manner and save the file. The additional games will be as follows. (For the sake of completeness, the first game is included again.)

```
<Games>
  <Game Number="1">
    <Date>2007/10/21</Date>
    <Home>WroxUnited</Home>
    <Visitor>Clatterham</Visitor>
  </Game>

  <Game Number="2">
    <Date>2007/10/22</Date>
    <Home>Mellingham </Home>
    <Visitor>WroxUnited</Visitor>
  </Game>

  <Game Number="3">
    <Date>2007/10/22</Date>
    <Home>WroxUnited</Home>
    <Visitor>Fulchester</Visitor>
  </Game>

</Games>
```

6. If you run the file the XML data will be sent to the browser, and most browsers can render a simple presentation (see Figure 7-44). Try it, noting that there is no ASP.NET 2.0 involvement yet.

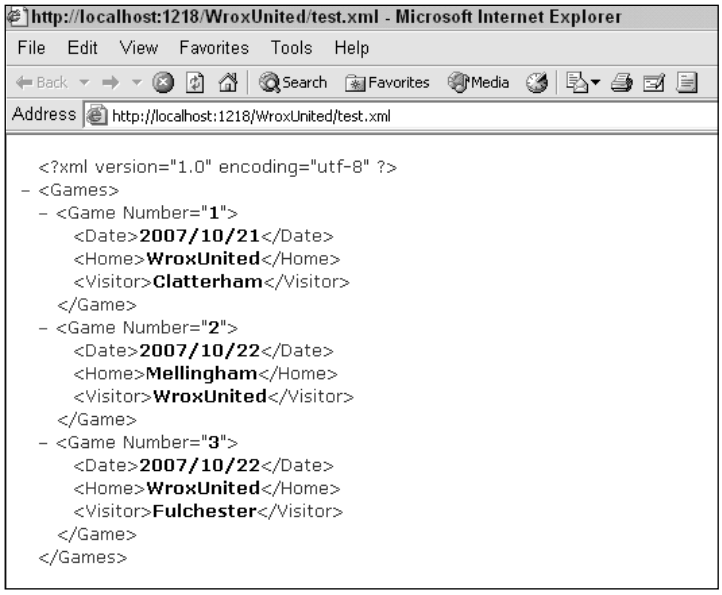


Figure 7-44

How It Works

You saw in this exercise that you start with a top-level node named `<Games>`. Then, being careful not to make typos in the case, you added a node for the first game. The data for that game was organized in two ways. The number of the game was placed in the `<Game>` tag as an attribute. But you chose to place the date and competitors in separate tags at a lower level than the `<Game>` tag. After running the file you saw how your browser handles a raw XML file. In the next section you see what ASP.NET 2.0 can do with that information.

Reading XML Data

Because XML data is organized as a hierarchy, ASP.NET 2.0 provides alternate data source and data-bound controls from those you used with tabular data earlier in the chapter. The XML data source control provides the data source control for most cases. The key property that must be set in this control is the name of the XML database file.

ASP.NET 2.0 supports rendering of tree data with three data-bound controls named `TreeView`, `Menu`, and `SiteMapPath`. The `TreeView` is a little tricky to set up, as you will see, but then does its job just fine. The `TreeView` control is fine for any XML data. The `Menu` control is designed only for its named purpose. The `SiteMapPath` control renders differently depending on the page that is currently opened. Chapter 2 presented more on this navigation control.

VWD offers a handy way to identify which pieces of data should appear in its rendering. The tool is called the `TreeViewDataBindings` Editor and it can be opened from the `TreeView` control's smart task panel as you will practice in the following exercise.

In the following Try It Out you create a display of the games scheduled for 2007 at the bottom of the `Fixtures.aspx` page.

Try It Out Reading XML Data

1. Open `Fixtures.aspx` in Design View and drag a `TreeView` control (in the navigation section of the Toolbox, shown in Figure 7-45) to the bottom of the page.

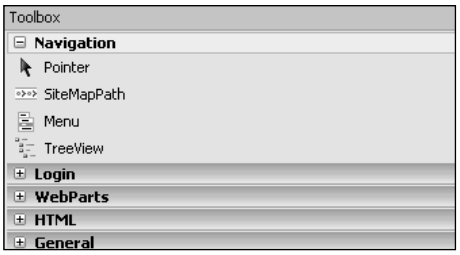


Figure 7-45

2. On the smart task panel select Choose Data Source and select New. Note that this time you have different choices for a data source; you want to use an XML file (see Figure 7-46).

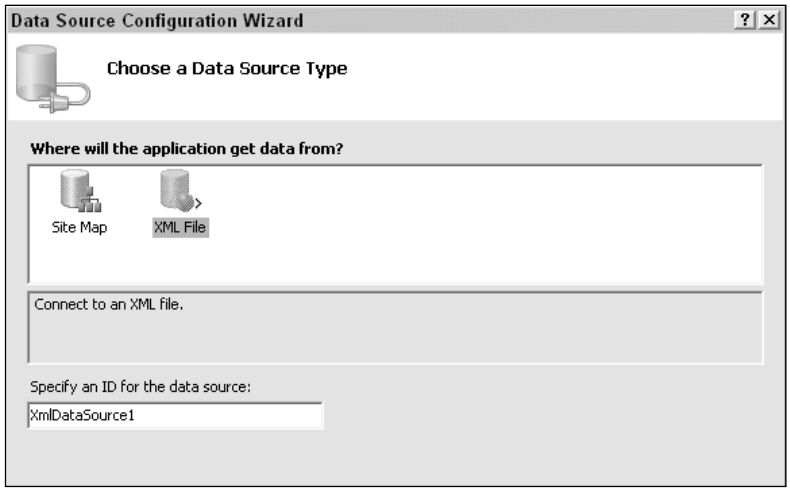


Figure 7-46

3. Specify an ID of Schedule2007XML and then browse to the `Schedules2007.XML` file that you created. For now, leave the Transform and XPath boxes in the wizard blank. Run the page in your browser (see Figure 7-47) and look at the tree at the bottom of the page:

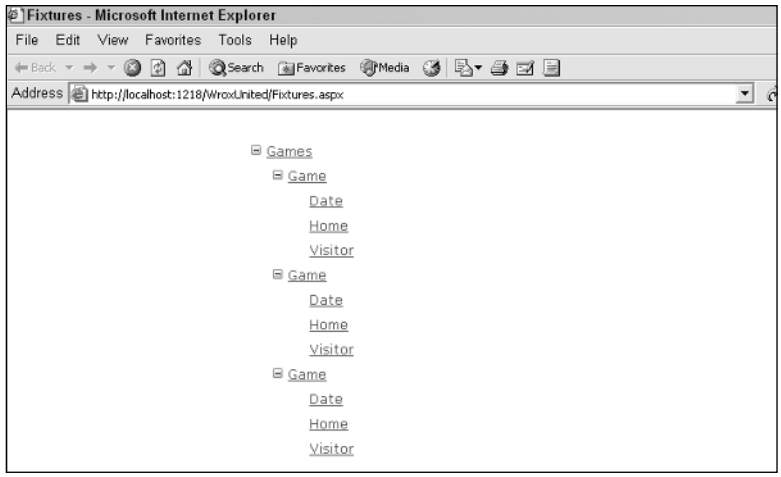


Figure 7-47

The page is rendering the names of the nodes but not the data of the nodes. Close the browser.

4. In Design View, select the `TreeView` control, open its smart task panel, and click "Edit TreeNode Data bindings." Select Game in the top left (the singular Game, not the plural Games) and click Add (see Figure 7-48).

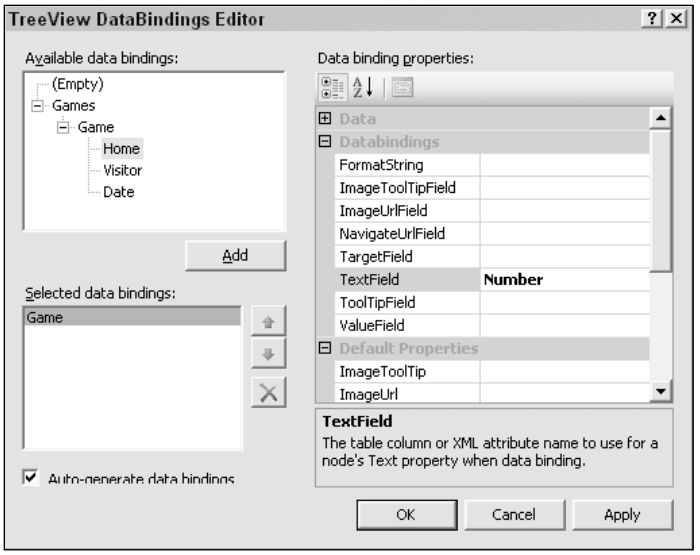


Figure 7-48

5. In the Properties window set the `TextField` to `Number`. Staying in the DataBindings editor, select Home, click Add, and set its `TextField` to `#InnerText` because you want to display the text between the `<Home>` and `</Home>` tags on the page. Repeat for the Date and Visitor data.

How It Works

In the first step you found the `TreeView` control in the Navigation panel of the Toolbox. After dragging it to the page you can set its source of data the same way that you do for other data-bound controls, by using the Choose Data Source in the smart task panel. But in the case of a `TreeView` you want to use a hierarchical source, so you pick the XML file you made in the last exercise.

As you observed in the first run of the page, by default you only get the generic names of the nodes, not the actual data. The data is specified by using the `TreeViewDataBindings` Editor. You can add (or remove) tags to which you want data rendered. Once a field is added you go to the right side and select its `TextField` property. If you have data within a tag, such as Number within the `<Game>` tag, then the name of that data will show up without a number sign. If the data is between an opening and closing tag, such as `<Home>WroxUnited</Home>`, the `TextField` option will be set to `#InnerText`.

Binding Syntax

In this book you have taken advantage of VWD's features to build code and thus spent little time examining the code that was built for you. But it is worth understanding code that actually brings together the data source controls and the data-bound controls. Within a template for a `GridView`, `DataList`, `Repeater`, `DetailsView`, or `FormView` you see the following code:

```
<asp:DataList ID="DataList1" runat="server"
  DataSourceID="SqlDataSource1"
     <ItemTemplate>
      <asp:Label ID="FixtureIDLabel"
         runat="server"
         Text='<%# Eval("FixtureID") %>'
         BackColor="Yellow"></asp:Label>
    </ItemTemplate>
  </asp:DataList>
```

The shaded line instructs the page to bind the `Text` property of the control named `FixtureIDLabel` to the field named `FixtureID` in the data source `SqlDataSource1`. This method (request for a specific behavior) named `Eval()` actually performs the connection between one field in the data source control and a rendering mechanism in the data-bound control. Two similar methods exist: `Eval()` is for read-only, and `Bind()` allows both read and write (and is covered in the Chapter 8). Within templates VWD will write code to specifically employ these methods. But if there is no templating, the binding is implied and will not appear in the code.

Summary

ASP.NET 2.0 greatly eases the use of data on a web page by encapsulating most of the code into easy-to-use controls. In this chapter you learned that data source controls and data-bound controls work together. The former provides a connection to an information source, and the latter renders that information onto a page. ASP.NET 2.0 ships with four data source controls (`SqlDataSource`, `AccessDataSource`, `XMLDataSource`, and `SiteMapDataSource`), each optimized to work with a particular type of data. This chapter focused primarily on the `SqlDataSource` control, because it can be used with any database that can understand SQL statements. A fifth data source control, `ObjectDataSource`, is used for custom-designed business objects.

After learning the basics of data source and data-bound controls, the chapter drilled down into the specifics of how to use them on your pages, specifically covering the following topics:

- How to use the `GridView`, `DataList`, and `Repeater` controls to display tabular data.
- How to use the `DetailsView` and `FormView` controls to display single records.
- How to use the `ListBox` and `DropDownList` controls to display a selection of records.
- How to use the `TreeView`, `SiteMapPath`, and `Menu` controls to display tree data.

Additionally, this chapter covered the use of templates and wizards when setting up data source and data-bound controls. Recall that a template is a space into which you can drag various fields or other controls. Once in a template, these controls can be bound to the record currently shown by the template.

Most data-bound controls offer templates. These spaces can hold many kinds of controls that can be data-bound, including labels, text boxes, and images. All of the bound controls within a template will have their information revised when the user moves from record to record. To change a template you select the control and switch to Template Editing mode. After making your changes, be sure to click the smart task panel's End Template Editing to revert to normal mode.

Data-bound controls can be configured to display only a portion of the records. This behavior can be set statically by a value in a `WHERE` clause of the `SELECT` command of the data source control. The restriction of records can also be set dynamically. The parameter can come from a querystring or another data-bound control. For example, the selection in a `DropDownList` (master control) can be used as the parameter of a `WHERE` clause that limits the records shown in a `GridView` (child control).

Reading and displaying data is half of the data story. The other half is getting information to flow in the opposite direction. Chapter 8 looks at how to get information from users and write it to your data store.

Exercises

1. Describe the general capabilities of data source and data-bound controls.
2. Which data-bound controls render data in tables?
3. Compare and contrast the `DetailsView` and `FormView` controls.
4. Describe how a `GridView` control can limit its records to only those that match a player's name selected in a `DropDownList` of last names.
5. Which data source control is best suited for the `Menu` or `SiteMapPath` data-bound controls?

8

Writing Data

In Chapter 7 you learned how to read data from a database and present it on a page. In this chapter you study the reverse, how to gather data from a user and write it to a database. When we refer to *writing* we mean three kinds of operations: the creation of new records, changing existing records, and deleting records. The pattern is the same for all three and the setup is made quite easy with the internal functionality of the data source and data-bound controls, as well as the auto-typing features of VWD. As a bonus this chapter discusses transferring files from the browser to the server and then wraps up with an exercise that integrates several techniques from Chapters 6 through this one.

Introduction to Writing Data

Recall from Chapter 7 that ASP.NET 2.0 uses two groups of controls to work with data. Data source controls provide a connection to a source of data and enable certain behaviors, such as reading and writing to the data source. Data-bound controls provide a user interface on the page that can take advantage of the data source control capabilities. For the most part, the controls are mix-and-match. A `DropDownList` can use a `SqlDataSource`, `XMLDataSource`, or `AccessDataSource` control. Conversely, a `SqlDataSource` control can have its output rendered by a `GridView`, `DetailsView`, `DataList`, or `DropDownList` data-bound control. Having noted that flexibility, data controls are optimized for either tabular (relational) or hierarchical (tree) data.

Data controls are optimized for one of two ways to organize information, as discussed in Chapter 7. The first type is relational and the second is hierarchical. Although there can be some crossover in functionality, the division of the controls is described in the following table.

	Relational	**Hierarchical**

Data Source Controls	`SQLDataSource`
	`AccessDataSource`
	`ObjectDataSource`
		`XmlDataSource`
		`SiteMapDataSource`

Data-bound Controls	`GridView`
	`DataList` and `Repeater`
	`DetailsView` and `FormView`
		`TreeView`
		`Menu`
		`SiteMapPath`

Both data source and data-bound controls have functionality (like writing to a database) built into their code and you can specifically turn on any or all of those behaviors. For example, in Chapter 7 you enabled paging and sorting. Most of this chapter discusses how to turn on the writing behaviors.

Before diving into details, let us clarify some terminology surrounding writing data. First, writing actually means *changing* data, as opposed to just creating it. That means that writing includes changes to existing records, creating new records, and deleting existing records. ASP.NET 2.0 uses some industry-standard language for control properties. Changing an existing record is called an `UPDATE`, and creating a new record is called an `INSERT` or `INSERT INTO`. `DELETE` means removing an entire record from the database. Note that if you want to delete one value from an existing record (for example the date of birth of one player), you would `UPDATE` that player's record with a change of the birth date value from a date to `NULL`. The term `SELECT`, which you used in the last chapter, means reading data (no changes). ASP.NET 2.0 controls add three additional terms that are used to accept a user's actions. `NEW` means to switch to a view of a control that allows the user to enter data for a new record. This action would be followed by `create`, which actually sends the SQL `INSERT INTO` instruction to the database. And last, `EDIT` means switch to a view wherein the user can change a record's data. That would be followed by a click on `UPDATE` to actually execute the updating instruction.

Options for Writing Data

Not all data controls support writing. Of the data source controls, all support writing data except for the `SiteMapDataSource`. But among the data-binding controls there are more limitations. The selection lists (`DropDownList` and `ListBox`) do not support writing. The new ASP.NET 2.0 data-bound controls support the best methods of writing data: `GridView`, `DetailsView`, and `FormView`. However, `GridView` can only update existing records, not create new records. `DataList` and `Repeater` can be used to write data, but because they are older controls in many cases they must use the older ASP.NET 1.1 techniques.

> **`GridView` does not support the creation of new records. But `GridView` can easily open a `DetailsView` control (as you practiced in Chapter 7) and that `DetailsView` can create a new record.**

DataKeyNames

At the time you enable some types of data writing, VWD will add a property to the data-bound control named `DataKeyNames`. The purpose is to hold both old and new values of a field so that the writing can be performed correctly. To understand this role, imagine that you have a table of comments about Wrox United games named MatchReports. In the table you have as the first field (as most tables do) a field that contains an ID number unique to each row. You call it MatchReportID, and it gets values of 1, 2, 3, and so forth, as fans send in reports about matches. Now say that there was a mix-up and the administrator has to change the ID of a report, say from 20 to 19. When the administrator makes the change he starts by selecting which record to change. ASP.NET 2.0 will store that record's ID value in a parameter just like it did in Chapter 7 when you used a `GridView` as a master control. Next the administrator changes the value of the ID field. When he sends that command to the database it will look something like the following:

```
UPDATE MatchReports SET MatchReport=19 WHERE MatchReport=@MatchReportID
```

Notice that there is the name of the field to change (MatchReportID) and the new value (19). That command also holds an identification of which record to change, something like `WHERE MatchReportID=@MatchReportID`. But there is a conflict because you have two potential values that could go into `@MatchReportID`: the old one as saved by the `GridView` (the value of 20) and the new one that the administrator entered (the value of 19).

`DataKeyNames` solves this problem by creating a dictionary that keeps two values for fields in its list. One value is the old and one is the new. When a writing command is issued to a database, ASP.NET uses its smarts to supply the new value from `DataKeyNames` for the `SET` part of the command and to use the old value from `DataKeyNames` for the `WHERE` part of the command. It would be wasteful and slow to load up the `DataKeyNames` dictionary with every field, particularly because most fields will not raise conflicts. VWD automatically adds to the `DataKeyNames` those fields that are structured as unique in the database. You can add others, but VWD usually gets it right. In summary, `DataKeyNames` holds names of fields for which ASP.NET 2.0 must remember both old and new values. When using VWD you rarely have to change `DataKeyNames`.

Changing Existing Records

The capability to change an existing record can be turned on with two simple steps using VWD. When you create a data source control you go through a panel in the wizard that asks you to select the table and columns (see Figure 8-1).

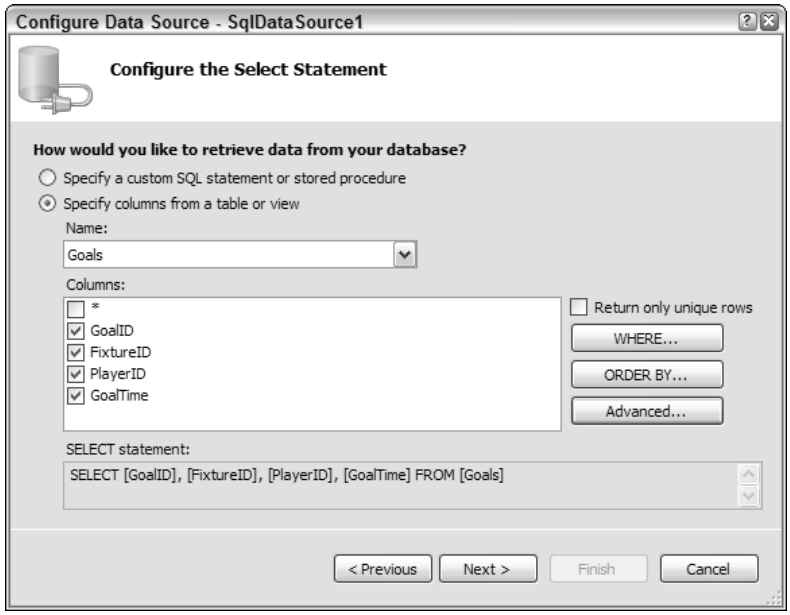


Figure 8-1

There is also an Advanced button that gives you the option to tell VWD to generate `INSERT`, `UPDATE`, and `DELETE` statements (see Figure 8-2). This simple step enables the `UPDATE` behavior of the data source

control. Also, checking Use optimistic concurrency will reduce conflicts of two updates at once on a busy web site.

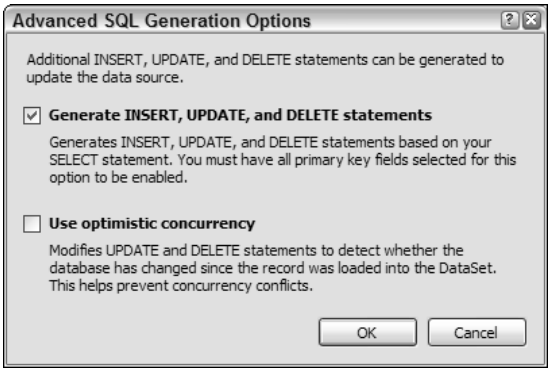


Figure 8-2

VWD takes care of all the work for you, fast and without error (we wish we could say the same for the Wrox United strikers). Two changes are made to the data source control. First, an `UPDATE` statement is added, similar to the following (`INSERT` and `DELETE` statements are also added, but those are discussed later):

```
<asp:SqlDataSource ID="SqlDataSource1" runat="server"
...
UpdateCommand= "UPDATE [MyTable]
        SET [Field1] = @Field1, [Field2] = @Field2
        WHERE [Field1] = @Field1>
...
 </asp:SqlDataSource>
```

The `UPDATE` statement indicates that you want to change an existing record. You provide the table holding the record (MyTable):

```
UpdateCommand= "UPDATE [MyTable]
```

Then you provide a set of field names and the values you want them to contain. ASP.NET 2.0 generally does not specify those values directly in the command; rather, it uses a reference to a parameter that holds the value. References to parameters begin with an at symbol (@) before the parameter's name, as shown here:

```
        SET [Field1] = @Field1, [Field2] = @Field2
```

Note the `WHERE` clause at the end, which specifies which record to modify. The following syntax says to change the record in the database for which the `Field1` value matches the value held in the `Field1` parameter. You know that the value to match is from the parameter because you use @ before the field name, which directs ASP.NET 2.0 to get the value from the parameters list. Without the `WHERE` clause the update would change *all* of the records to have the new values the user entered.

```
        WHERE [Field1] = @Field1
```

VWD also adds a set of tags to the data source control to create the `UPDATE` parameters. ASP.NET 2.0 automatically fills these with the values that currently exist in the table. When the user makes a change to the data-bound control, ASP.NET 2.0 intelligently substitutes in the new value. The exception is for unique fields such as identifiers, in which case ASP.NET 2.0 keeps both the old and new value in the `DataKeyNames` dictionary as discussed in the introduction to this chapter.

> **Parameters (of any type) are not controls. They are tags *within* data source controls.**

`<ControlParameters>` can hold values in the same way as `<UpdateParameters>`. Whereas `<UpdateParameters>` hold the values that the data source control read from the existing record, `<ControlParameters>` hold values that the user enters or selects from controls other than the data-bound control that is changing the data. For example, you may be changing the date in a `GridView`, but you want the date to come from a selection in a `Calendar` control. You encountered `<ControlParameters>` in Chapter 7 when you created pages with a master-child relationship, and you will see examples in context of writing data later in this chapter.

An optional property can be added to a data source control: `ConflictDetection="CompareAllValues"`. Conflict detection implements the `DataKeyNames` solution to avoid two users updating the same record at the same time.

In a data-bound control that implements updates you see two changes as well that are needed to move from a read-only control to a control that can update records (highlighted in the following code listing). First is the addition of a property for `DataKeyNames`. Second is in the list of fields, where you see the following new "field" added. Called a `CommandField` because it offers the user a button that will execute a command, it is only a field in the sense that ASP.NET 2.0 will create a field-like rendering for the button on the data-bound control:

```
<asp:DetailsView ID="DetailsView1" runat="server"
         AutoGenerateRows="False"
         DataKeyNames="FixtureID"
         DataSourceID="SqlDataSource1" Height="50px" Width="125px">
   <Fields>
     <asp:BoundField DataField="FixtureID"
         HeaderText="FixtureID" InsertVisible="False"
         ReadOnly="True" SortExpression="FixtureID" />
     <asp:BoundField DataField="FixtureDate"
         HeaderText="FixtureDate" SortExpression="FixtureDate" />
         <asp:CommandField
         ShowEditButton="True"
         ShowInsertButton="True" />
   </Fields>
 </asp:DetailsView>
```

For example, the preceding code would contribute toward a `DetailsView` as follows in Figure 8-3 with the Edit and New buttons at the bottom of the data-bound `DetailsView` control.

```
  <asp:CommandField ShowEditButton="True"
```

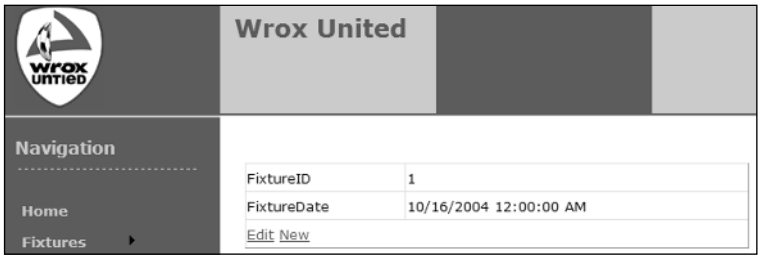


Figure 8-3

This small tag enables all of the functionality in the data-bound control to update records. This tag will render itself as a button labeled EDIT on a `DetailsView` or a column of EDIT buttons in a `GridView`. It will also automatically hide itself and substitute buttons for Update and Cancel when the control is in edit mode.

A common problem is to attempt to update a record with invalid data. For example, in the box for Goals Against a user may enter a bit of text or a date. When the data controls send this to the database an error will arise because the database is configured to limit values in a GoalsAgainst field to be integers. The problem can be solved in several ways, two of which are aspects of ASP.NET 2.0. First, you try to eliminate user-typed input whenever possible. For example, for the user to enter values for GoalsAgainst a football team, you could offer a list box with options from 1 to 10 (maybe 1 to 20 for Wrox United). The second technique is to use the ASP.NET 2.0 validation controls, which are covered in Chapter 15. As a rule of thumb, anything that a user types should be run through a validation control before it is sent to the database. This policy greatly reduces the susceptibility to a SQL injection attack.

The preceding directions explain the steps to turn on editing at the time you create a control. You can still turn on this feature using VWD after the control is on a page. Open the Common Tasks panel for the data source control and click Configure Data Source. You walk through the wizard again, but with choices filled in as per the existing state. It is easy to click the Advanced button and add the extra commands. Then go back and open the Common Tasks panel for the data-bound control and enable the Editing feature.

In the following Try It Out you practice the technique to enable updating data in a `GridView` and a `DetailsView` control by changing data for fixtures (games). You will be building on the `Fixtures.aspx` page you created in Chapter 7 that had a `GridView` with a child control of a `DetailsView`.

Try It Out Updating Existing Records

1. In VWD open the chapter Web site at C:\BegASPNET2\Chapters\Begin\Chapter08, and open the `Fixtures.aspx` page in Design. (Use the true `Fixtures.aspx`. Do not use the Fixtures-One or Fixtures-Stacked that you used as test pages in Chapter 7.)
2. Select the `GridView1` control and open its Common Tasks panel. Enable Editing and, if not already enabled, enable Selection.
3. Select the `SqlDataSource2` control (used by the `DetailsView`), open its Common Tasks panel, and click Configure Data Source. Make sure you select WroxUnitedConnectionString for the connection. On the Configure Select Statement screen, select the option to specify the columns from a table or view, select the Fixtures table, and select the individual columns (not the *).

4. Click the WHERE button to open the Add WHERE Clause window. For Column select FixtureID and for Source select Control. In the Parameter properties select GridView1 for the Control ID and click the Add button to add the parameter to the WHERE clause at the bottom of the screen. Click OK to close the window.

5. Back on the main wizard window, click the Advanced button, and on the Advancedwindow, turn on both options. Click OK to close the window, then Next and Finish to close the configuration wizard. As always, accept the refresh of the data keys if offered.

6. Select the `DetailsView` data-bound control and open its Common Tasks panel. Turn on Editing and close the panel. With these simple changes you have enabled editing of fixtures in both the `GridView` and `DetailsView`.

7. You will make one final change. VWD is overzealous in creating the `WHERE` clause for the `UpdateCommand`. By default VWD added a check of every field prior to updating. You can be confident that if you match the `FixtureID` you have the right record. So modify the `UpdateCommand` of `SqlDataSource2` (be sure you pick number two) in Source View to delete the shaded section in the following code – you may have to scroll the Source window to see the `UpdateCommand`. Your line breaks may be different; we have modified the listing for clarity. Be sure that the command still ends with the `">` characters:

```
UpdateCommand="UPDATE [Fixtures]
 SET
 [FixtureDate] = @FixtureDate,
 [FixtureType] = @FixtureType,
 [GoalsFor] = @GoalsFor,
 [GoalsAgainst] = @GoalsAgainst,
 [Notes] = @Notes,
 [Opponents] = @Opponents
 WHERE
 [FixtureID] = @original_FixtureID
  AND [FixtureDate] = @original_FixtureDate
  AND [FixtureType] = @original_FixtureType
  AND [GoalsFor] = @original_GoalsFor
  AND [GoalsAgainst] = @original_GoalsAgainst
  AND [Notes] = @original_Notes
  AND [Opponents] = @original_Opponents
```

8. Run the page in your browser. In the `GridView` control, try clicking Edit and changing the name of an opponent as in Figure 8-4.

	FixtureID	FixtureDate	FixtureType	GoalsFor	GoalsAgainst	Notes	Opponents
Update Cancel	1	10/16/2004 12:00:00 AM	Cup	1	5	A spark of brilliance from I	Wensleydale Cheeses
Edit Select	2	10/31/2004 12:00:00 AM	League	2	6		Fulchester Rovers
Edit Select	3	11/6/2004 12:00:00 AM	Friendly	0	3		Wilstone Wanderers

Figure 8-4

Now do the same in the `DetailsView` as in Figure 8-5.

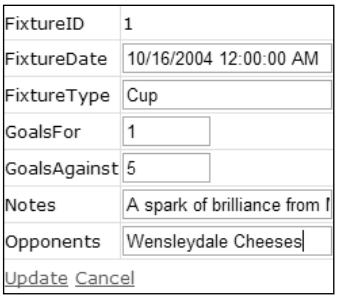


Figure 8-5

How It Works

Once again, ASP.NET 2.0 has made all of this easy by including the functionality of updating within the data controls. To enable updates in the data source control you checked off the option to include `INSERT`, `UPDATE`, and `DELETE` commands. This is more than you need for now (although you will use the `INSERT` and `DELETE` later in this chapter). VWD built two changes to the data source control that apply to updates. First is the addition of an `UpdateCommand` as follows.

```
<asp:SqlDataSource ID="SqlDataSource1" ...
UpdateCommand="UPDATE [Fixtures] SET [FixtureDate] = @FixtureDate, [FixtureType] =
@FixtureType, [GoalsFor] = @GoalsFor, [GoalsAgainst] = @GoalsAgainst, [Notes] =
@Notes, [Opponents] = @Opponents WHERE [FixtureID] = @original_FixtureID">
```

VWD then added a set of parameters that will hold the values you will use for updates, as shown in the following code. Note that the `FixtureID` is saved in two parameters (the first and last). The first is the new value, if the user enters one. The second is named `original_FixtureID` and will hold the original value so it can be used in the `WHERE` clause to match which record to change:

```
        <UpdateParameters>
            <asp:Parameter Name="FixtureDate" Type="DateTime" />
            <asp:Parameter Name="FixtureType" Type="String" />
            <asp:Parameter Name="GoalsFor" Type="Int16" />
            <asp:Parameter Name="GoalsAgainst" Type="Int16" />
            <asp:Parameter Name="Notes" Type="String" />
            <asp:Parameter Name="Opponents" Type="String"  />
            <asp:Parameter Name="original_FixtureID" Type="Int32" />
        </UpdateParameters>
```

In the `GridView` control you added the single property of displaying the Edit button in a column:

```
    <asp:GridView ID="GridView1" ...
        <Columns>
            <asp:CommandField ShowSelectButton="True" ShowEditButton="True" />
```

The procedure was almost the same for the `DetailsView`. You modified the `SqlDataSource2` to enable updates by adding an `UpdateCommand` and a set of update parameters. However, VWD is more conservative with `DetailsView` and provides `original_` parameters for all fields and compares all fields in the `WHERE` clause. You excised those extra comparisons and just relied on matching the `FixtureID`.

Adding New Records

Adding new records, known in SQL parlance as `INSERT` or `INSERT INTO`, is almost as easy as changing an existing record. The main difference is that the `GridView` does not support adding a new record, so we consider that case in a minute.

As discussed previously, four changes must be made to the data controls. First, in the data source control you have that Advanced button in the Create New Data Source wizard. A click there and a check on the Generate `INSERT`, `UPDATE`, and `DELETE` gave you all three of the SQL statements. That created two additions to the data source control. The first is the `InsertCommand` itself. The second is the set of `INSERT` parameters. (Actually, commands and parameters were also created for `UPDATE` and `DELETE`, but it is `INSERT` that is of interest to us in this section.)

In the data-bound control you enable inserting with a checkbox on the data-bound control's Common Tasks panel. Two changes result; the first is in the `<asp:commandfield>` where you now have the `ShowInsertButton`. This will co-exist with the `ShowEditButton` and `ShowDeleteButton` if they have been selected. The `ShowInsertButton` enables the functionality to add new records. Like the other `CommandField` buttons, `ShowInsertButton` automatically hides itself and displays other buttons (Insert and Cancel) when the control switches to `INSERT` mode.

`GridView` is a special case because it does not directly support the addition of new records. The most common path is to display existing records in the `GridView` and create a button on the `GridView` that goes to a `DetailsView` (which can be on the same page or a second page). The `DetailsView` can then open in `INSERT` mode, ready to accept the values for the new record. The option to open in `INSERT` mode is set by the `DefaultMode` property of the data-bound control.

As in editing, constraints on data are acceptable. For example, if you were adding a new match report, the fixture must match an existing fixture. You can't comment on a match that did not happen. As with editing, you can decrease these conflicts by giving users a list of possible options instead of typing. If they must type, then run the values through a validation control.

In this Try It Out you add the `INSERT` capability to the `Fixtures.aspx` page. You cannot insert new records in a `GridView`, so this exercise only affects the `DetailsView` control.

Try It Out — Inserting a New Record

1. Open VWD and your `Fixtures.aspx` page in Source View and scroll down to the `SqlDataSource2` control (the data source for the `DetailsView` control). Observe that in the last exercise when VWD added the capability to update a record, it also added similar tags for insert and delete operations. Therefore, in the data source control the insert behavior is already enabled.
2. Select the `DetailsView` control, open its Common Tasks panel, and enable inserting, as shown in Figure 8-6.
3. In the Properties window, find DefaultMode (see Figure 8-7) and change its value to Insert.
4. Save and view in the browser (see Figure 8-8). Try adding a new fixture and refresh the page.
5. As a final step, try entering some nonsense data, such as a date of 99/99/2006. Note how the error is not, at this point, handled very gracefully. Chapter 15 looks at handling errors.

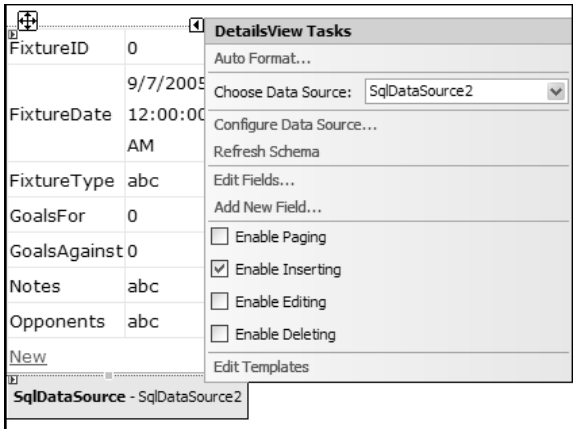


Figure 8-6

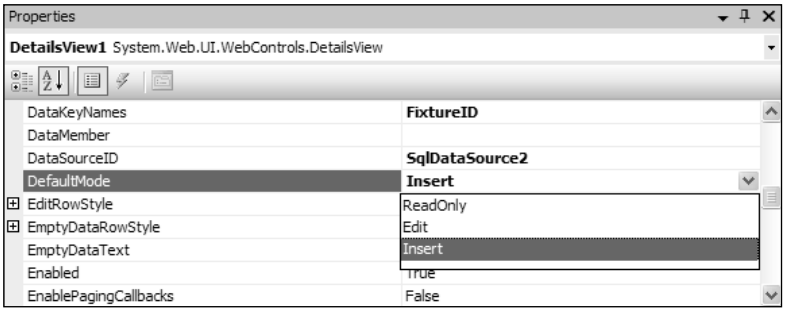


Figure 8-7

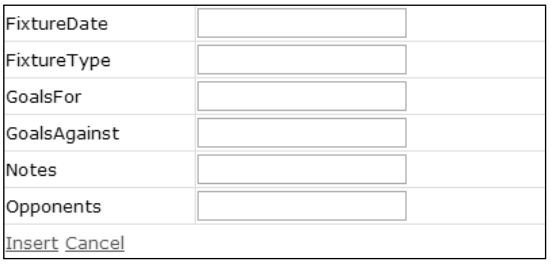


Figure 8-8

How It Works

Many of the tags for this process were created in the previous exercise when you configured the data sources and VWD offered the Advanced button with options to create `INSERT`, `UPDATE`, and `DELETE` commands. It may have seemed like an overwhelming number of tags at first, but you can now see how the pattern of a command plus a set of parameters enables a data writing function.

Specifically, you are using the `InsertCommand` of the `SqlDataSource2` that supports the `DetailsView`. That command relies on the set of `InsertParameters`, as shown in the following code. Note that there is no need for a `WHERE` clause because you do not need to identify an existing record upon which to carry out the action:

```
<asp:SqlDataSource ID="SqlDataSource2" ...
InsertCommand="INSERT INTO [Fixtures] ([FixtureDate], [FixtureType], [GoalsFor],
[GoalsAgainst], [Notes], [Opponents]) VALUES (@FixtureDate, @FixtureType,
@GoalsFor, @GoalsAgainst, @Notes, @Opponents)"
...
        <InsertParameters>
            <asp:Parameter Name="FixtureDate" Type="DateTime" />
            <asp:Parameter Name="FixtureType" Type="String" />
            <asp:Parameter Name="GoalsFor" Type="Int16" />
            <asp:Parameter Name="GoalsAgainst" Type="Int16" />
            <asp:Parameter Name="Notes" Type="String" />
            <asp:Parameter Name="Opponents" Type="String" />
        </InsertParameters>
...
</asp:SqlDataSource>
```

ASP.NET 2.0 handles `INSERT`s in a way that is very similar to the `UPDATE`s you did in the last section. When you select the option in the Advanced dialog, VWD builds a SQL `INSERT INTO` statement with a set of parameters that can hold the data entered by the user. When you enable `INSERT` on the data-bound control VWD adds the `CommandField` (button) for adding a new record. All the rest of the code is taken care of by Microsoft, hidden from your view in the data controls. The only trap to remember is that inserting new records is available in `DetailsView` and `FormView`, but not `GridView`.

Deleting Records

By now you have a good feel for how writing data works and can anticipate that the procedure for deleting a record is similar. In the data source control you must include the `DELETE` command, which can be automatically generated in the Advanced button of the control's Configure New Data Source dialog box. That button will also create a set of `DeleteParameters`. But there are differences. For example, the `DeleteParameters` will be used to make an exact match for deletion in the `WHERE` clause, but they will not be used for changing information in the record.

As discussed before, there are some hazards when writing data and these are particularly true for deleting. The first is the human error of deleting the wrong record. More sophisticated systems respond to a request to delete by actually moving the record to a Deleted table. That gives a chance for recovery, at least until the Deleted table is purged. Discussions of this strategy are common in database texts and are not difficult to implement in ASP.NET 2.0. A second problem is that the user attempts to delete a record that the database has blocked from deletion. That block is most often the result of another record being dependent on the record that was to be deleted. For example, a table of orders would have a field for the ID of a customer that placed an order. If you delete that customer you are left with a value in the Orders table that points to nowhere. In this case, the database will return an error.

In this Try It Out you enable the capability to remove a match from the list of fixtures.

Try It Out Deleting an Entire Record

1. Continue using VWD with `Fixtures.aspx` in Design View. Both of the data source controls already have the `DeleteCommand` and a set of `DELETE` parameters.

2. Select the `GridView` control, open its Common Tasks panel, and Enable Deleting (see Figure 8-9), which adds the following shaded line to the `GridView` control. That code also adds the Delete command fields in Figure 8-9.

```
<asp:GridView ID="GridView1" runat="server"
...
   <Columns>
       <asp:CommandField
         ShowEditButton="True"
         ShowSelectButton="True"
         ShowDeleteButton="True" />
...
   </Columns>

</asp:GridView>
```

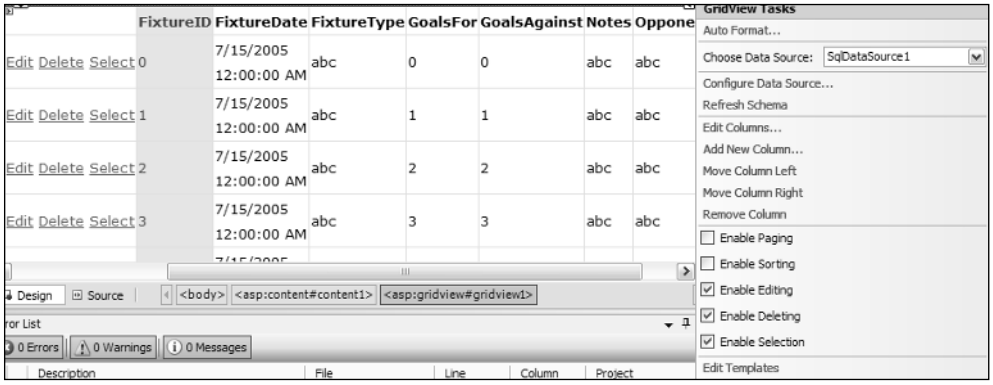


Figure 8-9

3. Select the `DetailsView` control, open its Common Tasks panel, and Enable Deleting. Also go to the `DetailsView`'s Properties window and change the DefaultMode back to ReadOnly.

4. As before, when VWD creates a `DetailsView` with deleting it is overly cautious in checking fields to match up the correct record to delete. The original `DELETE` statement is shown in the following code. (Be sure you are looking at `SqlDataSource2`, the one for the `DetailsView`.) Delete the shaded portion. Double-check that the `DeleteCommand` still ends with a double quote:

```
DeleteCommand="DELETE FROM [Fixtures] WHERE [FixtureID] = @original_FixtureID
AND [FixtureDate] = @original_FixtureDate
AND [FixtureType] = @original_FixtureType
AND [GoalsFor] = @original_GoalsFor
AND [GoalsAgainst] = @original_GoalsAgainst
AND [Notes] = @original_Notes
AND [Opponents] = @original_Opponents
"
```

5. Save the page and test it in your browser. It should look like Figure 8-10.

6. Note that if you try to actually delete a fixture you will get an error message. Many other aspects of the site rely on the list of fixtures, so deleting on will leave those data hanging without a fixture. This situation is called a *reference constraint* as mentioned in the error.

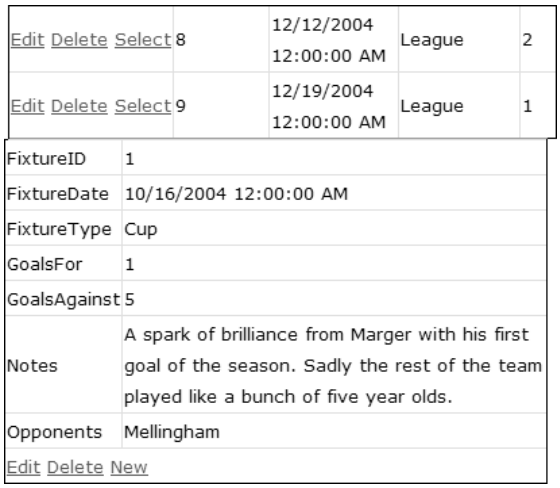


Figure 8-10

How It Works

The pattern is the same as for other means of changing data. The data source control must have a `DeleteCommand`. When you checked the option in the Advanced step of the Configure Data Source wizard, VWD created the `DeleteCommand` for you. VWD also created a set of `DeleteParameters` that will be used by the `WHERE` clause to identify the record to delete. As with `UPDATE`, VWD tries to match every field in the `DeleteParameters` list for `DetailsView`. This may be necessary in some cases, but for us a simple match of the `FixtureID` is sufficient.

You then enabled deleting on the data-bound control, which instructed VWD to add a `CommandField` of the type Delete to the data-bound control. The term "field" here is a little odd because there is no connection to a field in the data table. But it is an addition to the data-bound control that is rendered similarly to a field.

One thing you may have noticed while running through the exercises in this chapter is that you have two ways of showing and editing the fixtures: a GridView and a DetailsView. When you edited data in one, the changes weren't reflected in the other. To get around this you need to add code to the data source controls, and although it's only a single line of code you need, it has to be entered in several places. This is because there are several ways the data can change; you can insert new fixtures, edit existing fixtures, or delete fixtures. Each of these causes the SqlDataSource control to raise an event, and it is within that event that you have to rebind the data for the other control.

The code for this is shown below:

```
Protected Sub SqlDataSource1_Deleted(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
    Handles SqlDataSource1.Deleted
  DetailsView1.DataBind()
End Sub

Protected Sub SqlDataSource1_Inserted(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
    Handles SqlDataSource1.Inserted
  DetailsView1.DataBind()
End Sub

Protected Sub SqlDataSource1_Updated(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
    Handles SqlDataSource1.Updated
  DetailsView1.DataBind()
End Sub

Protected Sub SqlDataSource2_Deleted(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
    Handles SqlDataSource2.Deleted
  GridView1.DataBind()
End Sub

Protected Sub SqlDataSource2_Inserted(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
    Handles SqlDataSource2.Inserted
  GridView1.DataBind()
End Sub

Protected Sub SqlDataSource2_Updated(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
    Handles SqlDataSource2.Updated
  GridView1.DataBind()
End Sub
```

You can see that there are three events for each control. The `Deleted` event is raised after a record is deleted, the `Inserted` event is raised after a record is added, and the `Updated` event is raised when a record is updated. Even through you are using a GridView control to display one set of data, and a DetailsView control for the other, the events look the same because it is the SqlDataSource control that raises the event. For the GridView, which is bound to `SqlDataSource1`, the DetailsView needs to be refreshed, so the `DataBind()` method is called on the DetailsView, which instructs it to re-fetch the data. A similar procedure is done for the events of `SqlDataSource2`, which is used by the DetailsView, but this time the `DataBind()` method is called on the GridView1 control. It's a simple procedure — when data in one control changes, you refresh the data in the other control.

Uploading Pictures

ASP.NET 2.0 offers an easy way to upload pictures (or other files) from the browser to the server. Although not strictly a database issue, the topic is covered here. The toolbar offers the FileUpload tool, which can

be added to the page to produce a text box with a browse button. You, as the designer, must also add a button to give the user the capability to actually execute the upload.

In the button's click code, the simplest option is shown in the following line. The file that the user indicated (either by typing or browsing) will be transferred to the server:

```
FileUpload1.SaveAs(FileUpload1.FileName)
```

But this code is too simplistic because the file will be plopped into the root of the web site. You can add a literal string to be appended in front of the file name that will direct the file into an appropriate folder on the server. Note that when you open the page in your browser you can view the source, but the path on your server is not revealed. The following code places the file in MyImageFolder:

```
FileUpload1.SaveAs("MyServer\MyWebsite\MyImageFolder\" & FileUpload1.FileName)
```

When the `FileUpload.SaveAs` method has been invoked, ASP.NET 2.0 creates an object named `FileUpload.PostedFile` with several properties about the operation. The most obvious are `FileName` and `ContentLength`. So if you create a label named `Label1` you can display in its text the name of the file that was uploaded as follows:

```
FileUpload1.SaveAs("C:\BegASPNET2\WroxUnited\MatchImages\" & FileUpload1.FileName)
Label1.Text = "File uploaded to WroxUnited from: <br/>" & _
  FileUpload1.PostedFile.FileName
```

What if the user clicks the button without first selecting a file? You can avoid this problem with an `IF THEN` statement as follows (code structures such as `IF THEN` are explained in Chapter 9):

```
If FileUpload1.HasFile Then
 FileUpload1.SaveAs("C:\BegASPNET2\WroxUnited\MatchImages\" & FileUpload1.FileName)
Else
 Label1.Text = "Please select a file before clicking the 'Upload' button"
End If
```

Other errors can occur, so you should encase the `FileUpload` method in an error catching routine as follows:

```
If FileUpload1.HasFile Then
 Try
   FileUpload1.SaveAs("C:\BegASPNET2\WroxUnited\MatchImages\" & _
     FileUpload1.FileName)
 Catch ex As Exception0
   Label1.Text = "Failed because: <br/>" & ex.Message
 End Try
   Label1.Text = "File uploaded to WroxUnited from: <br/>" & _
     FileUpload1.PostedFile.FileName
Else
  Label1.Text = "Please select a file before clicking the 'Upload' button"
End If
```

In the following Try It Out you give users a way to add pictures to the gallery.

Try It Out — Uploading Files — Basic

1. Using VWD, create a new page named `GalleryUpload.aspx` using the Web Form template. As you have with most pages up to this point, use the `site.master` as the Master page, use Visual Basic, and enable the option to place the code on a separate page.

2. In Design View, add a `FileUpload` control from the toolbar and a `Label` control that will have an ID of `FileUploadReport` with an empty `text` property. Also add a `button` control with the `text` property set to `"Upload"`.

3. Double-click the button to go to its code. Add the following shaded code to the `Sub`:

```
Protected Sub Button1_Click(ByVal sender As Object, ByVal e As System.EventArgs)
Handles Button1.Click
  If FileUpload1.HasFile Then
    Try
      FileUpload1.SaveAs("C:\BegASPNET2\Chapters\Begin\Chapter08\MatchImages\" & _
        FileUpload1.FileName)
    Catch ex As Exception
      FileUpload1.Text = "Failed because: <br/>" & ex.Message
    End Try
    FileUploadReport.Text = "File uploaded to WroxUnited from: <br/>" & _
      FileUpload1.PostedFile.FileName
  Else
    FileUploadReport.Text = "Please select a file before clicking " & _
      "the 'Upload' button"
  End If
End Sub
```

4. Save the page and view it in your browser (see Figure 8-11). You probably won't have pictures of the hapless Wrox United fumblers, but you can try uploading any jpeg or gif you have on your hard drive.

Figure 8-11

How It Works

The `FileUpload` control itself is a simple drag and drop. The browsing capability is built in. However, there is no built-in means to execute the upload. So you added a button to fire the `SaveAs` method of the `FileUpload` control. That method needs an argument of where to put the file on the server. You hard-coded a literal for the path and then appended the name of the file as the user entered in the `FileUpload` control.

But you have done some embellishments beyond the basic control. The `FileUpload` control has a handy property called `HasFile`. When there is a valid file name in the text box, the `HasFile` property will be `TRUE`. The `IF` statement determines whether the user actually typed or browsed to a file to upload. If not, the code hops down to the `ELSE` statement to display an error message. Other things could go wrong, like the Wrox United webmaster (even more hapless than the team) changes the name of the folder in which to store images. So you encapsulated the execution of the `SaveAs` within a `Try...Catch` block.

Improving the Upload of Pictures

You finish this chapter with an improvement to the page that uploads photos and, in the process, review some ideas from this chapter and Chapters 6 and 7. You will add a feature that when a photo is uploaded, an entry is created in the database table of photos. In other words, you will both upload the file and create a new record. The following few paragraphs give an overview of your tasks and the Try It Out gives exact directions.

Start by using the Data Explorer to take a look at the structure of the Gallery table as in Figure 8-12. Each record represents an image a fan has uploaded, with fields for the fan's name, URL of the picture file, date, and opponent.

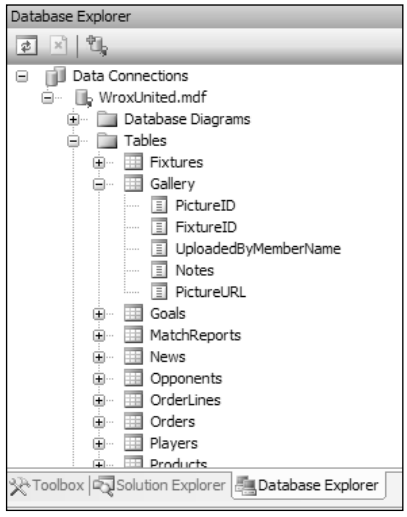


Figure 8-12

Now you need to add inputs to the page to get the information you need for the fields of the Gallery table. Whenever possible, avoid letting users type information. In this case, the number of matches is reasonably small, so you will create a `ListBox` control for that input. The `SelectCommand` that provides data for the `ListBox` will display the date of the match to the user. The `FixtureID` will be the `ListBoxValue`. You will also want to gather the user's name and comments with text boxes. The page will end up looking like Figure 8-13.

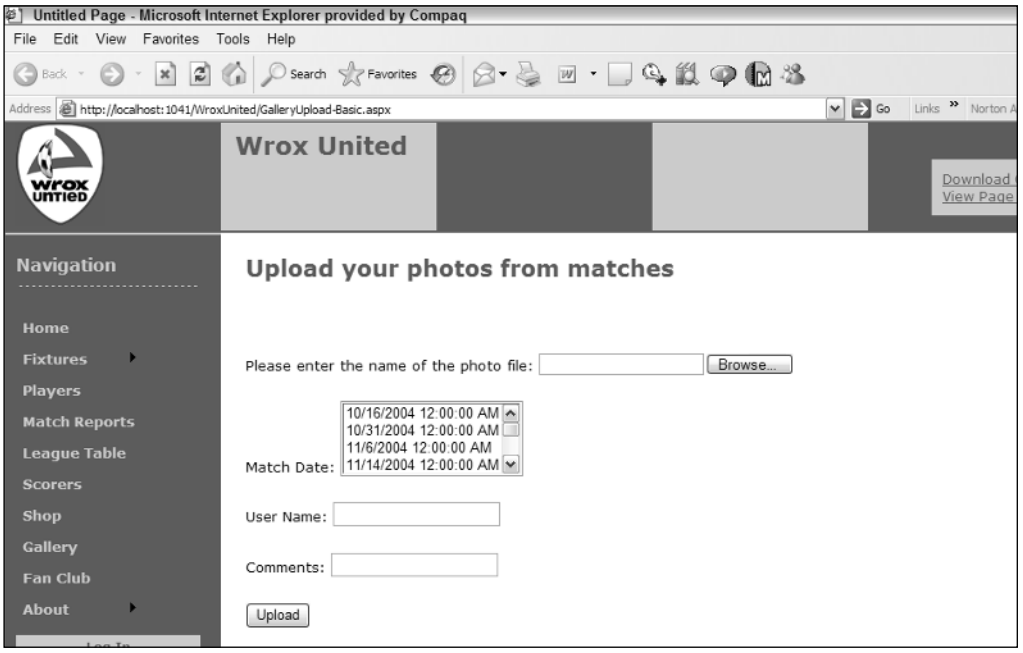


Figure 8-13

Now the trick will be inserting a new record into the table. You do this by setting up a `SqlDataSource` control that is enabled for inserting. But you do not need to render any data, so this data source control will not have a data-bound control. Built into the `SqlDataSource` is the `Insert` method, which you can invoke from your button-click code.

In this Try It Out you enhance the gallery upload so that it performs the upload of the image file and then creates a record for the image file in the Gallery table.

Try It Out — Uploading Files with Record Creation

1. Using VWD, open the Solution Explorer and make a copy of the `GalleryUpload.aspx` pages following these instructions. Find in the file list, but do not open, the `GalleryUpload.aspx` page. Right-click it and select Copy. Right-click the root of the site and select Paste. Now find the nascent file that will be named `Copy of GalleryUpload.aspx`. Rename it `GalleryUploadEnhanced.aspx`. This procedure ensures proper copying and renaming of the associated code file.
2. Working with `GalleryUploadEnhanced.aspx` in Design View, move the insertion bar below the `FileUpload` control, add a `ListBox`, and from the smart task panel invoke the Configure

Data Source wizard. Use a Database source and name the control `SqlDataSourceFixtures`. Use the WroxUnited connection string and set it to display from the Fixtures table only the `FixtureID` and `FixtureDate` fields, ordered by date. In the end of the wizard you can set the `ListBox` properties of the `DataTextField` to the date and the `DataValueField` to the `FixtureID` (see Figure 8-14).

Figure 8-14

3. Add two `TextBox` controls for the fan's name and notes about the picture. In the Properties window set the ID of the boxes to `TextBoxMemberName` and `TextBoxNotes`. Give them some labels with text that identify what the user should type in the box.

4. Add a second `SqlDataSource` to the page that you will configure to create the record in Gallery for the new uploaded photo. Name it `SqlDataSource2`. Using its smart task panel, configure the data source and choose the Wrox United connection string. Use the Gallery table and select all of the fields. In the Advanced panel, check on the creation of the `INSERT`, `DELETE`, and `UPDATE` commands. Click the Next and Finish buttons. If you want, switch to Source View and delete the commands and parameters for the `UPDATE` and `DELETE` functions. They will not be used, so deleting them cleans up the code and makes it mountains easier, but they don't interfere if you want to leave them. Be careful not to delete any end-of-property double quotes or any end-of-tag > symbols.

5. Switch to Source View and find the set of `<InsertParameters>`. Modify them so that they come from the four input controls, as per the shaded lines in the following listing of the entire .aspx page's code:

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="GalleryUpload-Enhanced.aspx.vb" Inherits="GalleryUpload" title="Untitled
Page" %>
```

```
<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">
    <h2>Upload your photos from matches</h2>
    <br /><br />Please enter the name of the photo file:
    <asp:FileUpload ID="FileUpload1" runat="server" />
    <br /><br />
    Match Date:
    <asp:ListBox ID="ListBox1" runat="server"
        DataSourceID="SqlDataSource1"
        DataTextField="FixtureDate"
        DataValueField="FixtureID">
    </asp:ListBox>

    <asp:SqlDataSource ID="SqlDataSource1" runat="server"
            ConnectionString="<%$ ConnectionStrings:WroxUnited2 %>"
            SelectCommand="SELECT [FixtureID], [FIxtureDate] FROM [Fixtures]">
        </asp:SqlDataSource>

    <br /><br />
    User Name: <asp:TextBox ID="TextBoxMemberName" runat="server"></asp:TextBox>
    <br /><br />
    Comments: <asp:TextBox ID="TextBoxNotes" runat="server"></asp:TextBox>
    <br /><br />
    <asp:Button ID="Button1" runat="server" Text="Upload" /><br />
    <asp:Label ID="FileUploadReport" runat="server"></asp:Label><br />

    <asp:SqlDataSource ID="SqlDataSource2" runat="server"
        ConflictDetection="CompareAllValues"
        ConnectionString="<%$ ConnectionStrings:WroxUnited2 %>"
        InsertCommand="INSERT INTO [Gallery] ([FixtureID], [UploadedByMemberName],
Notes], [PictureURL]) VALUES (@FixtureID,@UploadedByMemberName,@Notes,@PictureURL)"
        OldValuesParameterFormatString="original_{0}" >
        <InsertParameters>
            <asp:ControlParameter Name="FixtureID"
                ControlID="ListBox1"
                PropertyName="SelectedValue"
                Type="Int32" />
            <asp:ControlParameter Name="UploadedByMemberName"
                ControlID="TextBoxMemberName"
                PropertyName="Text"
                Type="String" />
            <asp:ControlParameter Name="Notes"
                ControlID="TextBoxNotes"
                PropertyName="Text"
                Type="String" />
            <asp:ControlParameter Name="PictureURL"
                ControlID="FileUpload1"
                PropertyName="FileName"
                Type="String" />
        </InsertParameters>
    </asp:SqlDataSource>
</asp:Content>
```

6. Now you just need to modify the GalleryUpload-Enhanced.APX.VB code page (shown here). In Design View, double-click the Upload button and add one line to the code, as follows:

```
Protected Sub Button1_Click(ByVal sender As Object, ByVal e As System.EventArgs)
Handles Button1.Click
  If FileUpload1.HasFile Then
    Try
      FileUpload1.SaveAs("C:\BegASPNET2\Chapters\Begin\Chapter08\MatchImages\" & _
        FileUpload1.FileName)
    Catch ex As Exception
      FileUploadReport.Text = "Failed because: <br/>" & ex.Message
    End Try
    FileUploadReport.Text = "File uploaded to WroxUnited from: <br/>" & _
      FileUpload1.PostedFile.FileName
    SqlDataSource2.Insert()
  Else
    FileUploadReport.Text = "Please select a file before clicking " & _
        "the 'Upload' button"
  End If
End Sub
```

7. Save the page and test it in your browser by uploading any picture (you can use My Pictures/Samples) along with picking a match and your name and a comment. Figure 8-15 shows the screen prior to clicking the Upload button.

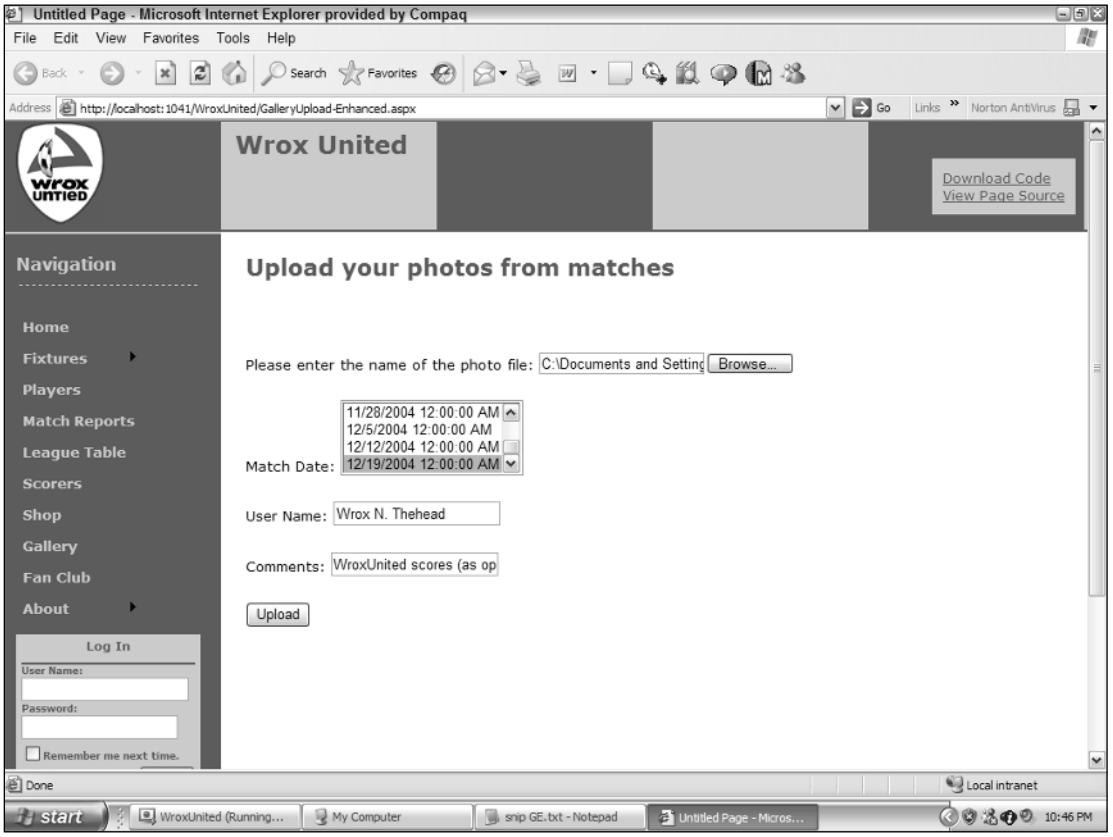


Figure 8-15

8. Confirm your success by closing the browser, returning to VWD, opening the Database Explorer, and expanding WroxUnited and then Tables. Right-click Gallery and select Show Table Data. Observe your new record as in the bottom line of Figure 8-16.

Gallery: Quer...OXUNITED.MDF)

PictureID	FixtureID	UploadedByMe...	Notes	PictureURL
1	1	lou		aaronson.jpg
2	1	lou	asdfasdfadf	aaronson.jpg
3	1	lou	asdfasdfadf	aaronson.jpg
4	1	lou	foo	aaronson.jpg
5	1	lou	another good one	aaronson.jpg
6	1	dave		aaronson.jpg
7	1	dave	test	aaronson.jpg
8	1	dave		aaronson.jpg
22	9	Wrox N. Thehead	Wrox Scores! (As opponents' goal keeper ties his shoe.)	Sunset.jpg
NULL	NULL	NULL	NULL	NULL

Figure 8-16

How It Works

The objective here was to create a new record in the Gallery table whenever a user uploaded an image. You started by setting up inputs so the user could enter data needed for the record. The `ListBox` offered a choice of games and two `TextBox` controls took in the user's name and notes. In order to populate the `ListBox` you created a `SqlDataSource` that picked up two fields from the Fixtures table.

In order to create a new record you need to add a `SqlDataSource` control that holds the `INSERT` functionality. When you asked VWD to add commands for insert you got a lot, and it wasn't what you wanted. You deleted the commands and parameters for `SELECT`, `UPDATE`, and `DELETE` because you won't use them. Then within the `<InsertParameters>` you changed to use the input controls as sources.

Last, you wanted to actually tell the `SqlDataSource` to perform the insert of a new record. You did that with a single line of code in the `Button_Click` event that invoked the `Insert()` method.

This enhanced page brings together several ideas from the last few chapters. You used code in an event (Chapter 6) to catch problems with the `FileUpload` and to invoke the data source control's `Insert()` method. You read from a database (Chapter 7) to stock the `ListBox`. And, last, you wrote to a database (in this chapter) to create a new record to represent the uploaded picture.

Summary

Writing data includes creating entire new records (called inserting), changing values in existing records (updating), and removing entire records (deleting). Both data source and data-bound controls contain code for behavior to write to databases. This chapter explained how to turn on and use these behaviors.

Most, but not all, data controls support writing. Selection lists (`DropDownList` and `ListBox`) do not support writing. `GridView` can update and delete, but not insert. `DetailsView` or `FormView` are ideal for all forms of writing.

Any database front-end that updates data can run into problems when a value is simultaneously changed and needed for identifying a unique record. ASP.NET 2.0 manages a dictionary of old and new

values. The fields to be included in the dictionary are listed in the `DataKeyNames` property of the data-bound control.

The pattern for inserting, updating, and deleting is to make three changes to the data controls. In the data source control you must add the appropriate command with the value of a valid SQL statement. You must also include a set of parameters that feed values into the SQL statement. In the data-bound control you must include a `CommandField` of the type equal to the writing operation you want to perform. All three of these changes are made through VWD with check-offs in wizards or the Common Tasks panels.

The parameters can be a little tricky until you gain some experience. Simple parameters will hold the existing values that came from the database. `ControlParameters` will hold values that were entered by the user into controls other than the data-bound control that holds the parameter. Reference to a value in a parameter is made in a command by placing an at (@) symbol before the parameter's name. Parameters are organized into sets for each kind of writing command. So when performing an `INSERT` ASP.NET 2.0 will look up values in the parameter set within `<InsertParameters>`.

Keep in mind two caveats when writing data:

- First, writes can lead to logical and organizational errors. For example, your database administrator will not let you delete a customer if that customer has an order (otherwise the order would be shipped to a non-existent customer). It behooves you to limit your user requests and then also be prepared to handle a rejection from your database.
- Second, writing commands opens your data to a number of types of attacks. Whenever possible, present the user with a list of options rather than allowing typed input. When typing is absolutely necessary, use the ASP.NET 2.0 validation controls.

The capability to transfer files from the user to the server enhances many business objectives. A single, simple control provides the functionality to identify a file. However, the actual transfer requires the use of a button to actually execute the uploading behavior. As demonstrated in the final exercise, that button can also trigger the execution of writing behavior in a data source control that has no data-bound control. The data source control can use control parameters to gather values and create an insert in a table.

Over the last eight chapters you have seen how powerful ASP.NET 2.0 can be with the use of practically no code. You have solved many common business scenarios such as logging on, personalization, and working with data. But in some more advanced cases you will be forced to write custom code, and for those techniques carry on to Chapter 9.

Exercises

1. Enabling the capability to write to a database requires changes to the properties of a data source control, a data-bound control, or both?
2. Describe the difference between an `asp:Parameter` and an `asp:ControlParameter`.
3. What problem does the `DataKeyNames` property solve?
4. A page needs to delete the date of birth value from one record. Which command should be used?
5. What tags must be added to a page to allow a `GridView` to create new records?

9

Code

You're now at the stage where the site is getting more features, and you need to start learning more about code. Some of the code used in previous chapters might not have been explained fully — that's because what the code was doing was more important than the actual code itself. It's not that the code wasn't important, but rather that the technique being taught was the key; understanding how the actual code worked would come later. Now it's time to learn about the basics of writing code, what makes good code, and how you put all that code together.

This chapter looks at the following topics:

- What data types and variables are and how they are used
- How you make decisions in your code
- How you repeat lines of code
- What object-oriented programming means and why it's important
- How to think about structuring your code so it's well organized and easy to maintain
- How one of the new language features in ASP.NET 2.0 eases working with collections of objects

There's a lot to cover, and although some of it might sound difficult, it's actually quite easy. The first section discusses data types.

Variables and Data Types

When you use applications, you don't really care how the application stores your data, just that it does. As a programmer, however, you have to think about this. What sort of data is the user entering? Is it text, numbers, dates, or something else? This matters because how you store data internally in your application affects not only how you deal with the data, but also what you can do with that data. To store data internally, *variables* are used (variables are simply names, used to store information during code), and variables have types; there is a type for each type of data. For example, there is a data type called `String`, unsurprisingly used for *strings*, or text data. There is a data

type called `Date` for dates and times, an `Integer` data type for whole numbers, and a `Decimal` or `Double` data type for floating-point numbers. Each has different characteristics; the `Integer` type can only store integer numbers, and trying to store any other type of data into an `Integer` will raise an exception. Likewise, the `Date` data type can only store dates and times. The full list of data types is as follows:

- `Boolean` is used to store either `True` or `False`. The default value is `False`.
- `Byte` is used for a single byte of data. This can be a single character or a number from 0 to 255. The default value is 0.
- `Char` is used for two bytes of data. This can be a character or a number from 0 to 65,535. Because it is bigger than a `Byte`, `Char` can store double-byte characters like those used by foreign characters sets such as Chinese. The default value is 0.
- `Date` is used to store a date and time. The default value is 0:00:00 (midnight) on January 1, 0001.
- `Decimal` is used for decimal values. It supports up to 29 significant digits and is therefore the most accurate type for financial numbers. The default value is 0.
- `Double` is used for floating-point numbers. Unlike the `Decimal` data type, `Double` has a smaller range and is less accurate. However, it is also faster in use, so it is the preferred data type for floating-point numbers unless a great depth of precision is required. The default value is 0.
- `Integer` is used for whole numbers between –2,147,483,648 and 2,147,483,647. The default value is 0.
- `Long` is used for whole numbers between –9,223,372,036,854,775,808 and 9,223,372,036,854,775,807. The default value is 0.
- `Object` is used to represent objects. In VB, the default value is `Nothing`. In C#, the default value is `null`.
- `SByte` is used to hold whole numbers between –128 and 127. The default value is 0.
- `Short` is used for whole numbers between –32,768 and 32,767. The default value is 0.
- `Single` is used for floating-point numbers that don't require the full size of a `Double`. The default value is 0.
- `String` is used for storing text (or string) data. The default value is `Nothing` in VB and `null` in C#.
- `UInteger` is the unsigned equivalent of an `Integer`. Because it is unsigned it can only store positive numbers, giving a range of 0 to 4,294,967,295. The default value is 0.
- `ULong` is the unsigned equivalent of a `Long`. Because it is unsigned it can only store positive numbers, giving a range of 0 to 18,446,774,073,709,551,615. The default value is 0.
- `UShort` is the unsigned equivalent of a `Short`. Because it is unsigned it can only store positive numbers, giving a range of 0 to 65,535. The default value is 0.

Having different data types allows the type to provide features that only that type requires. For example, the `DateTime` type allows dates to be manipulated, the individual parts of the date or time to be extracted, and so on. Also, data types allow you to choose the most efficient way of storing data, so if you need to store a really long number, you would use a `Long`. A `Long` takes up more room in memory than a `Short`,

so if you only ever needed to store numbers between 1 and 100, you wouldn't use a `Long`. In essence the data type you choose depends not only on the type of data, but also its size.

Common Language Runtime Types

This may seem confusing, but there are different names for the same data types. This is because there are data types that the language uses, and data types that the *Common Language Runtime* (CLR) uses. Simply put, the CLR is the system that actually makes .NET run. You don't need to know much about it now, although it's definitely worth learning about as you become more experienced. The reason that the CLR has data types and the language has data types is that the CLR is common to all languages in .NET. Whether you use Visual Basic .NET, C#, or even COBOL .NET, underneath you are using the CLR. However, languages have history (apart from C#, which was new for .NET, but C# has a C and C++ base in terms of the language syntax), and so have data types of their own. For compatibility reasons it makes sense to keep these specific language types. This enables users of the language to work with familiar data types, and the compiler takes care of using the actual CLR data type.

For much of what you do you'll use the language data types, but there are times when you need to know what CLR data type a language data type maps onto, and the following table shows this:

CLR Type	Visual Basic Type	C# Type
`Boolean`	`Boolean`	`bool`
`Byte`	`Byte`	`byte`
`Char`	`Char`	`char`
`DateTime`	`Date`	`DateTime`
`Decimal`	`Decimal`	`decimal`
`Double`	`Double`	`double`
`Int32`	`Integer`	`int`
`Int64`	`Long`	`long`
`Object`	`Object`	`Object`
`SByte`	`SByte`	`sbyte`
`Int16`	`Short`	`short`
`Single`	`Single`	`float`
`String`	`String`	`string`
`UInt32`	`UInteger`	`uint`
`UInt64`	`ULong`	`ulong`
`UInt16`	`UShort`	`ushort`

When you look at converting between data types you'll see why it might be important to know the underlying data type.

Declaring Variables

There is a specific syntax for creating variables, which requires the name and data type. The name is up to you, but it's always best to use a sensible name, something that represents what the variable holds. To define a variable you use the `Dim` statement, like so:

```
Dim VariableName As DataType
```

Replace the `VariableName` and `DataType` with your requirements:

```
Dim FirstName As String
Dim LastName As String
Dim Age As Integer
Dim Birthday as Date
```

You've used sensible names for the variables: two `String` types to hold the first and last names, an `Integer` to hold the age, and a `Date` to hold the birthday. In some documents and books you might see a prefix on the variable name, giving an indication of its data type. For example, the names and ages might be declared like so:

```
Dim strFirstName As String
Dim sLastName As String
Dim iAge As Integer
Dim dBirthday as Date
```

Here `str` or `s` has been used as a prefix for `String` types, `i` for `Integer` types, and `d` for `Date` data types. You may find this technique useful when learning how to use variables and data types, although it isn't generally recommended and has dropped out of favor. A correctly named variable should give a good indication of its data type. Having said that, there are times when some form of prefix is useful, and you'll see this when you look at classes a little later in the chapter.

Assigning Values

Once you declare a variable, you can assign values to it, and this is simply a matter of setting the variable equal to the required value. The syntax for this is as follows:

```
variable = value
```

This says give the variable named on the left of the equals sign the value on the right of the equals sign. For example:

```
FirstName = "Arthur"
LastName = "Arbuthnot"
Age = 24
Birthday = #10/25/1980#
```

As you can see, string values are enclosed in quotation marks, whereas numeric values aren't. Notice that the date value is enclosed within hash marks (#), and the format is MM/DD/YYYY. This is a fixed format when assigning dates like this, and takes no account of the regional settings of your machine. You can also assign a time part, like so:

```
Appointment = #10/25/1980 11:10 PM #
```

Alternatively, you can assign a time like this:

```
Appointment = #10/25/1980 23:10 #
```

Variables can also be initialized when they are declared, like so:

```
Dim FirstName As String = "Arthur"
Dim LastName As String = "Arbuthnot"
Dim Age As Integer = 24
Dim Birthday As Date = #10/25/1980#
```

These examples show the assignment using literal values, but you can also assign values to other variables or objects. For example, in ASP.NET pages it's very common to assign values from user-entered data, perhaps from a text box:

```
FirstName = FirstNameTextBox.Text
LastName = LastNameTextBox.Text
```

Or vice versa:

```
FirstNameTextBox.Text = FirstName
LastNameTextBox.Text = LastName
```

The `TextBox` control has a property called `Text` that contains the text value, so you are simply copying that value into the `String` variable, or copying the string value into the property. This is fine for `String` types, but extra work needs to be done if the variable isn't a `String` type; for example, allowing users to enter their age would require a text box and an `Integer` type variable. However, you can't assign the values of differing types — you need to convert them.

Data Conversion

Visual Basic .NET does provide some automatic conversion of data types, but it's best not to rely on this, otherwise you tend to forget that conversion is actually happening. Explicit conversion makes it clear exactly what your code does, a useful point when you (or others) look at your code later. There isn't a single syntax for converting between types, but there is a lot of commonality in the different methods.

Converting to string values is the simplest, because every data type has a `ToString` method. For example, to convert the age to a `TextBox` you could use:

```
AgeTextBox.Text = Age.ToString()
```

For the `Boolean` type the conversion method is the same, but the string value will be either `True` or `False`.

Converting from a string value to another type is slightly different, because no methods on the `String` type do this automatically. Instead you have to use a separate class to perform the conversion.

Converting Data Types Using the Framework Classes

Two ways exist to convert from string values to other types using the framework classes, and it's worth mentioning both in case you see them in code. The first is to use the `Parse` method that most data types supply. For example, to convert a number held in a `TextBox` control into an `Integer` data type, you could do this:

```
Dim Age As Integer
Age = Integer.Parse(AgeTextBox.Text)
```

What's happening here is that the `Parse` method *parses* the value passed to it — that is, it reads the value, checks that it is an integer value, and converts it into an integer. The value to be converted is the value from the `Text` property of the `AgeTextBox` control, which is a string. So the string is passed into the `Parse` method, which converts it into an integer and returns the integer, which in turn is assigned to the `Age` variable.

All of the data types, apart from `Object`, support the `Parse` method, which means that even though you may be using a different data type the syntax is the same. For example:

```
Dim ANumber As Double
ANumber = Double.Parse(NumberTextBox.Text)
```

The second way to perform data conversion is to use the `Convert` class, which converts between types. It's a very flexible class in that it can convert between all types, but it does require knowledge of the CLR type. For example, the preceding example using an integer could be written as follows:

```
Dim Age As Integer
Age = Convert.ToInt32(AgeTextBox.Text)
```

For the double example this would be:

```
Dim ANumber As Double
ANumber = Convert.ToDouble((NumberTextBox.Text)
```

In use there is no difference between the `Convert` class and the data type class when converting types. The only reason for using the `Convert` class is that it makes code easier to convert to another language. This was important when writing the Wrox United web site, but may not be important to you if you intend to stick with one language.

Converting Data Types with Casting

Another way of converting between types is by *casting*. Instead of explicitly converting the type, the value is forced into another type. Casting doesn't work in the same way as converting, and isn't always suitable. For example, you can't use casting to convert from strings to numbers. You can, however, use casting to convert between similar types. For example, you could cast between a `Double` and an `Integer` by using the following code:

```
Dim MyDouble As Double = 123.456
Dim MyInteger As Integer
MyInteger = CType(MyDouble, Integer)
```

The `CType` function accepts two arguments. The first is the variable to be converted, and the second is the new type. What this does is to force the variable, `MyDouble`, into being something it's not; it's a bit like pushing a round block through a square hole. `MyDouble` is still a `Double`, but the value that `CType` returns is an `Integer` — the `Double` squashed into the space that an `Integer` holds.

Another way of casting is to use `DirectCast`, which has the same syntax as `CType`:

```
Dim MyDouble As Double = 123.456
Dim MyInteger As Integer
MyInteger = DirectCast(MyDouble, Integer)
```

One thing you should be aware of is that casting may change the value of the variable. In the preceding example this is obvious, because changing a floating-point number into an integer will lose the values after the decimal point. Converting between a `Long` and an `Integer` isn't so obvious, but may result in changes. Because an `Integer` has a range half that of a `Long`, if the value in the `Long` exceeds that of the `Integer`, the value will be shortened when converted.

Null Values

All data types have default values, but there is also the concept of a null value. This doesn't usually affect the standard types, and is more common on custom or complex types, and simply means that the object doesn't exist. For example, consider a method that returns a `DataSet` object, filled with data from a database. What happens if, while fetching the data, there is some sort of error? There will probably be an exception thrown (these are covered in Chapter 15), but the method still might return, only there's no data for you — the value returned might be null.

In Visual Basic .NET the null value is represented by the keyword `Nothing`. You'll look at how you test for null values later.

Working with Strings

When working with strings it's useful to know that the `string` class has a great number of methods that allow you to manipulate those strings, and any variable that is a string therefore has the ability to use those methods. You won't see all of them here, but instead concentrate on some of the most common ones.

One of the most common requirements is being able to strip blank spaces (or white space as it's sometimes called) from the beginning or end of strings. This is useful when taking input from a user and is especially important when trying to compare two string values. For example, consider the following code fragment:

```
Dim Name1 As String = "Dave"
Dim Name2 As String = "Dave     "

If Name1 = Name2 Then
```

The `If` test would result in `False`, because the strings aren't the same — `Name2` has spaces at the end. Three methods can help here: `TrimStart` removes spaces from the start of the string, `TrimEnd` removes spaces from the end of a string, and `Trim` removes spaces from both the start and end of a string. If the preceding code were modified to include `Trim`, the result would be `True`:

```
Dim Name1 As String = "Dave"
Dim Name2 As String = "Dave     "

If Name1.Trim() = Name2.Trim() Then
```

Both strings have been trimmed so the `If` test would return `True`. The strings have only been trimmed as part of the comparison, though; the strings haven't been modified themselves. Consider this code:

```
Dim Name1 As String = "Dave"
Dim Name2 As String = "Dave     "

If Name1.Trim() = Name2.Trim() Then
  ' this would return True
End If

If Name1 = Name2 Then
  ' this would return False
End If
```

You can see that using `Trim` affects only that one instance, unless the underlying variable is changed:

```
Dim Name1 As String = "Dave"
Dim Name2 As String = "Dave     "

Name1 = Name1.Trim()
Name2 = Name2.Trim()

If Name1 = Name2 Then
  ' this would return True
End If
```

Now that `Name1` and `Name2` have been reassigned with the trimmed values, subsequent comparisons work. The key point here is that using string methods affects only that particular use of the string, and the string variable will be changed only if assignment is done.

Another situation that can occur when comparing strings, especially those supplied by user input, is mismatched case. What if the user has the caps-lock key stuck on? Two methods can help with this: `ToLower`, which converts the string to lowercase, and `ToUpper`, which converts the string to uppercase. For example:

```
Dim Name1 As String = "dave"
Dim Name2 As String = "DAVE"

If Name1 = Name2 Then
```

This code would fail because the strings are different, even though we as humans know them to mean the same thing. To get around this you can change the case:

```
Dim Name1 As String = "dave"
Dim Name2 As String = "DAVE"

If Name1.ToLower() = Name2.ToLower() Then
```

Now the test would succeed because the values being compared are lowercase.

Plenty of other string methods exist, some of which are described in the following list:

- `EndsWith`, which returns `True` if the string ends with a given string. For example:

```
If MyString.EndsWith("ate") Then
```

- `StartsWith`, which returns `True` if the string starts with a given string. For example:

```
If MyString.StartsWith("wha") Then
```

- `IndexOf`, which returns the position within the string of a given character or string, or `-1` if the item isn't found. For example:

```
If MyString.IndexOf("abc") > 0 Then
```

- `Insert`, which inserts a string at a given position. For example, to insert the string `new words` at position `5` you would use:

```
MyString.Insert(5, "new words")
```

- `LastIndexOf`, which returns the last position within the string of a given character or string. This is similar to `Indexof` but is useful for finding the last instance of a character.
- `Length`, which returns the length of a string.
- `PadLeft` and `PadRight` perform the opposite of `Trim`, allowing you to pad strings to a given length. The padding defaults to a space but can be any character. For example, to pad a string to a total of 15 characters you would use the following:

```
MyNewString = MyString.PadLeft(15)
```

- `Remove`, which removes a section of a string. For example, to remove five characters starting at position 4 you would use:

```
MyNewString = MyString.Remove(4, 5)
```

- `Replace`, which replaces characters within the string. For example to replace `abc` with `def` you would use:

```
MyNewString = MyString.Replace("abc", "def")
```

- `SubString`, which returns a portion of a string. For example, to return five characters starting at position 4 you would use:

```
MyNewString = MyString.SubString(4, 5)
```

For a full list of string methods you should consult the documentation.

Working with Dates

In earlier code snippets you saw dates being assigned to a literal value in MM/DD/YYYY format. You may think this is fine, especially if you are used to that format, but seeing literal dates can be very confusing. If your code is used by someone not used to that format, whether they are across the world or at

the desk next to yours, they might be unsure of your intentions. For example, take the date 03/05/2005; does this represent March 5 or May 3? You could easily assume the format, but that leads to potential errors.

Instead of using literals to initialize dates, it's better to create a new instance on a date, like so:

```
Dim Birthday As New Date(2005, 3, 5)
```

The parameters are in year, month, and day order, and because you have IntelliSense (or at least the documentation if you aren't using VWD), you know what the order should be. If required, the individual parts of the date can be accessed like so:

```
Birthday.Day
Birthday.Month
Birthday.Year
```

Other properties exist such as `DayOfWeek` and `DayOfYear`, as well as ones for dealing with the time and parts of the time. You can find more information about these additional properties in the documentation.

Dates behave just like numeric variables in that they allow addition, subtraction, and comparison. For example, you can add a number of days using the `AddDays` method:

```
NewDate = Birthday.AddDays(18)
```

There is also a `Subtract` method that subtracts one date from another. However, this method doesn't return a `Date` type, but rather a `TimeSpan`, which is a data type used to define spans of time. For example:

```
Dim Date1 As New Date(2005, 3, 10)
Dim Date2 As New Date(2005, 3, 5)
Dim Difference As TimeSpan

Difference = Date1.Subtract(Date2)
Label1.Text = Difference.ToString()
```

This code creates two dates, March 10 and March 5, and then declares a variable of type `TimeSpan`, which will hold the difference between the dates. The difference is calculated by using the `Subtract` method of the date — because the `Date1` variable is a `Date` type the `Subtract` method can be used, and `Date2` is passed into this method. The result is that `Date2` is subtracted from `Date1`, and in this case the result would be 5.00:00:00, which represents 5 days, 0 hours, 0 seconds, and 0 milliseconds.

Now that you have a good base of knowledge to work with, the following Try It Out has you work with simple data types.

Try It Out — Working with Simple Types

1. Open the directory for the Chapter 9 samples, called C:\BegASPNET2\Chapters\Begin\Chapter09 under the directory where you placed the sample code.
2. Create a new Web Form called `SimpleTypes.aspx`. Remember to make sure it uses a separate file for the code.

3. Drag three text boxes, three labels, and a button onto the page, so it looks like Figure 9-1. Make sure the `TextBox` and `Label` controls are in order, so `TextBox1` is at the top, followed by `TextBox2` and then `TextBox` 3.

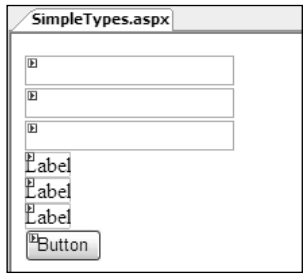


Figure 9-1

4. Double-click the button to create the code-behind file and button click event, and add the following code into the event procedure:

```
Label1.Text = TextBox1.Text + TextBox2.Text
Label2.Text = DateTime.Parse(TextBox3.Text).ToString("dd MMM yyyy")
Label3.Text = DateTime.Parse(TextBox3.Text).ToString()
```

5. Save both the Web Form and the code-behind file, and set the Web Form to be the start page (right-click the page in the Solution Explorer).

6. Press F5 to run the page and enter **3** into the first text box, enter **4** into the second text box, and **12/2/05** into the third text box.

7. Press the button and observe the results. On a machine configured with UK regional settings, you'll see Figure 9-2.

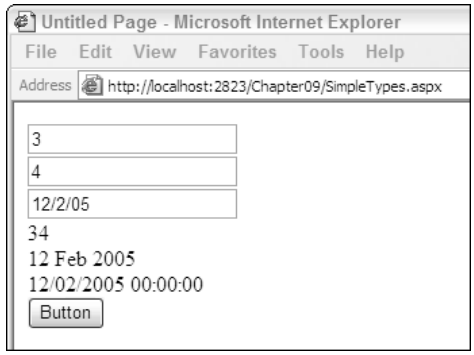


Figure 9-2

With the regional settings set to USA, Figure 9-3 will appear.

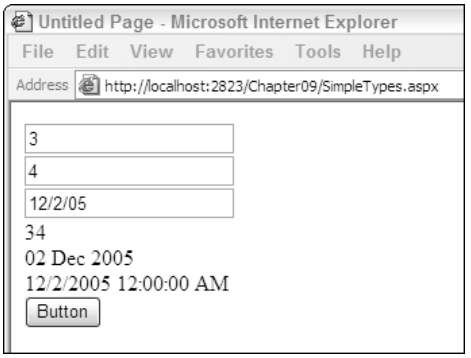


Figure 9-3

How It Works

There are two points to note about this page. The first is that the numbers you entered into the text boxes haven't been added together as you might expect, and the second is that the date format changes depending on the regional settings.

Take a look at the numbers first:

```
Label1.Text = TextBox1.Text + TextBox2.Text
```

The code seems obvious, just adding two numbers together, but you have to remember that the `Text` property of the `TextBox` control returns a string. For strings, the addition operator (`+`) means the same as the concatenate operator (`&`), so it simply joins the strings together. To add the strings you would have to convert them to numbers first, like so:

```
Label1.Text = Convert.ToInt32(TextBox1.Text) + Convert.ToInt32(TextBox.Text)
```

Here the `Convert` class is used to convert the text to numbers, so when the addition is done the values are numbers.

For the dates, you have to consider the regional settings of the machine upon which the web server is running — this is where the code is executed. As it happens, when running the VWD web server, the machine processing the pages is the same as your browser, but on a real web site this isn't the case. So let's see what the code does. The first line converts the value from the text box into a `DateTime` type by using the `Parse` method, and then it converts it back into a string. The `ToString` method has an explicit format, where `dd` is the day number, `MMM` is the month name, and `yyyy` is the year:

```
Label2.Text = DateTime.Parse(TextBox3.Text).ToString("dd MMM yyyy")
```

The reason for converting to a date and back to a string is to show that parsing the date is system-dependent. So if you are writing a web site for a company that uses a different date format from yours, the results you see may not always be what you expect.

The final line of code shows what the default `ToString` method does:

```
Label3.Text = DateTime.Parse(TextBox3.Text).ToString()
```

This simply shows the date and time. Notice that this displays the same value for the date irrespective of the regional settings. The time is shown differently but again that's because of the regional settings on the machine. You might like to experiment with your regional settings to see how the output differs. If you do this you will need to stop the VWD web server before rerunning the application; you can do this by selecting the icon in the task tray and clicking Stop from the right mouse-button menu.

One thing you might like to experiment with is what happens if you either leave a text box empty or enter the wrong data type (for example, entering a string into the third text box for conversion to a string). Depending on what you enter you might see a different range of exceptions, a topic that is covered in more detail in Chapter 15.

Working with Arrays and Collections

Arrays and collections are two sides of the same coin; they both provide ways of storing multiple copies of data types. For example, consider having to store several names, perhaps the authors of this book. You could store them in individual strings, but then what if you wanted to print them all out? You'd need a statement for each variable. With an *array* or a *collection* you need only one variable for multiple items. You can think of arrays as cells in a spreadsheet. A *single dimensional* array is a single row with multiple cells, and a *multi-dimensional* array is multiple rows, each with multiple cells. Instead of cells, the term *elements* is generally used, and the *index* is the number of the element (the row or column number, to continue the spreadsheet analogy).

Single Dimensional Arrays

Arrays are declared in much the same way as variables, but with the addition of parentheses after the variable name. For example:

```
Dim Names() As String
```

This declares a string array called `Names`, but it's an empty array because there is no number within the parentheses. The number defines the length of the array — the number of items it can hold. So to store five names you would change the declaration to the following:

```
Dim Names(4) As String
```

The use of `4` isn't a typo here, it's because arrays start at 0. So this array has 0, 1, 2, 3, and 4, which gives five entries. The bounds of the array are 0 to 4.

Accessing array values, either to read or assign values, follows the same rules, with the addition of the parentheses. Within the parentheses you put the index number of the element required. For example:

```
Names(0) = "Dave"
Names(3) = "Dan"
NameTextBox.Text = Names(4)
```

In this example `Dave` is the first entry and `Dan` is the fourth entry. The entries between are empty because no values have been set for them.

Trying to access an element that doesn't exist (anything above 4 in this example) will generate an exception with the message "Index was outside the bounds of the array."

Arrays can also be dynamically sized when declared:

```
Dim Names() As String = {"Dave", "Chris", "Chris", "John", "Dan"}
```

Here the array has five elements with the first being assigned to `Dave`, the second to `Chris`, and so on. The braces enclose the list of items for the array.

If you need to resize an array you can use the `ReDim` statement:

```
ReDim Names(9)
```

This will resize the array to 10 elements, but will remove the existing values. The `Preserve` keyword needs to be added if you need to keep the values:

```
ReDim Preserve Names(9)
```

If the array is resized to smaller than its original size, elements will be lost.

Multi-Dimensional Arrays

Arrays aren't limited to one dimension, so you can replicate that spreadsheet type of storage. For example, to use an array to store first and last names, you could do this:

```
Dim Names(4, 1) As String
Names(0,0) = "Dave"
Names(0,1) = "Sussman"
Names(1,0) = "Chris"
Names(1,1) = "Hart"
...
Names(4,0) = "Dan"
Names(4,1) = "Maharry"
```

Here the declaration separates the dimensions by a comma. The number of elements in each dimension is included in the variable declaration, so the first dimension has five elements (0–4), and the second has two (0–1). This gives you storage like so:

	0	1
0	Dave	Sussman
1	Chris	Hart
	...	
4	Dan	Maharry

A 4-by-4 array (four rows, four columns) would be declared as follows:

```
Dim MyArray(3, 3) As String
```

Remember, 0 counts as one element, to 0 to 3 is four elements. Adding another dimension is as simple as adding a comma and another number. So a three-dimensional array, with four elements in each dimension, would be

```
Dim MyArray (3, 3, 3) As String
```

Like single dimensional arrays, multi-dimensional ones can also be initialized at declaration time:

```
Dim Names(,) = {{"Dave", "Sussman"}, {"Chris", "Hart"}}
```

Like the single dimension, braces are used to surround the entries, but there are two sets of braces, one for each dimension; the outer set for the first dimension and the inner set for the second. The first names, `Dave` and `Chris`, are placed in the first dimension, and the last names, `Sussman` and `Hart`, are placed in the second dimension. So this is the same as

```
Dim Names(1, 1) As String
Names(0,0) = "Dave"
Names(0,1) = "Sussman"
Names(1,0) = "Chris"
Names(1,1) = "Hart"
```

Which style you use is a matter of personal preference. There's no real difference between them.

Collections

Another way of storing multiple items is to use collections. These differ from arrays in that they are always dynamically allocated, which makes them more suitable for situations where the amount of data changes frequently. There are different collections for different purposes, stored in the `System.Collections` namespace (more on namespaces later), including

- `ArrayList`, which provides a general collection for objects.
- `Hashtable`, which provides storage for key/value pairs. A key/value pair is simply the storage of values, which can then later be identified by a key. In array terms the key is the index of the array element, but a `Hashtable` allows the key to be non-numeric.
- `Queue` provides a first-in, first-out collection, which means that items are taken off the queue in the same order in which they were placed onto it, just like a real queue — the person who arrives first gets served first.
- `SortedList`, which provides ordered storage for key/value pairs.
- `Stack` provides a last-in, first-out collection, where items are taken off the stack in the reverse order in which they were placed onto it. Think of a stack of plates — the last one put onto the stack is the first off.
- `StringCollection`, which provides a collection of strings.

There are other collections, but these are the ones you'll probably use most frequently. Data is added to collections by calling an `Add` method, the parameters of which depend on the collection being used. For the `StringCollection` you simply supply the string to be added. For example:

```
Dim Names As New StringCollection()
Names.Add("Dave")
Names.Add("Chris")
```

To access the entries you use the same method as an array:

```
NameTextBox.Text = Names(0)
```

This would return `Dave`, because the names are added in numerical order.

A `HashTable` is different because the index isn't numerical, but rather string-based. With a `StringCollection` the index is a number, and it is assigned automatically, in order of the items added. With a `HashTable` you have to specify the key as well as the item you want to add. For example:

```
Dim Names As New Hashtable()
Names.Add("Dave", "Sussman")
Names.Add("Chris", "Hart")
```

In this example the first parameter is the key and the second is the value; this leads to them being called key/value pairs. You can also add entries without using the `Add` method:

```
Names("John") = "Kauffman"
```

There's no real difference between using and not using the `Add` method, although it's best to use `Add` if only because it's clearer as to what is being done. Without the `Add` method the code looks more like an assignment, so you aren't completely sure whether a new item is being added, or if an existing one is being modified.

To access the entries you use the key:

```
NameTextBox.Text = Names("Chris")
```

One important point about using `HashTables` is that the keys must be unique. So in the previous example a `HashTable` wouldn't really be suitable for storing the author names, because two of the authors have the same first name. So this code would fail:

```
Dim Names As New Hashtable()
Names.Add("Chris", "Ullman")
Names.Add("Chris", "Hart")
```

An exception would be raised on the second `Add` line, because the key has already been used.

Collections, and arrays for that matter, aren't only useful for storing native types such as strings or integers. They can also be used to store custom classes, and you'll look at that later in the chapter. The following Try It Out, however, puts your knowledge of arrays and collections to use.

Try It Out — Working with Arrays and Collections

1. Create a new Web Form, called `ArraysCollections.aspx`.
2. Add a `TextBox`, a `Button`, a `ListBox`, and another `TextBox` to the form.

3. For the text boxes set the `TextMode` property to `MultiLine`, the `Columns` property to `50`, and the `Rows` property to `5`. When finished it should look like Figure 9-4.

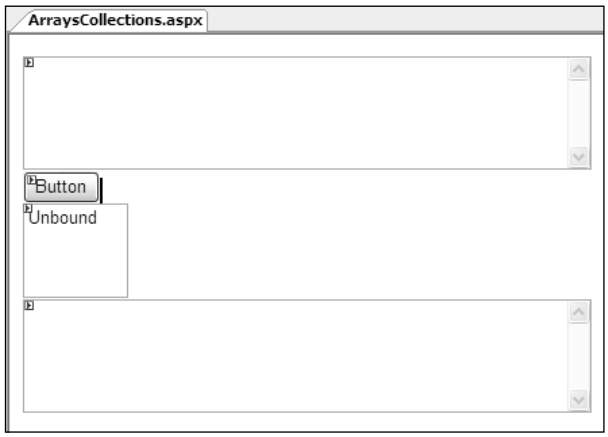


Figure 9-4

4. Enter the following code into the `Click` event for the button:

```
Dim splitChars As String = " "
Dim words() As String
Dim wordIndex As Integer

words = TextBox1.Text.Split(splitChars.ToCharArray())

ListBox1.Items.Clear()
For wordIndex = words.Length - 1 To 0 Step -1
  ListBox1.Items.Add(words(wordIndex))
Next

Dim paragraph As String = String.Empty
For Each word As ListItem In ListBox1.Items
  paragraph &= word.Value & " "
Next

TextBox2.Text = paragraph
```

5. Save the files, and set `ArraysCollections.aspx` as the start page.
6. Press F5 to run the page and enter **Wrox United are the best** into the first text box.
7. Press the button and you will see the screen shown in Figure 9-5.

You can see that the sentence in the first text box has been split into its component words, that those words have been entered into the list box in reverse order, and then the words have been combined into the second text box.

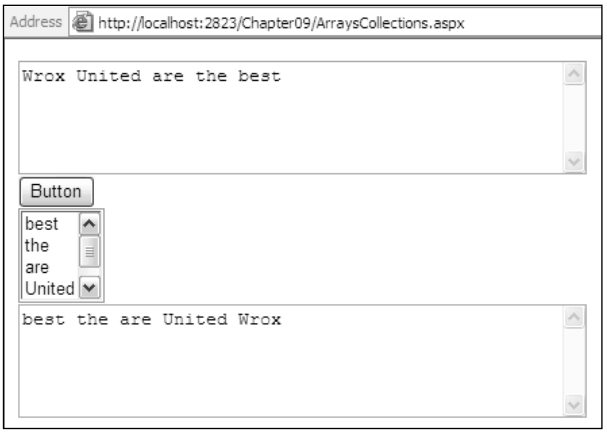


Figure 9-5

How It Works

The first three lines of the code simply define variables. The first, `splitChars`, is a string containing the characters that will be used to split the sentence. The second, `words`, is an array of strings, and the third, `wordIndex`, is an `Integer` that will be used to count through the array:

```
Dim splitChars As String = " "
Dim words() As String
Dim wordIndex As Integer
```

Next, the sentence entered into the text box is split into an array, using the `Split` method. Although it looks like `Split` is a method of the `Text` property, you must remember that the `Text` property returns a `String` — so `Split` is a method of the `String` class. The parameter passed into the string is not the `splitChars` variable itself, but `splitChars` converted to a character array (using the `ToCharArray` method). This is because a character array is the required type for the `Split` method, which allows a great deal of flexibility in splitting strings:

```
words = TextBox1.Text.Split(splitChars.ToCharArray())
```

At this stage the `words` array now contains a separate entry for each word in the sentence, ready for addition into the list box. Before the words are added to the list the existing `Items` collection is cleared, which stops the list from getting ever bigger if the button is clicked multiple times. Then you loop through the words array, but loop backwards, adding each word into the list:

```
ListBox1.Items.Clear()
For wordIndex = words.Length - 1 To 0 Step -1
  ListBox1.Items.Add(words(wordIndex))
Next
```

Don't worry too much about the exact syntax of the looping — you'll get to that later in the chapter.

Once the words are in the list they can be removed again, into another string. This has an initial value that might seem unusual — `String.Empty` — but this is quite a common thing for initializing strings:

```
Dim paragraph As String = String.Empty
```

`String.Empty` is a special value that indicates that the string is, well, empty. This is different from a string assigned to `""`, which has a value, albeit a string of length zero that doesn't contain any characters. The reason for having a distinction between a zero length string and an empty string is that it allows you to detect whether the string has been set or changed from its initial value. One of the reasons for declaring an initial value is that without it you get a warning in VWD, but on a later line, indicating that the `paragraph` variable is being used before it has been set. In this case it doesn't matter, but reducing warnings in VWD means it's easier to spot warnings and errors that do matter.

You now loop through the `Items` collection of the list box, and the `Items` collection contains `ListItem` objects. The `Value` of each `ListItem` is simply appended to the paragraph string, along with a space:

```
For Each word As ListItem In ListBox1.Items
  paragraph &= word.Value & " "
Next
```

Finally, the paragraph is displayed in the second text box:

```
TextBox2.Text = paragraph
```

This may seem an overly lengthy way to reverse the words in a sentence, but the point of the exercise is to show that there are different ways of working with arrays and collections.

Deciding Whether to Use Arrays or Collections

There are pros and cons of using both arrays and collections, and the decision of which to use can sometimes be confusing. In general if the number of elements isn't going to change, an array is best; it's efficient, fast, and provides easy access to the elements. If you need to change the number of elements, or insert elements in between others, then a collection is best.

Both arrays and collections can, like some of the data objects, be used for data binding. For example, the Wrox United shop could have a list of delivery methods in a drop-down list:

```
Dim delivery() As String = {"Post", "Courier", "International"}
DeliveryDropDownList.DataSource = delivery
DeliveryDropDownList.DataBind()
```

Here the array is simply used as the source to which to bind the list. Collections can also be used in this manner. Data binding was covered in Chapter 7.

Enumerations

Enumerations are a custom data type where the value can be one of a number of values. This is easier to see with an example, so let's look at the `Calendar` control. This is a complex control and has many properties to allow its look to be changed, one of which is the `DayNameFormat` (see Figure 9-6).

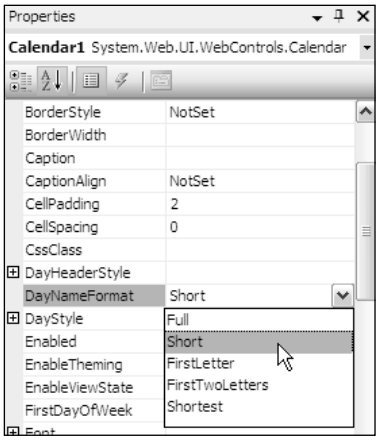


Figure 9-6

The format must be one of these five values (Full, Short, FirstLetter, FirstTwoLetters, and Shortest), and no other, so there needs to be a way of ensuring only these values can be selected. This is where enumerations come in because enumerations restrict the variable to a set of known values. The syntax for creating an enumeration is as follows:

```
Public Enum EnumerationName
  enumeration values
End Enum
```

What this does is declare a new type, with the name of the type being whatever name you give it as `EnumerationName`. This type is a special type where the values can only be one of the supplied list. For example, the `DayNameFormat` is an enumeration, which has been created like so:

```
Public Enum DayNameFormat
  Full
  [Short]
  FirstLetter
  FirstTwoletters
  Shortest
End Enum
```

Because this is a new type it can be used in variable declarations:

```
Dim dayFormat As DayNameFormat
dayFormat = DayNameFormat.FirstLetter
```

This declares a new variable of the enumeration type — `DayNameFormat`. Then it assigns a value to the variable, and the value assigned is one of the defined values. This shows as the enumeration name and value separated by a period. What's great is that you get IntelliSense, so you can pick from a list of the known values when assigning the variable.

Enumerations provide a way to have a human-readable value associated with a number. In the preceding example no numbers are explicitly assigned, so they are created automatically, starting at 0. So here

`Full` would be `0`, `Short` would be `1`, and so on. The `Short` value has been enclosed within square brackets because `Short` is also a data type; using the square brackets tells .NET that this is the custom name rather than the data type. If you don't want to use the default numbers for the values, you can specify them yourself. For example:

```
Public Enum DeliveryType
  Post
  Courier = 4
  International
End Enum
```

Here the `Post` would be `0` and the `Courier` has an explicit value of `4`. `International` doesn't have an explicit value so automatic numbering starts again, at the last number used, so would therefore have a value of `5`.

Enumerations are used when you need to allow one of a limited number of values for a selection. It's used extensively in the ASP.NET server controls to allow only selected values, often allowing the behavior to change; the `TextBox`, for example, has a `TextMode` property that can be one of `SingleLine`, `MultiLine`, or `Password`. How the `TextBox` is displayed changes depending on which value is selected. When creating code yourself, for the day-to-day running of an application, there is perhaps less use for them (the Wrox United site doesn't use any `Enums`), but they can be useful, perhaps when building central libraries of code.

Constants

Constants are another way to provide a human-readable form for values, but unlike enumerations, constants are a single value only and as their name suggests, they are constant and never change. This is useful for situations where you need to use a fixed value; using a constant means you can give that value a name and use the name throughout the code. The value is defined once, meaning it is easy to change, and because the readable name is used throughout the code, the code becomes more maintainable.

Even if the value is used only once, it's sensible to use constants because they provide a way to centralize this type of fixed value. The syntax for a constant is as follows:

```
Private Const ConstantName As Type = Value
```

`Const` is what defines this as a constant, and `Private` is how visible the constant is — you'll be looking at this later in the chapter. The rest of the declaration is just like any other variable, the difference being that the value is constant, and therefore cannot be changed.

For example, in the Wrox United web site there is a shopping cart to store items bought from the shop. Members of the fan club receive a 10% discount, so this value is stored as a constant:

```
Private Const MemberDiscountPercentage As Single = 0.1
```

When the total price of the order is calculated this constant can be used, just like any other variable:

```
MemberDiscount = SubTotal * MemberDiscountPercentage
Total = SubTotal - MemberDiscount
```

You'll look at the implementation of the shopping cart later in the chapter.

Statements

Statements are where the real action of code is, allowing you to control the program. You have seen many statements in code already in the book, and at the time it wasn't convenient to explain what they meant or how they worked. Now is that time, because statements are what drive your code. Statements are what allow you to structure your code, to make decisions, to repeat actions a number of times. For example, to make a decision you use the `If Then` statement, which can be used to allow the code to react to external criteria. Take the Wrox United checkout page, where members of the fan club receive a discount. This is done with a decision, which goes something like this:

```
If person is a member of the fan club Then
  give that person a discount
End If
```

The `If`, `Then` and `End If` are the Visual Basic statements that test a condition — or ask a question. Think of the program as a person deciding what to do.

For repeating tasks there are statements called loops, and there are different types of loops for different tasks. Some (`For Next`) repeat a fixed number of times, whereas others (`While`) repeat until a condition is met, or while a condition is true.

Before conditions and loops can be examined in more detail, some other topics need to be covered.

Operators

The first thing to look at is *operators*, which are how values are manipulated. If you can remember back to your math lessons in school, this will be familiar. You've already seen the assignment operator, the equals sign (`=`), in action earlier in the chapter, and this simply assigns a value to a variable. The next several sections discuss how remaining operators allow you to carry out some predefined operation.

Concatenation

Concatenation is used to join strings together. For example, consider if you had the first and last names in a multi-dimensional array (as shown when you looked at arrays), and you wanted to have a single variable with the full name. You would use the concatenation operator, the ampersand (`&`), to do this:

```
Dim FullName As String
FullName = Names(0,0) & Names(0,1)
```

This takes the last name and joins it to the end of the first name. However, there is no space separating them, so the code could be

```
FullName = Names(0,0) & " " & Names(0,1)
```

Now you have two concatenations taking place. First a space is added and then the last name. You could have also used another form of the assignment operator:

```
FullName = Names(0,0)
FullName &= " "
FullName &= Names(0,1)
```

The use of &= simply says take the variable on the left of the assignment and append to it the contents on the right. This also works with arithmetic operators, which are the subject of the next section. The addition operator (+) can also be used for string concatenation.

Arithmetic Operators

Arithmetic operators allow you to perform, well, arithmetic on variables: addition, subtraction, and so on. The following table displays the arithmetic operators:

Operator	Action
+	Addition
-	Subtraction
*	Multiplication
/	Division
^	Exponentiation
Mod	Modulus
\	Integer division

The standard mathematical operators are easy to understand; they add, subtract, multiply, and divide in the way you'd expect:

```
Dim n1 As Integer = 6
Dim n2 As Single = 14.3
Dim n3 As Double

n3 = n1 + n2              ' results in: 20.3
n3 = n2 - n1              ' results in: 8.3
n3 = n1 / n2              ' results in: 0.41958
n2 = n1 * n2              ' results in: 85.8
```

Exponentiation raises one number to the power of another:

```
Dim n1 As Integer = 10
Dim n2 As Integer

n2 = n1 ^ 2               ' results in: 100
n2 = n1 ^ 3               ' results in: 1000
```

Modulus divides two numbers and returns the remainder. One of the classic uses for this has been to test whether a number is odd or even:

```
Dim n1 As Integer

n1 = 1 Mod 2              ' results in: 1
n1 = 2 Mod 2              ' results in: 0
n1 = 3 Mod 2              ' results in: 1
n1 = 14 Mod 2             ' results in: 0
```

So if a number Mod 2 is 0, then it's even.

Integer division allows you to obtain the integer portion of a division — the number of times a divisor goes into a number:

```
Dim n1 As Integer

n1 = 1 \ 2                ' results in: 0
n1 = 2 \ 2                ' results in: 1
n1 = 3 \ 2                ' results in: 1
n1 = 14 \ 2               ' results in: 7
```

Like concatenation, operators can be combined with assignment. In order to add one to a number you can do this:

```
Dim n1 As Integer = 4
n1 = n1 + 1
```

This says take `n1`, add one to it, and assign that value back to `n1`. Remember that assignment works by taking the value on the right of the equals sign and assigning that to the variable of the left of the equals sign. This works even if the variable being assigned is on the right because the right side is calculated first. An alternative to this is to combine operators:

```
Dim n1 As Integer = 4
n1 += 1
```

This has the same result as the first example although it looks very different. In fact it's just a shortcut that allows the addition operator to be combined with the assignment; it simply says take the `n1` variable and add one to it. The other arithmetic operators can be used in the same way.

The subtraction operator is also used for negation, like so:

```
Dim n1 As Integer
Dim n2 As Integer

n1 = -3
n2 = -n1                  ' results in: 3
```

Negation can be used on any numeric type.

Comparison Operators

Comparison is how decisions are made in code; you'll come onto the mechanism of that in due time, but the operators define what comparison is made. The comparison operators are shown in the following table:

Operator	Action
<	Less than
<=	Less than or equal to

Operator	Action
>	Greater than
>=	Greater than or equal to
=	Equal to
<>	Not equal to

Comparison always involves an *expression* — the term for all operators and operands involved in the comparison. The result of a comparison expression is a Boolean value — it is either `True` or `False`. You'll look at the mechanics of using expressions in decisions in a while, but these operators work just like the ones you've already seen. So if you have two variables, `n1` with a value of `4` and `n2` with a value of `5`, the following could be used as expressions:

```
n1 > n2                    ' results in: False
n2 > n1                    ' results in: True
```

For numbers the comparison is obvious, but for other data types it might not be. Dates, for example, work in a similar way, but the test is whether one date is earlier or later than another. For example:

```
Dim d1 As New DateTime(2005, 10, 1)  '  1 October 2005
Dim d2 As New DateTime(2004. 1, 2)   '  2 January 2004

d1 > d2                              ' results in: True
```

The greater than operator tests to see if the first date is later than the second, so the result is `True`.

Two other comparison operators also are used with objects. The operator `Is` checks to see if two object references point at the same object. The `IsNot` operator does the opposite, checking to see if two object references point at different objects; they are the equivalent of equals (`=`) and not equals (`<>`) for objects. This is useful when dealing with objects, and many of the scenarios where this is used are covered in later chapters. However it's worth showing an example here, and because databases have already been covered that can be the example. When using the data controls on pages you get a lot of functionality by just dropping a control onto a page and setting a few properties, but there are occasions where you need to explicitly deal with a database, and this becomes more true as you gain experience and write more complex applications. The checkout for Wrox United is one case, where the items from the shopping cart are written to the database. For this a `SqlConnection` object is used, which provides a way to connect to a specific database. For example:

```
Dim conn As New SqlConnection(" . . .")
conn.Open()

' insert the checkout items

conn.Close()
```

This code fragment opens a database connection, inserts the checkout items, and then closes the connection. However, if there is an error when opening the connection, the `conn` variable wouldn't contain an

active connection, so the `Close` would fail. This is where the `Is` and `IsNot` tests are used, so the `Close` could be modified to

```
If conn IsNot Nothing Then
  conn.Close()
End If
```

If an error occurs, `conn` wouldn't be assigned a value and would be `Nothing`, so `conn` is tested before being closed. If it is not `Nothing` (I'm sure the editors are having a fit about all these double negatives), the connection can be closed. You'll see more about this topic in Chapter 15.

Logical Operators

Logical operators allow the combination of expressions. The operators are as follows:

Operator	Action
`And`	True if both sides of the expression are true
`Or`	True if one side of the expression is true
`Xor`	True if only one side of the expression is true
`AndAlso`	Short-circuited version of `And`
`OrElse`	Short-circuited version of `Or`
`Not`	Negates the expression

All except `Not` require two expressions, in the following form:

```
LeftExpression Operator RightExpression
```

The following table should make the result more obvious:

Operator	LeftExpression	RightExpression	Result
`And`	True	True	True
	True	False	False
	False	True	False
	False	False	False
`Or`	True	True	True
	True	False	True
	False	True	True
	False	False	False

Operator	LeftExpression	RightExpression	Result
Xor	True	True	False
	True	False	True
	False	True	True
	False	False	False

The AndAlso and OrElse operators have the same result as And and Or, but there is a subtle difference. With the normal versions, both expressions (left and right) are evaluated, but with the short-circuited operators this isn't necessarily so. They will stop evaluating expressions if one of the expressions can guarantee a result. For example, consider the following code:

```
Dim Name As String = "Dave"

If Name = "Dave" Or Name = "Dan" Then
  ' name is either Dave or Dan
End If
```

In this case Name is checked to see if it is Dave and then checked to see if it is Dan. Now consider this:

```
If Name = "Dave" OrElse Name = "Dan" Then
```

Here Name is first checked to see if it is Dave. It is, so the second expression (the check for Dan) is never done — it's not needed, because it won't affect the result. In many cases it won't matter which form (normal or short-circuited) you use, but there are times it does. For example, imagine instead of a simple test for a name you called a function that updated a database. When using the normal form the database would be updated, but the short-circuited version wouldn't call the function and the database wouldn't be updated. Using the standard And the code would be

```
If User.IsInRole("Admin") And UserAudit("Admin") Then
  ' user is an admin and their details have been updated
End If
```

This would call the UserAudit function even if the current user weren't in the Admin role because using And means that both parts of the test are done. To get around this the following could be used:

```
If User.IsInRole("Admin") AndAlso UserAudit("Admin") Then
  ' user is an admin and their details have been updated
End If
```

Now UserAudit is called only if the user is in the Admin role. Using AndAlso means that if the first part of the test fails, there is no point evaluating the second part, so it is never run.

Another time when the short-circuited form is useful is when you need to see if a property of an object has a value; you only want to check if the object actually exists, not if it is set to Nothing. For example, consider the following code, where data is fetched from a database and then some action needs to be performed only if some rows were returned:

```
Dim rdr As SqlDataReader
rdr = DataLayer.GetProducts()

If rdr IsNot Nothing And rdr.HasRows Then
```

Assume that the database access fails for some reason, and `rdr` is set to a null value — that is, `Nothing`. With the normal form of `And`, both expressions are tested. First the check for `Nothing` is done, and this test returns `False` — `rdr` is `Nothing`. Next the second test is done, to check the Boolean `HasRows` property, to see if any data was returned. But `rdr` is `Nothing` so this will generate an exception. To cure this problem you can use the short-circuited form of `And`:

```
If rdr IsNot Nothing AndAlso rdr.HasRows Then
```

Now there will be no exception. The first test is done, and because it is `False` the second test isn't done. There's no need because the first is `False` and the entire expression can never be `True`.

Operator Precedence

Operators aren't limited to just one or two expressions, and can be combined in a multitude of ways. Before doing this however, you need to understand that there is an order of precedence, so the result you get might not be what you expected. Consider the simple expression:

```
1 + 2 * 3
```

This returns 7 because multiplication has a higher precedence than addition. You can use parentheses to force a change in order:

```
(1 + 2) * 3
```

This returns 9 because the expression in parentheses is evaluated first. It's always a good idea to include parentheses in your expressions because it makes your intentions clear, and this is certainly a good thing when you (or someone else) comes to look at your code later.

If you don't use parentheses the order of precedence is as follows, in descending order:

- Exponentiation (`^`)
- Unary negation (`-`)
- Multiplication and division (`*`, `/`)
- Integer division (`\`)
- Modulus (`Mod`)
- Addition and subtraction (`+`, `-`) and string concatenation (`+`)
- String concatenation (`&`)
- Arithmetic bitshift (`<<`, `>>`)
- Comparison (`=`, `<>`, `<`, `<=`, `>`, `<=`, `Like`, `Is`, `TypeOf...Is`)

- Negation (`Not`)
- Conjunction (`And`, `AndAlso`)
- Disjunction (`Or`, `OrElse`, `Xor`)

This chapter hasn't covered all of these operators because some of them you won't use very often, or they are used in more advanced techniques. They have been included in the preceding list just so that you know where they fit into the order.

Decisions

Decisions are how you make code react to data, usually from a database or user input. You've already seen plenty of decisions throughout the book, and in this chapter logical operators covered how expressions play an important part of the decision-making process. Decisions can be made in two ways, and which way you use depends on the number of values an expression can be. For example, if an expression can return one of two values (True or False), the `If` statement is used. If the decision is a selection among a number of choices (perhaps the delivery method from the Wrox United shop), the `Select` statement is used.

Single Selections

Single selections are based around the `If...Then` statement, which always has three parts. The first is the expression being tested, which will result in a `True` or `False` value. The second is the block of code to be executed if the expression is `True`. Finally there is the `End If`, which ends the decision-making process. The syntax is as follows:

```
If condition Then
  ' code to run if condition is true
End If
```

This tests a single condition and only runs code if the condition is true. Alternatively there is

```
If condition Then
  ' code to run if condition is true
Else
  ' code to run if the condition is false
End If
```

This tests a single condition but has code for both the true and false situations. For multiple tests you can use:

```
If condition Then
  ' code to run if condition is true
ElseIf condition1 Then
  ' code to run if condition1 is true
Else
  ' code to run if no conditions were true
End If
```

There can be any number of `ElseIf` conditions.

Consider Wrox United, where the club sends out a newsletter, but only to those fan club members who have checked the checkbox when they entered their details. The user settings are stored in the `Profile` object, which was shown in Chapter 5:

```
If Profile.Mailings = True Then
  ' send the newsletter to this person
End If
```

This is a simple case, where there is only one expression being tested, and one set of code to run.

If some code needs to be run when the expression is `False`, the `Else` statement can be used:

```
If Profile.Mailings = True Then
  ' send the newsletter to this person
Else
  ' don't send the newsletter
End If
```

There is also a third statement, `ElseIf`, for choosing among several different expressions. For example:

```
If Profile.IsNewUser Then
  ' send introductory mail
ElseIf Profile.Mailings = True Then
  ' send the newsletter to this person
Else
  ' don't send the newsletter
End If
```

In this example the expressions first checks to see if the member is a new user — that is, if they've only just joined and haven't had any mailings yet. If so, the introductory mail is sent. If the first expression is `False`, that is, they aren't a new user, the next expression is checked — do they require mailings? If so, then that code block is run, and if none of the expressions are `True` the `Else` block is run. If a condition tests true the appropriate code block is run and no more conditions are tested — the `If` statement ends.

Multiple Selections

For selections where the expression can be one of a number of possible answers, the `If` statement can become unwieldy. For example, consider the Wrox United shop where you can buy a range of branded merchandise. Currently items are sent using the standard postal service, but what if the club wanted to offer different delivery methods, perhaps by way of a drop-down list:

```
Dim delivery() As String = {"Next Day Post", "3 Day Post", _
                            "Courier", "International"}
DeliveryDropDownList.DataSource = delivery
DeliveryDropDownList.DataBind()
```

The underscore at the end of the line is a line wrapping character. It must be preceded with a space and tells Visual Basic that the line of code hasn't ended, but continues on the next line.

Maybe the data is from an array, or more likely from a database where the delivery type and associated cost are both included. When the total price is calculated, though, different action needs to be taken — perhaps to instruct the packing department which box type to use, or maybe to interface

directly with the delivery company's tracking system. Using the `If` statement would result in the following code:

```
Dim del As String = DeliveryDropDownList.SelectedValue
If del = "Next Day Post" Then
  ' pack in a normal box and stick lots of stamps on it
ElseIf del="3 Day Post" Then
  ' pack in a normal box and stick one stamp on it
ElseIf del="Courier" Then
  ' pack in a courier specific box and book a pickup
Else
  ' pack in a large crate and take to the freight company
End If
```

You can see that all those `ElseIf` statements and the layout make this hard to read. In situations like this it's best to use the `Select` statement, which would turn this code into the following:

```
Select Case DeliveryDropDownList.SelectedValue
Case "Next Day Post"
  ' pack in a normal box and stick lots of stamps on it
Case "3 Day Post" Then
  ' pack in a normal box and stick one stamp on it
Case "Courier" Then
  ' pack in a courier specific box and book a pickup
Case Else
  ' pack in a large crate and take to the freight company
End Select
```

This code is much neater, easier to read, and less error prone. It works in a similar way to the previous example, where the expression is on the first line — the selected value from the drop-down list. This is then compared to each of the values in the `Case` statements, starting at the top and working down. The first match causes the code block under that `Case` statement to be executed, and all other `Case` statements are ignored. If there is no match, the code block under the `Case Else` statement is run.

The `Select` statement is much more flexible than shown in the preceding code, because it allows matching multiple selections or ranges. The syntax for this is as follows:

```
Select Case condition
Case test1
  ' code to run if condition matches test1
Case test2
  ' code to run if condition matches test2
Case else
  ' code to run if the condition matches no tests
End Select
```

The `Select Case` starts the selection process, with each selection being preceded by a `Case` keyword. Once again, you have to think of the program as a person making decisions; in this case do that, and so on.

For example, consider a membership system that requests the age when the member is created, perhaps to customize the membership pack (free crayons for kids!):

```
Select Profile.Age
Case 0
  ' wow, that's starting really early
Case 1, 2, 3, 4, 5
  '  add some free crayons
Case 8 To 15
  ' add leaflet about junior training camp
Case Is <= 21
  ' add leaflet about under 21 side
Case Is > 65
  ' add leaflet about bingo evenings
End Select
```

Here there are a variety of ways in which selection is done. The first `Case` matches a single value, and the second matches any of the values 1, 2, 3, 4, or 5. The third `Case` matches a range of values, and the fourth `Case` matches any value less than or equal to 21, with the final match being for values over 65. You need to be careful with the `Is` keyword and comparison operators, because these could mask matches further down in the list (remember these are tested in order). So placing `Case Is <= 21` first would catch all numbers below 22 irrespective of whether more specific matches were declared further down in the `Select` statement. Notice that there is no `Case Else` statement, so nothing happens if the age is between 22 and 65. This is fine under these circumstances, but when using a `Select` statement with user input it's always best to include an `Else` statement to ensure that you catch data that is outside your range checking.

Loops

Loops provide a way to repeat actions, either a fixed number of times or until some condition is met. The decision of which loop to use depends on whether you know in advance how many times you need to loop, or whether some external factor influences this. For example, when a `DataReader` object provides a way to read through some records from a database, this has a `Read` method that returns `False` when there are no more records. This is a case of not knowing in advance the number of times you need to loop.

The While and Do Loops

To perform looping until some condition is met you can use the `While` or `Do` loops, both of which are dependent upon an expression. Take the `While` loop first, using the case of data from a database:

```
Dim conn As New SqlConnection("...")
Dim cmd As New SqlCommand("SELECT * FROM Products", conn)
Dim rdr As SqlDataReader = cmd.ExecuteReader()

While rdr.Read()
  ' do something with the data record
End While
rdr.Close()
```

Ignore the SQL statement, because it's not that important for this example; all that's important is that a number of records will be returned when the SQL command is run. This statement is simple — the `While` loop continues execution of its code block while the condition is `True`. The `Read` method returns `True` if it has a record, and `False` if it doesn't, so this loop continues until there are no more records. So, the first time the `While` statement is encountered the expression is tested. If it is `True`, the code between the

`While` and `End While` statements is executed, and when the `End While` is encountered, the loop starts again, testing the expression once more. This continues until the expression is `False`, in which case processing continues with the statement after the `End While`. This happens irrespective of the initial value of the condition, so if the condition is initially `False`, the contents of the loop are never executed.

If you need to stop processing a loop, that is, break out of it in the middle, you can use the `Exit While` statement. For example:

```
While rdr.Read()
  If rdr("ItemCost") < 0 Then
    Exit While
  End If
End While
```

Now on to the `Do` loop, which has two forms, the first of which is where the condition is tested before the contents of the loop are executed. For example:

```
Do While rdr.Read()
  ' loop contents
Loop
```

In this case the `Do` loop is no different from a `While` loop; looping continues while the condition is true. This can be reversed by use of the `Until` statement, where the loop continues until the condition is `true`:

```
Do Until condition
  ' loop contents
Loop
```

Both the `While` and `Do` loops in the form shown test the condition before the loop starts, which means that the code block for the loop might never get executed. To guarantee at least one execution you can use the `Do` loop with the condition at the end:

```
Do
  ' loop contents
Loop While condition
```

Alternatively, you can use the `Until` statement in the place of the `While` statement:

```
Do
  ' loop contents
Loop Until condition
```

Because the condition is not tested until after the loop contents have been executed the first time, this type of loop is not suitable for use with a data reader. For example, you cannot do this:

```
Do
  If rdr("ItemCost") < 0 Then
    Exit While
  End If
Loop While rdr.Read()
```

Though this is perfectly valid, the code will fail unless `Read` has already been called. The reason for this is that when a data reader is first opened it doesn't point at the first record, but rather before it. So the act of calling `Read` moves to the first record. In the preceding code, if no `Read` has been called, the access to `rdr("ItemCost")` will fail because there will not be a valid record.

The For Loop

The `For` loop is useful when the number of iterations is known, and is most often used when counting through numeric values or performing some action a set number of times. For example:

```
Dim counter As Integer
For counter = 1 To 10
  ' loop code
Next
```

Here the `loop code` is executed 10 times. The variable `counter` starts at `1` and is incremented by `1` each time through the loop. The default increment can be changed by using the `Step` statement, as shown in the following code:

```
Dim counter As Integer
For counter = 1 To 10 Step 2
  ' loop code
Next
```

This time the loop is executed five times because `counter` is incremented by `2` each time through the loop. You're not limited to incrementing either, because looping can be done backwards:

```
Dim counter As Integer
For counter = 10 To 1 Step -1
  ' loop code
Next
```

Here the loop starts at `10` and `1` is subtracted from `counter` each time. Like the `While` and `Do` loops, `For` loops can be exited during processing:

```
Dim counter As Integer
For counter = 1 To 10
  ' loop code

  If SomeFunction(counter) Then
    Exit For
  End If

  ' loop code
Next
```

Here if `SomeFunction` returns `True`, the loop is executed directly. Any code below the `Exit For` statement is ignored.

The For Each Loop

The `For Each` loop is used for looping through collections or arrays and has a variety of uses, and unlike the `For` loop you don't need to know in advance the number of times the loop will run. Regardless of what you're looping through the syntax is the same:

```
For Each LoopVariable As Type In Collection
Next
```

The parts of this are as follows:

- `Collection` is the object containing the items to be looped through. It doesn't have to be a collection (from `System.Collections`), but can be an array.
- `LoopVariable` is the name of the variable that will be assigned to each individual entry from `Collection`.
- `Type` is the data type of `LoopVariable`.

For example, consider the following code that loops through a string array:

```
Dim Names() As String = {"Dave", "Dan", "Chris", "Chris", "John"}
Dim AllNames As String

For Each Name As String In Names
  AllNames &= Name & " "
Next
```

This first creates an array of names, plus a variable to hold all of the names concatenated together. When the loop starts, `Name` is assigned to the first entry in the array, `Dave`, and this is appended to the `AllNames` variable. The next time around the loop, `Name` is assigned to the next entry in the array, `Dan`, and so on. When all items in the array have been processed the loop ends.

There is a second form of this loop where the loop variable is declared outside of the loop:

```
Dim Name As String
For Each Name In Names
  AllNames &= Name & " "
Next
```

For the purposes of the loop this is exactly the same as declaring the variable in the loop itself, but it does affect the scope of the variable (more on that in the "Variable Scope and Lifetime" section later in the chapter).

Collections and lists are used a lot in .NET programming, so `For Each` is very useful. In Wrox United `ForEach` is used as part of the shop, when the checkout is reached (this is `Checkout.aspx`). The shop allows you to buy multiple items, and these are put into a shopping cart — this is a custom object called `Cart`, which contains a collection of `CartItem` objects. You'll look at the creation of the shopping cart later, but when you check out, the items in the cart need to be added to the database, and because it is a collection, `For Each` is ideal.

The checkout function won't be discussed in complete detail, but here's what you have:

- A `ShoppingCart` object that contains the cart. This is stored in the `Profile` as `Cart` (the profile is covered in Chapter 11).
- A collection of `CartItem` objects. This is stored as the `Items` property of the `ShoppingCart`.

In order to iterate through the items in the cart you could use the following code:

```
For Each item As CartItem In Profile.Cart.Items
Next
```

Each time through the loop, `item` would contain the actual item from the cart. When the user proceeds to the checkout, here is what you need to do:

- Create an order in the database, adding it into the `Orders` table.
- Loop through the items in the cart and add each item to the `OrderLines` table.

This sounds like a lot of work, and is actually quite a lot of code (around 80 lines or so including comments), but is really simple. It builds on some of the data techniques seen in Chapter 8, and although those aren't covered in detail the code should be familiar. Here's where the actual items from the cart are added to the database:

```
cmd.CommandText = "INSERT INTO OrderLines(OrderID, ProductID, " & _
                                         "Quantity, Price)" & _
                  " VALUES (@OrderID, @ProductID, @Quantity, @Price)"

cmd.Parameters.Add("@OrderID", Data.SqlDbType.Int)
cmd.Parameters.Add("@ProductID", Data.SqlDbType.Int)
cmd.Parameters.Add("@Quantity", Data.SqlDbType.Int)
cmd.Parameters.Add("@Price", Data.SqlDbType.Money)

cmd.Parameters("@OrderID").Value = OrderID

For Each item As CartItem In Profile.Cart.Items
  cmd.Parameters("@ProductID").Value = item.ProductID
  cmd.Parameters("@Quantity").Value = item.Quantity
  cmd.Parameters("@Price").Value = item.Price

  cmd.ExecuteNonQuery()
Next

' clear the cart
Profile.Cart.Items.Clear()
```

The first line simply sets the SQL statement used to insert the items, and the following lines create the parameters and set the `OrderID`. The object `cmd` is a `SqlCommand` object, with an associated connection. Within the loop the details of each `item` are copied to the parameters, and then the query is executed — this happens for each order item, so the SQL statement happens each time. Once all of the items have been added to the database the `Items` collection of the shopping cart is cleared.

Give all of this looping and testing a try by working out how well Wrox United is doing. In the following Try It Out you loop through the fixtures to see how many goals have been scored and how many games have been won, lost, or drawn.

Try It Out Looping and Making Decisions

1. Create a new Web Form called `Decisions.aspx` and set this as the start page. Remember to place the code in a separate file when you create the Web Form.
2. Add six labels and some text, so the page looks like Figure 9-7. You can just type the text directly onto the page, and make sure you add the labels in top to bottom order, so `Label1` is at the top and `Label6` is at the bottom:

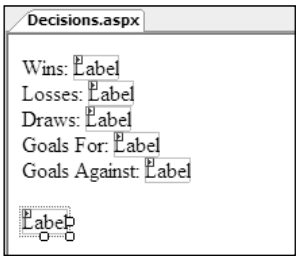


Figure 9-7

3. Create the `Page_Load` event procedure by opening the code file and selecting (Page Events) from the first list and `Page_Load` from the second. In the `Page_Load` event add the following code (remember you can copy if from the finished samples if you don't want to type it all in):

```
Dim conn As New SqlConnection( _
    ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString)
Dim cmd As New SqlCommand("select * from Fixtures", conn)
Dim rdr As SqlDataReader

Dim wins As Integer = 0
Dim losses As Integer = 0
Dim draws As Integer = 0
Dim goalsFor As Integer = 0
Dim goalsAgainst As Integer = 0
Dim winRatio As Integer

conn.Open()
rdr = cmd.ExecuteReader(CommandBehavior.CloseConnection)

While rdr.Read()
  goalsFor += Convert.ToInt32(rdr("GoalsFor"))
  goalsAgainst += Convert.ToInt32(rdr("GoalsAgainst"))

  If goalsFor > goalsAgainst Then
    wins += 1
  ElseIf goalsFor < goalsAgainst Then
    losses += 1
  Else
```

```
      draws += 1
    End If
  End While

  Label1.Text = wins.ToString()
  Label2.Text = losses.ToString()
  Label3.Text = draws.ToString()
  Label4.Text = goalsFor.ToString()
  Label5.Text = goalsAgainst.ToString()

  If losses = 0 Then
    Label6.Text = "No losses - a perfect season."
    Return
  End If

  winRatio = Convert.ToInt32((wins / losses) * 100)

  Select Case winRatio
    Case 0
  Label6.Text = "No wins. Relegation is a certainty."
    Case Is < 25
  Label6.Text = "Less than 25%. Very poor."
    Case Is < 50
  Label6.Text = "Under half. Could do better."
    Case Is < 75
  Label6.Text = "Winning more than losing. Excellent."
    Case Else
  Label6.Text = "A high ratio - near the top of the table."
  End Select
```

4. At the top of the code file add the following two `Imports` statements (don't worry about what these are — they are covered later in the "Namespaces" section):

```
Imports System.Data
Imports System.Data.SqlClient
```

5. Save the files and run the page to see Figure 9-8.

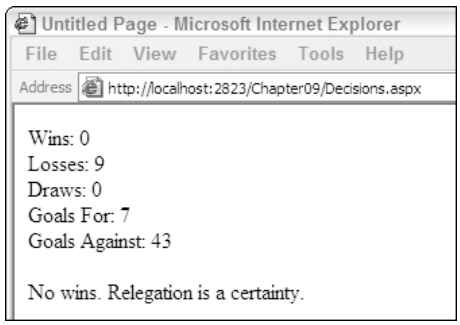


Figure 9-8

The output isn't spectacular, but it's the code that's interesting, so let's see how it works.

How It Works

First you have the variable declarations, starting with a connection to the database, a command to fetch the fixtures, and a reader to iterate through the fixtures:

```
Dim conn As New SqlConnection( _
  ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString)
Dim cmd As New SqlCommand("select * from Fixtures", conn)
Dim rdr As SqlDataReader
```

Next you have the variables to hold the counts of the wins, losses, draws, goals scored, and the win ratio:

```
Dim wins As Integer = 0
Dim losses As Integer = 0
Dim draws As Integer = 0
Dim goalsFor As Integer = 0
Dim goalsAgainst As Integer = 0
Dim winRatio As Integer
```

Once the variables are declared the database is opened and the data fetched:

```
conn.Open()
rdr = cmd.ExecuteReader(CommandBehavior.CloseConnection)
```

With the data reader full of data, the loop is started; the `Read` method returns a Boolean value of `False` when it has read the last record. This will continue until there are no more records:

```
While rdr.Read()
```

Within the loop the totals are incremented, the values from the reader being converted into integers before being used to increment the totals:

```
  goalsFor += Convert.ToInt32(rdr("GoalsFor"))
  goalsAgainst += Convert.ToInt32(rdr("GoalsAgainst"))
```

Now comes the first decision, incrementing the number of wins, losses, and draws:

```
  If goalsFor > goalsAgainst Then
    wins += 1
  ElseIf goalsFor < goalsAgainst Then
    losses += 1
  Else
    draws += 1
  End If
End While
```

Once the loop has finished, the totals can be displayed in the labels:

```
Label1.Text = wins.ToString()
Label2.Text = losses.ToString()
Label3.Text = draws.ToString()
Label4.Text = goalsFor.ToString()
Label5.Text = goalsAgainst.ToString()
```

The ratio of wins to losses needs to be counted next (despite the fact that given the team's performance you can almost assume this will be zero!). However, before you do the calculation you need to ensure that the number of losses isn't zero, otherwise a division by zero exception would occur. So if the number of losses is zero, a message is displayed and `Return` forces the `Page_Load` event handler to exit:

```
If losses = 0 Then
  Label6.Text = "No losses - a perfect season."
  Return
End If
```

If the team has lost at least one match, the ratio is calculated:

```
winRatio = Convert.ToInt32((wins / losses) * 100)
```

Now the message can be displayed depending on the win ratio. Remember that the `Case` statements are tried in the order in which they are declared, so the `Case Else` will match a win ratio of higher than 75%:

```
Select Case winRatio
  Case 0
Label6.Text = "No wins. Relegation is a certainty."
  Case Is < 25
Label6.Text = "Less than 25%. Very poor."
  Case Is < 50
Label6.Text = "Under half. Could do better."
  Case Is < 75
Label6.Text = "Winning more than losing. Excellent."
  Case Else
Label6.Text = "A high ratio - near the top of the table."
End Select
```

All of these statements, the loops and decisions, are fairly simple on their own, but together they show you the power of what code can do. You can build up functionality with more and more statements, as the complexity of your applications requires.

The next section introduces the topic of namespaces, a fundamental way in which code can be arranged.

Namespaces

Namespaces are simply a way to logically group related code, and a *namespace* is simply a name, and that name can include periods to provide grouping. For example, the namespace for the data handling code of ADO.NET is in `System.Data`, whereas the SQL Server-specific code is in `System.Data.SqlClient`. All of the data types are in the `System` namespace. Namespaces can also be created for your own code, so for the Wrox United code the namespace is `Wrox.Web` — this is defined in the classes within the `App_Code` directory.

Namespaces are important for several reasons:

- Grouping related code means it's easier to find related items. For example, if you want to find all of the data handling code you know it's located within the `System.Data` namespaces. This can be useful when using the documentation.

- Namespaces provide more readable code, because if the namespace is known then only the data type is required to define a variable. For example, consider declaring a `SqlConnection` object without having the namespace known to the program:

```
Dim conn As System.Data.SqlClient.SqlConnection()
```

  This is more typing as well as being hard to read. However, with the namespace known this can be reduced to:

```
Dim conn As SqlConnection()
```

- Namespaces allow both the compiler and IntelliSense to find the variable types.

To use a namespace you use the `Imports` statement:

```
Imports System.Data
Imports System.Data.SqlClient
```

You can test to see if this is working by taking these lines out of the Decisions sample. See what happens in the code editor; IntelliSense squiggles indicate a problem, and you get a compiler error if you try to run the page.

Within your code you can declare namespaces by use of the `Namespace` statement — you place this around your classes. For example:

```
Namespace Wrox.Web
  ' class goes here
End Namespace
```

You can use the same namespace in multiple files, so you can split your code into physical files (a file for each class is a good idea), while the namespace spans those classes — the namespace is logical and not physical.

Now that you know how code works and how it can be organized, you can move on to the subject of classes, a topic that underlies the whole of .NET.

Working with Classes

Object orientation sounds complex and scary, one of those things people tell you that you have to master before you become a "'proper programmer." Ignore them; there's no such thing as a "proper programmer." It's a term that doesn't really mean anything. Object orientation is worth learning though, and it will make you a better programmer; everyone can be a better programmer, and this is just one step along the ladder. It's important not to worry about this topic, because object orientation is actually quite simple. It can get complex, but at the basic level it's easy to get into and doesn't require a degree in rocket science (unless you work at NASA, in which case knowledge of astrophysics might be useful).

Throughout the book you've already seen plenty of objects. In fact everything you've seen has been an object: the ASP.NET controls are objects, data access is done via objects, ASP.NET pages are objects, even the data types are objects. This is one of the underpinnings of .NET — everything is an object. By defining a few terms you'll see how these fit in with the existing objects and new objects you create.

First is the difference between objects, classes, and instances. A *class* is a template for an object; it defines what the object will be able to do — think of it as a cookie cutter, defining the shape of the cookie. An *object* or *instance* is a class that's been created — it's the actual cookie, once freed from the cutter. Let's look at these terms with an example, perhaps the `SqlConnection`:

```
Dim conn As SqlConnection
```

This defines the variable `conn` as being of type `SqlConnection`. As it stands, however, this isn't usable, because it just defines the type of object — the object doesn't yet exist. You've only defined the shape of the cookie cutter, and haven't actually cut the cookie. To create the cookie you create an instance of the object:

```
conn = New SqlConnection
```

This can also be done at declaration time:

```
Dim conn As New SqlConnection
```

Use of the `New` keyword creates the instance, and once created the object becomes usable.

The *properties* of a class define the characteristics of that class. For example, the `SqlConnection` object has a property called `ConnectionString`, which defines the details of the database being connected to. Another property is `State`, which indicates what state the connection is in (open, closed, and so on):

```
If conn.State = ConnectionState.Open Then
  ' The connection is open
End If
```

The *methods* of a class define the actions that can be performed, so for the `SqlConnection` you can `Open` or `Close` it:

```
conn.Open()
```

The *events* of a class provide the user of the class with information about the status. For example, the `SqlConnection` has two useful events, `InfoMessage` and `StateChange`. The first is *raised* (or *fired*) when SQL Server returns a warning or some informational message, and the second is raised when the `State` is changed — when the connection is closed, for example.

Creating Classes

You can create classes in ASP.NET pages, but if you are creating the class for a special purpose it's best to use a separate file and location. The best place for these is in the `App_Code` directory, a special directory into which class files can be put. Using this directory allows you to keep your class files together, as well as having them automatically compiled by ASP.NET. You'll look at creating this later, but for now look at the structure of a class. The syntax is as follows:

```
[Accessor] Class ClassName

End Class
```

The `ClassName` can be anything you want, but like variable naming it's best to use something sensible. For example, the shopping cart item is a class called `CartItem`, and the cart itself is called `ShoppingCart`.

The `Accessor` defines the accessibility of the class; that is where the class can be seen from. This can be one of the values detailed in the following table:

Accessor	Description
`Public`	No access restrictions.
`Private`	The class is only accessible from within its declaration context.
`Protected`	The class is only accessible from within its own class or derived classes.
`Friend`	The class is only accessible from within the assembly that contains it.
`Protected Friend`	The class is only accessible from within its own class, a derived class, or its containing assembly.

It's best not to worry too much about these for the moment. As a general rule, if you create a class that's going to be used in ASP.NET pages you should use `Public`. So the shopping cart becomes:

```
Public Class ShoppingCart
End Class
```

Constructors

The *constructor* is a special method that runs when the class is instantiated, and it allows you to set the initial state of the class when it's created. The constructor is always called `New`. For example, the shopping cart with the constructor is highlighted in the following code:

```
Public Class ShoppingCart

  Private _dateCreated As DateTime
  Private _items As List(Of CartItem)

  Public Sub New()
    _items = New List(Of CartItem)
    _dateCreated = DateTime.Now
  End Sub

End Class
```

What this constructor does is create another object — a new `List` of `CartItem` objects. This is what the cart items are stored in — it's a collection of `CartItem` objects (this is covered in more detail in the "Generics" section). Once that's created, the initial creation date is set. You could use this `ShoppingCart` class like so:

```
Dim cart As New ShoppingCart()
```

This would create a new instance, and you'd know that the items collection had also been created, ready for you to add items.

The `CartItem` class shows another aspect of constructors — overloading:

```
Public Class CartItem

  Private _productID As Integer
  Private _productName As String
  Private _productImageUrl As String
  Private _quantity As Integer
  Private _price As Double
  Private _lineTotal As Double

  Public Sub New()
  End Sub

  Public Sub New(ByVal ProductID As Integer, ByVal ProductName As String, _
                 ByVal ProductImageUrl As String, _
                 ByVal Quantity As Integer, ByVal Price As Double)

    _productID = ProductID
    _productName = ProductName
    _productImageUrl = ProductImageUrl
    _quantity = Quantity
    _price = Price
    _lineTotal = Quantity * Price

  End Sub
End Class
```

Here there are two constructors. The first, with no parameters, does nothing, and the second accepts parameters containing the details for an item being bought. Don't worry too much about the specific syntax of the parameters; you'll look at that in detail when you look at methods. The important point to note is that the constructor is overloaded — that is, there are two of them. You can have overloaded constructors (and methods) as long as the *signature* differs. A signature is what defines the uniqueness of a constructor or method — this includes its name, its return type, and the type and order of the parameters. Because these two constructors have different signatures, they are both allowed.

Having two constructors means the class can be created in two ways. Either with this:

```
Dim item As New CartItem()
```

Or with this:

```
Dim item As New CartItem(1, "Scarf", "images\scarf.jpg", 1, 4.95)
```

The first constructor creates an empty cart item, ready for you to fill in the details, whereas the second constructor creates a cart item with the details already filled in. These details are passed in as parameters within the parentheses and these get mapped to the parameters declared in the `New` method.

Properties

Properties are used to control the characteristics of a class, or to expose to users of the class some internal values. For example, consider the `CartItem` class; if the first constructor is used, how would the details of the item being bought be set? The variables can't be accessed directly because they are `Private`, so

they can't be seen outside of the class. Properties are the answer, and these would be created in the following manner:

```
Public Class CartItem

  Private _productID As Integer
  Private _productName As String
  Private _productImageUrl As String
  Private _quantity As Integer
  Private _price As Double
  Private _lineTotal As Double

  Public Property ProductID() As Integer
    Get
      Return _ProductID
    End Get
    Set (ByVal value As Integer)
      _productID = value
    End Set
  End Property

End Class
```

Let's break this down and look at the parts. First you have the definition of the property itself, by use of `Public Property` — the `Public` means it's going to be accessible outside of the class, which is exactly what you want. In fact it's the reason for creating the property in the first place, to make the internal variable accessible. You then specify the name of the property and the data type:

```
Public Property ProductID() As Integer
```

Next comes the bit allowing read access to the property — the `Get . . . End Get` (often called the *getter*), which simply returns the value of the internal private variable:

```
  Get
    Return _ProductID
  End Get
```

Next is the bit that allows the value to be written to — between the `Set . . . End Set`. The `Set` (or *setter* as it's sometimes called) has a parameter that is of the same type as the property — an `Integer` in this case. This value is used to set the value of the internal variable:

```
  Set (ByVal value As Integer)
    _productID = value
  End Set
End Property
```

This form is the same for all properties, with only the name and data type changing. For example, a property for the product name would be:

```
Public Property ProductName() As String
  Get
    Return _Productname
```

```
    End Get
    Set (ByVal value As String)
      _productName = value
    End Set
  End Property
```

With these two properties in place, the `CartItem` could be used like so:

```
Dim item As New CartItem()

item.ProductID = 1
item.ProductName = "The WroxUnited Scarf"
```

That would create the class and set the properties. When setting a property value the setter part of the property is called, and the value to be set (`1` in this case of the `ProductID`) is passed into the setter as the variable `value`.

To read from the properties you could do the following:

```
IDTextBox.Text = item.ProductID.ToString()
NameTextBox.Text = item.ProductName
```

The first line reads from the property, converting to a string, because the `Text` property of the `TextBox` is a `String` type. When the property is accessed, the getter is called, which simply returns the value from the internal variable. For the `ProductID` that is an `Integer`, but the `ProductName` property is a `String` so no conversion is required.

Read-Only Properties

If you only want to provide read-only access to a property, and not allow the user of the class to update the property, you can make it read-only, like so:

```
  Public ReadOnly Property ProductID() As Integer
    Get
      Return _ProductID
    End Get
  End Property
```

Here another keyword has been added — `ReadOnly`, and only the getter section of the property is included. Now the value cannot be set. This is exactly what the `LineTotal` property of the `CartItem` does:

```
  Public ReadOnly Property LineTotal() As Double
    Get
      Return _quantity * _price
    End Get
  End Property
```

Here you can see that you don't even have a `Private` variable. The value returned is simply a calculation.

Because the property is read-only, the value cannot be set, and trying to do so will generate a compile error.

Write-Only Properties

Making a property write-only follows a similar procedure to the read-only, except for a different keyword and the inclusion of only the setter:

```
Public WriteOnly Property ProductID() As Integer
  Set (ByVal value As Integer)
    _productID = value
  End Set
End Property
```

Here the keyword is `WriteOnly`. With this definition, trying to read from the property would result in a compile error.

Properties Versus Public Variables

While you've been reading the text on properties you might have been wondering why you have them, why not just make the internal variables public? Well, you could easily do this:

```
Public Class CartItem

  Public ProductID As Integer
  Public ProductName As String
  Public ProductImageUrl As String
  Public Quantity As Integer
  Public Price As Double
  Public LineTotal As Double

End Class
```

This would work, but is not a good idea because it breaks one of the rules of object orientation—*abstraction* (there are other rules of object orientation, but they aren't pertinent to this particular topic). This means that you should abstract functionality, thus hiding the inner workings of the class. The reason for working this way is that it allows you to change how the class works internally without changing how it's used. For example, consider the `LineTotal`, which is the `Quantity` multiplied by the `Price`. You have to have some way of calculating the total, and if you use a `Public` variable then where do you put the calculation? It could be done in the constructor, but what about the blank constructor that just creates an empty item? Would you have the user of the class calculate the total, or provide some other function to do it? Neither are good solutions.

Abstraction simply means that you are providing a simple, guaranteed way to access the functionality of the class, and that the user doesn't have to know about how the class works. You're using properties to hide the internal storage—those private variables are the internal storage and the properties are just a way for users of the class to access the internal variables.

Abstracting the internal storage with properties allows you to handle the problem of a line total, because the property accessor does the calculation for you. In fact, using this type of abstraction means you could store the internal state of the `CartItem` in any way you pleased, without having to change the code that uses `CartItem`.

There are no strict rules on naming for the private variables that actually store the property values, but an underscore as a prefix is commonly used, as well as a different case. So your property would be `LineTotal`, and the internal private variable is `_lineTotal`.

Methods

Methods are the actions of a class, what you use to get the class to perform a task. The `CartItem` class is purely for storage, has no actions, and therefore contains no methods (although technically the constructor is a method). The shopping cart, however, contains methods, because you need to do things like insert, update, and delete items.

Methods fall into two types: those that return a value (a `Function`) and those that don't (a `Sub`). The `Function` is useful for performing an action and then returning some result, perhaps whether or not the action succeeded. The `Sub` is useful when you don't need a value from the action.

The syntax for a `Function` is as follows:

```
[Accessor] Function FunctionName([parameters]) As DataType
  Return value
End Function
```

For a `Sub` the syntax is as follows:

```
[Accessor] Sub FunctionName([parameters])
End Sub
```

You can see that they are broadly similar. Like classes, the `Accessor` defines the visibility of the method. Use `Public` for methods that are visible from everywhere, and use `Private` for a method that is only used by the class. Both `Sub`s and `Function`s accept an optional parameter list, much like constructors — you'll look at the ins and outs of parameters in more detail soon.

The difference between the two method types is the returning of a value. The `Function` defines a data type, which is the type of the value being returned, and this is done with the `Return` statement. Let's use the shopping cart and examine the methods, starting with deleting items, because that's the simplest:

```
Public Sub DeleteItem(ByVal rowID As Integer)

  _items.RemoveAt(rowID)
  _lastUpdate = DateTime.Now

End Sub
```

Here the `Sub` takes a single parameter — the index of the row to be deleted. This index is then passed into the `RemoveAt` method of the `_items` collection, which is the collection that stores the cart items. When the item has been removed, the last update time is set. The method could be called like so:

```
Profile.Cart.DeleteItem(2)
```

This would remove the third row — remember that arrays and collections start at 0.

Inserting items into the cart is done with the `Insert` method:

```
Public Sub Insert(ByVal ProductID As Integer, ByVal Price As Double, _
                  ByVal Quantity As Integer, ByVal ProductName As String, _
```

```
                    ByVal ProductImageUrl As String)

    Dim NewItem As New CartItem()

    NewItem.ProductID = ProductID
    NewItem.Quantity = Quantity
    NewItem.Price = Price
    NewItem.ProductName = ProductName
    NewItem.ProductImageUrl = ProductImageUrl

    _items.Add(NewItem)
    _lastUpdate = DateTime.Now()

  End Sub
```

This routine accepts five parameters, one for each part of the item (the ID, the price, and so on). Within the routine, a new `CartItem` is created, and the properties are set to the values of the parameters. Once all of the parameters are set the item is added to the `_items` collection and the time is updated.

One problem with the `Insert` method is that it could be called multiple times for the same product; this would result in multiple items in the cart. It would be more sensible to see if the item is already in the cart, and if so simply add one to the quantity. To do this you need to search through the collection looking for an item with the same `ProductID`, so a function has been created to do this:

```
  Private Function ItemIndexOfID(ByVal ProductID As Integer) As Integer

    Dim index As Integer

    For Each item As CartItem In _items
      If item.ProductID = ProductID Then
        Return index
      End If
      index += 1
    Next

    Return -1

  End Function
```

Here the function accepts the `ProductID` as a parameter and returns an `Integer`. Within the function the `_items` collection is looped and if the `ProductID` of an item matches the supplied `ProductID`, the `Return` statement is used to return the index. If the loop ends without having found a match, `-1` is returned. Notice that this function is marked as `Private`; that's because it's not going to be used from outside the class.

The `Insert` method can now be changed to the following:

```
  Public Sub Insert(ByVal ProductID As Integer, ByVal Price As Double, _
                    ByVal Quantity As Integer, ByVal ProductName As String, _
                    ByVal ProductImageUrl As String)

    Dim ItemIndex As Integer = ItemIndexOfID(ProductID)

    If ItemIndex = -1 Then
      Dim NewItem As New CartItem()
```

```
      NewItem.ProductID = ProductID
      NewItem.Quantity = Quantity
      NewItem.Price = Price
      NewItem.ProductName = ProductName
      NewItem.ProductImageUrl = ProductImageUrl

      _items.Add(NewItem)
    Else
      _items(ItemIndex).Quantity += 1
    End If

    _lastUpdate = DateTime.Now()

  End Sub
```

The method still accepts the same parameters, but the first thing it does is call the private `ItemIndexOfID` to get the index number of the current product. If the index is `-1`, then it didn't already exist in the collection and is added. If it does exist, the `Quantity` is increased.

Shared Methods and Properties

With classes you've seen that you have to create an instance of them before they can be used. For certain classes this can be an overhead that's not really required. For example, consider a class called `Utils` that provides a range of utility methods, one of which is `Log`, to log exceptions:

```
Public Class Utils
  Public Sub Log(ErrorMessage As String)
    ' log the error
  End Sub
End Class
```

You could use this like so:

```
Dim u As New Utils
u.Log("An exception occurred")
```

The object instance exists only for the purpose of calling the `Log` method; there are no properties to set, so it seems a bit of a waste to have to create the instance, especially if it's going to be used only once. To get around this you can create shared class members (sometimes called *static* members). For example:

```
Public Class Utils
  Public Shared Sub Log(ErrorMessage As String)
    ' log the error
  End Sub
End Class
```

The introduction of the `Shared` keyword means that a class instance is no longer required, allowing the method to be called like so:

```
Utils.Log("An exception occurred")
```

When dealing with utility classes, shared methods are extremely useful, and you'll see how the logging features can be implemented in Chapter 15.

Inheritance

Inheritance is another of the key features of objected-oriented software, and works just like real life, where we inherit properties and behavior from our parents. Inheritance can get quite complex, so this section just covers the basics to give you an understanding of what it is and how it works, especially as it's used in all code-behind files. The essentials of inheritance are that one class (the base class) can be inherited by another (the sub-class), in which case the sub-class automatically has the same methods and properties as the base class. But the sub-class can change the behavior if it needs to, or add to it.

ASP.NET uses inheritance as part of its standard programming model, and you have probably already seen this in action. For example, consider a `Default.aspx` Web Form, which would have the following in it:

```
<%@ Page Language="VB" CodeFile="Default.aspx.vb" Inherits="_Default" %>
```

Here you can see the `Inherits` keyword being used, telling you that when the Web Form is compiled it should inherit its features from the class `_Default`. This class is in the code-behind file:

```
Partial Class _Default
  Inherits System.Web.UI.Page

  . . .
End Class
```

This class in turn inherits from `System.Web.UI.Page`, which is the class that provides all of the base functionality for ASP.NET pages. One thing to notice is the `Partial` keyword, which tells the compiler that this class is split across multiple files — the Web Form and the code-behind file.

The following Try It Out uses some simple (and rather contrived) examples to show how inheritance works.

Try It Out — Classes and Inheritance

1. Create a new class in the `App_Code` directory called `Vehicles.vb`. If the `App_Code` directory doesn't exist you can create this directory by selecting the top item in the Solution Explorer and using the right mouse button to select Add ASP.NET Folder and then App_Code Folder, as shown in Figure 9-9.
2. Delete the template class created, and create a new one called `Vehicle`, which has properties called `Wheels` and `TopSpeed`, and a method called `Warning`:

```
Public Class Vehicle

  Protected _wheels As Integer
  Protected _topSpeed As Integer
  Protected _warningSound As String

  Public Property Wheels() As Integer
    Get
      Return _wheels
    End Get
    Set(ByVal value As Integer)
      _wheels = value
```

```
    End Set
  End Property

  Public Property TopSpeed() As Integer
    Get
      Return _topSpeed
    End Get
    Set(ByVal value As Integer)
      _topSpeed = value
    End Set
  End Property

  Public Overridable Function Warning() As String
    Return _warningSound
  End Function

End Class
```

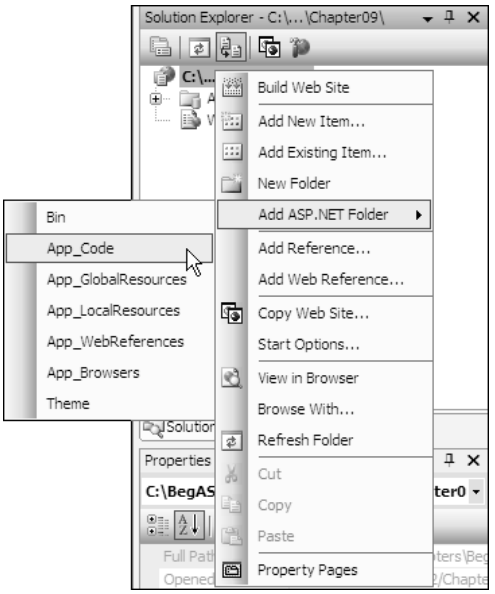


Figure 9-9

3. After that create another class, in the same file, called `Car`:

```
Public Class Car
  Inherits Vehicle

  Public Sub New()
    _wheels = 4
    _topSpeed = 150
    _warningSound = "Honk"
  End Sub

End Class
```

4. And now another class called `Bike`:

```
Public Class Bike
  Inherits Vehicle

  Public Sub New()
    Wheels = 2
    MyBase.TopSpeed = 30
    _warningSound = "Ring Ring"
  End Sub

End Class
```

5. And another class called `Skateboard`:

```
Public Class Skateboard
  Inherits Vehicle

  Public Sub New()
    _wheels = 4
    _topSpeed = 15
  End Sub

End Class
```

Between the `End Sub` and `End Class`, type the following:

```
Public Overrides
```

Now press the space bar to see that a little helper tip pops up (see Figure 9-10).

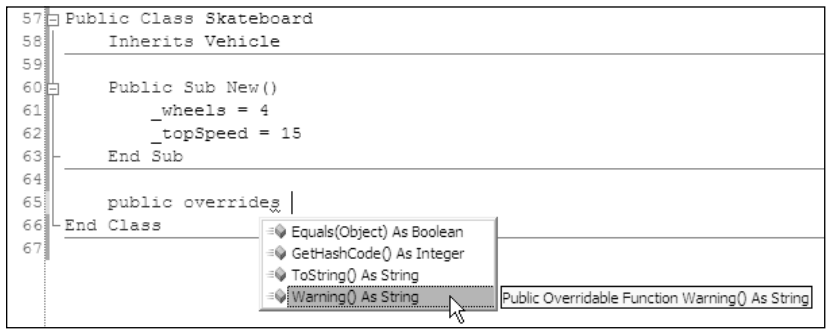


Figure 9-10

6. Select the `Warning() As String` entry (you can ignore the others) and press Return. See how the function is created for you. Delete the existing return line and add a new one:

```
Public Overrides Function Warning() As String
  Return "No warning - you'll have to shout yourself"
End Function
```

7. Save and close the class file.

8. Create a new Web Form called `Inheritance.aspx`. Add three buttons and three labels, so it looks like Figure 9-11. Make sure the `Label` next to `Wheels` is `Label1`, the `Label` next to `Speed` is `Label2`, and the `Label` next to `Warning` is `Label3`. You can use the `Text` property of the buttons to change the text shown on them.

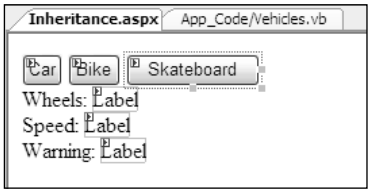


Figure 9-11

9. Create event handlers for the `Click` event for the three buttons. For the `Car` button:

```
Public Sub Button1_Click(ByVal Sender As Object, _
                         ByVal e As Sytem.EventArgs) Handles Button1.Click

    Dim MyTransport As New Car()
    Label1.Text = MyTransport.Wheels.ToString()
    Label2.Text = MyTransport.TopSpeed.ToString()
    Label3.Text = MyTransport.Warning()

End Sub
```

10. For the `Bike` button:

```
Public Sub Button2_Click(ByVal Sender As Object, _
                         ByVal e As Sytem.EventArgs) Handles Button1.Click

    Dim MyTransport As New Bike()
    Label1.Text = MyTransport.Wheels.ToString()
    Label2.Text = MyTransport.TopSpeed.ToString()
    Label3.Text = MyTransport.Warning()

End Sub
```

11. For the `Skateboard` button:

```
Public Sub Button3_Click(ByVal Sender As Object, _
                         ByVal e As Sytem.EventArgs) Handles Button1.Click

    Dim MyTransport As New Skateboard()
    Label1.Text = MyTransport.Wheels.ToString()
    Label2.Text = MyTransport.TopSpeed.ToString()
    Label3.Text = MyTransport.Warning()

End Sub
```

12. In the Solution Explorer right-click `Inheritance.aspx`, and from the menu select Set As Start Page.

13. Press F5 to run the page. Click the three buttons and notice what is displayed in the labels.

How It Works

To see how this works you'll start with the `Vehicle` class. This is much as you've seen before, but with a few subtle differences. One of the private variables, `_warningSound`, is not set anywhere — don't worry about that, it's deliberate, and will be used in other classes. Also the private variables are declared as `Protected`, meaning that other classes in the same file will be able to access them. This class will be the base class — the class that other classes inherit from. The other difference is that the `Warning` method has a new keyword on it — `Overridable`:

```
Public Overridable Function Warning() As String
  Return _warningSound
End Function
```

This means that inheriting classes can override this method and provide their own implementation. So let's look at the inheriting classes, starting with the `Car`:

```
Public Class Car
  Inherits Vehicle

  Public Sub New()
    _wheels = 4
    _topSpeed = 150
    _warningSound = "Honk"
  End Sub

End Class
```

This defines a new class but in the line after the class name it specifies the class to be inherited from. This means the `Car` automatically has the properties and methods that the base class has. The base class hasn't set any values so the car has a constructor to do this, which uses the private variables declared by the base class. It can access those variables because they've been declared as `Protected`.

The `Bike` class is slightly different:

```
Public Class Bike
  Inherits Vehicle

  Public Sub New()
    Wheels = 2
    MyBase.TopSpeed = 30
    _warningSound = "Ring Ring"
  End Sub

End Class
```

The way it inherits is the same, but setting the properties is different. For the number of wheels, instead of using the private variable of the base class, the property of the class is used. Even though the current class doesn't define the `Wheels` property itself, it does have a `Wheels` property because it is inherited from the base class. For the top speed the property of the base class is called directly; the keyword `MyBase` refers to the base class. There is no property for the warning sound so the private variable is used directly.

All of these methods are acceptable, and you'll see all three used in various pieces of documentation, books, or online tutorials. In general it's best to use the properties, because that fits with the object-oriented principles talked about earlier.

The `Skateboard` class is different again:

```
Public Class Skateboard
  Inherits Vehicle

  Public Sub New()
    _wheels = 4
    _topSpeed = 15
  End Sub

  Public Overrides Function Warning() As String
    Return "No Warning - you'll have to shout yourself!"
  End Function

End Class
```

The constructor sets the values for wheels and top speed, but not the warning message. The big difference is that the `Warning` property is overridden, meaning that instead of using the `Warning` method from the base class, the `Skateboard` class is defining its own `Warning` method. This is called *polymorphism*, and allows different classes to have the same methods and properties but with different behavior.

Using these classes is simple:

```
Dim MyTransport As New Car()
Label1.Text = MyTransport.Wheels.ToString()
Label2.Text = MyTransport.TopSpeed.ToString()
Label3.Text = MyTransport.Warning()
```

This simply creates the new class and accesses the properties and the methods. Whatever the class type created you can see that the same properties and methods are available. Even though these classes don't define the properties themselves, inheritance means they have the properties. The same applies to the methods, where the `Car` and `Bike` don't define the methods, but the `Skateboard` does, overriding the existing implementation and providing its own.

Variable Scope and Lifetime

Although a topic related to variables, the discussion of scope and lifetime has been left until now because it affects all of the other topics you've learned about. The term *scope* means the degree to which a variable is accessible to other code, and the scope affects the lifetime. You've seen how `Private` and `Public` affect the visibility of methods and properties, but may not realize that visibility of variables depends on where they are declared. To make this easier, take a look at some code:

```
Public Class Class1
  Private _variable1 As Integer

  Private Sub Method1()
```

```
      Dim variable2 As Integer

      _variable1 = 1
      variable2 = 3
    End Sub

    Private Sub Method2()
      _variable1 = 2
    End Sub
  End Class
```

The variable `_variable1` is declared within the class, outside of any methods, so it can be accessed from any methods and properties. On the other hand, `variable2` is declared within the method `Method1`, so it can only be accessed within `Method1` — no other methods or properties would be able to use it. This is termed a *local variable*.

The same rules apply to variables declared within code blocks. For example:

```
Dim number1 As Integer
If number1 = 15 Then
  Dim number2 As Integer
  number2 = number1 + 15
End If
```

Here `number1` is declared outside of the `If Then` block, and can therefore be used within it. But `number2` is declared within the code block, so it cannot be used outside of the code block. The same rules apply to other code blocks such as loops.

The `For Each` loop also has this:

```
For Each item As CartItem in Cart.Items
Next
```

The variable item is declared within the statement itself, but follows the same rule — it can only be accessed from within the loop. Trying to access it outside of the loop would generate a compile error.

Generics

Generics refers to classes and methods that work uniformly on values of different types. Generics are often discussed as an advanced topic, and though some of it is advanced, some of it is simple and easy to use. In fact, one feature of generics is used in the shopping cart. Remember how the cart consists of two classes: the `CartItem` and the `ShoppingCart`, which uses the `CartItem` as a collection.

Many of the collections discussed early in the chapter provide storage for objects — the `Object` being a type. Because they are designed to work with a data type of `Object`, collections can in fact store any data type. However, when you take items out of a collection they often need to be converted from the `Object` data type to their native data type. This involves extra coding and reduces performance. Another problem is because collections can store any data type it means you can store any data type in them. If

you had a collection to store the `CartItem` objects you could in fact store strings, numbers, dates, and so forth in the same collection. For example you could do this:

```
Dim _items As New List()
Dim item As New CartItem( . . .)

_items.Add(item)
_items.Add("this isn't a cart item")
_items.Add("65")
```

When taking items out of the collection you'd have no idea what data type it was unless you tracked which objects you put into the list.

To get around this problem you use generics, or more specifically generic collections. These are stored in the `System.Collections.Generic` namespace, and the one the shopping cart uses is the `List`:

```
Private _items As List(Of CartItem)
```

This simply states that `_items` is a `List`, but a list only of `CartItem` objects. So now you do this:

```
Dim _items As New List(Of CartItem)
Dim item As New CartItem( . . .)

_items.Add(item)
```

But because the list is of a specific data type you can't do this:

```
_items.Add("this isn't a cart item")
_items.Add("65")
```

Both of these lines would generate compile time errors. Whenever you need a collection of custom classes, it's always a good idea to use generic collections, because they improve the readability of your code, reduce the potential for errors, as well as provide performance improvements over the standard collections.

Summary

This chapter has covered a lot of ground, but it was necessary. Although the rich controls in ASP.NET 2.0 provide a way to create web applications with less code than previous versions, you can't get away without coding completely. So you've learned the fundamentals of coding and what you need to control your program. Specifically, this chapter covered the following topics:

- Variables and data types, and how to work with the different data types, seeing that data types have different features. You also looked at arrays and collections, as a way of storing groups of variables.
- The control of programs is by way of decisions and loops, which use expressions and operators as part of the decision process. You saw how there are different ways to perform both decisions and loops, depending on the requirements.

- You then looked at classes, and how they have constructors, properties, and methods. This chapter didn't look at events explicitly, but like the controls you use on Web Forms, custom classes can have them if required.
- Finally, you took a brief look at generics, and saw how they help produce type-safe code and improve code readability and performance.

The next chapter examines componentization, and discusses the use of code-behind files and standalone classes from the design and structure perspective rather than what the code actually means.

Exercises

1. Create a class and shared method (called `DeliveryDate`) to calculate delivery date given the date of an order. All deliveries should be made within three days of the order.
2. Continuing from Exercise 1, modify the `DeliveryDate` method to take into account that deliveries do not happen on the weekend.
3. Modify the `DeliveryDate` method to take into account that an order takes three working days to process. So orders falling on a Thursday will be delivered on the following Monday, and orders from Friday will be delivered on the following Tuesday.
4. For each of the following Boolean expressions, say for what integer values of `A` each of them will evaluate to `True` and when they will evaluate to `False`:
   a. NOT A=0
   b. A > 0 OR A < 5
   c. NOT A > 0 OR A < 5
   d. A > 1 AND A < 5 OR A > 7 AND A < 10
   e. A < 10 OR A > 12 AND NOT A > 20

10

Componentization

Programming has been through several distinct phases in its history and has moved a long way from its humble beginnings where punch-cards dashed with holes were placed into mechanical readers. Early programs on PCs were often just sequential lines of Do A, Do B, Do C kinds of commands. If you wanted to repeat a section of the code, you were left with the option of going Do A, Do A, and Do A or encasing it in a loop and telling the PC to Do A 20 times. This quickly made code repetitive and unwieldy. Worse than that, it made it hard to follow, even for the people who had written it. To follow the flow from the beginning of a program to the end was as difficult as following the path of one thread of spaghetti on a plate in a mound of food. In fact, it became commonly known as spaghetti-coding!

Over the past 20 years there has been a move away from this kind of coding to a more object-based approach. This is where you break down the design of an application into a series of objects, and then any time you require an object, you just call it whenever you need it. This process is known as *componentization*. This is the creation of small objects, or components, that are self-contained parcels of code that have specific functions and are only called by the main application when needed. You looked at objects in Chapter 9 and saw how they could be mapped onto real-life counterparts to make coding less abstract. However, objects didn't totally solve the problems with spaghetti-coding.

Classic ASP suffered from this malaise as well, and despite having a whole series of objects such as `Response`, `Request`, and `Server`, and also allowing users to create their own objects, ASP pages are still a nightmare to debug and follow if they get too big. In fact, three main problems can be highlighted, the first being that HTML code and ASP code tended to be dumped in the same page together, despite having completely different purposes. HTML manages the structure of the page, whereas ASP is concerned with what the page does. The second problem is that with any kind of data handling in a page, there are two different purposes being dealt with, the connecting to and management of data stores, and the reading and writing of the data itself to a data source. The third problem is that of code-reuse, how users could easily create portable objects that could be called from within the code over and over, and how they could end up reducing the amount of code needed.

With ASP.NET 1.x these problems were partially addressed; however, the solutions weren't perfect. ASP.NET 2.0 delivers the most comprehensive set of solutions to these problems; indeed, at the design previews the ASP.NET development team openly boasted that ASP.NET 2.0 meant a 70% reduction of code in your pages. This chapter looks at the following topics:

- Separation of code and content
- Code-behind
- Data layers
- User controls

You've already looked at a lot of the new controls that are designed for every aspect of a web site, but now you're going to dig behind the scenes and see how ASP.NET 2.0 also makes life easier for the developer with separation of code from content, data layers, and user controls.

The Separation of Code from Content

The funny thing with most text books that you pick up about a new technology is that they'll quite happily tell you what was wrong with the old one, but not a lot about shortcomings in the new. Time and time again you'll probably come across a variation on the same theme: the code of the page should be separated from the style and design of the page. It happened in HTML, it happened in classic ASP, and it still happened to some extent in ASP.NET 1.x, although with a little care and effort it was possible to eliminate. With each new release you get a bit closer to achieving that lofty ambition. Before describing what ASP.NET 2.0 can offer to improve upon this, you need to know the answer to the question, "What is the separation of code from content, and why do you need to do it?

Let's start with the first part, but first, I will digress a little. In most walks of life it's possible for a person to wear many hats at the same time, thus you'll find builders who can do carpentry, actors who think they can write, bus drivers who think they could drive a racing car; the list goes on. The truth is while most people's skills are spread across a fairly wide area, they're only likely to be able to specialize or be an expert in one or two areas at most. With programming, it's common to find designers, administrators, and programmers lumped in together. In fact, in recent years "web site developer" has become a bit of an insult, meaning someone who can't really design, can't really program, and would struggle to administer a database as well. In fact, I've seen several job advertisements where the time-honored "time wasters need not apply" has been replaced by the 21st-century version "web developers need not apply!"

You might well be thinking at this point, "Hang on, I want to be a web developer, what's wrong with that?" Well behind the seeming insult is a more serious point: A web developer is usually the person who has to spread him- or herself thinly across three related but really quite different disciplines. The old cliché "jack of all trades, master of none" springs to mind. One of the reasons why they've had to do this is because the technologies involved (in this case ASP) have forced all three disciplines into one web page. So within your ASP page you would have to place the controls, have to implement the design, have to stick the code to make it work, and that code would more likely than not reference the database. Classic ASP was very easy to learn and pick up and hence people could get away with doing this kind of thing, but the truth is a lot of early ASP sites were very ugly, took ages to access the database, and were quite often buggy.

Consider this scenario: What happens if your boss tells a designer to change the font on the web site, while telling the developer to add a search text box to the front page to search on the contents of the site? In times gone by, both people would be scrambling for the same page to make the alterations. Worse still, the designer could do his version of `index.asp`, while the programmer could do his, and therefore neither version would please the boss. Even if they did it sequentially, quite often the programmer would mess up the pristine design, or the design would break a vital piece of code. I'm not intending to patronize either job; this has honestly happened on projects I've worked on. It therefore makes more sense to have two different versions of the same page. And it makes sense to let the designer with his graphic design and art qualifications do the interface of the web site, with the programmer at the back end connecting all the bits of the site and making them work.

This is where separating the code from the content comes in. In this fictitious scenario, you'd probably use Cascading Style Sheets to get around the problem. However, you'd still have the problem of the separating the design from the code. In other words, the positioning of the ASP.NET controls would still be the remit of the programmer. ASP.NET 2.0 goes beyond the separation of code from content.

The Separation of Code from Design

So far you've read about two distinct areas in ASP.NET 2.0, the first being the HTML code and ASP.NET controls, which you can see in this sample page:

```
<html>
<head>
</head>
<body>
<form runat="server">
<aspnet:label id="label1" runat="server" text="Enter your name:"><aspnet:label>
<aspnet:textbox id="textbox1" runat="server"></aspnet:textbox>
<aspnet:button id="button1" runat="server" text="submit">
</form>
</body>
</html>
```

The second is the actual code, which is placed within the `<head>` tags of the first:

```
<script language="VB">
Sub Form Page_Load()
 If Page.IsPostback=true then
    Label1.Text = "Hello" + textbox1.Text
 End If
End Sub
</script>
```

This layout is known as the *single-file* scenario. This chapter uses the term single-file when talking about putting the code within `<script>` tags on the page. The first section of code in the single-file sample page is purely concerned with the design and structure of the page. For instance, you could move the `label` and `textbox` and `button` around, and the program would still work perfectly. However, if you messed with the order of the second page, everything would come to a jarring halt.

Worse still, behind the scenes the single-file scenario actually created far more work than was necessary. A second scenario is a little sidebar that displays a shopping basket as you browse around the site. How would you do it? Would you have to add this code to every single page? If you added it to every page, would you have to update every single page, every time you made a change? A sensible strategy of separating content from code, data from code, and being able to reuse the code is obviously needed. So let's start by looking at the first point in this three-pronged strategy.

Code-Behind

Code-behind is simply a separate code file linked to your Web Form or .aspx page. You place all of your HTML tags and ASP.NET controls in the .aspx page, and you have a separate page "behind" this page that contains all of the code that is normally contained within the `<script>` blocks for the page. So to answer the designer/developer dilemma, your designer can update the .aspx page, while your developer can update the code-behind page.

Code-behind pages are very easy to use. Like their .aspx counterparts, they are composed of pure text and can be viewed in Visual Web Developer, Notepad, or any text editor. The .aspx is the centerpoint, and the code-behind is like an attachment. In Visual Web Developer code-behind pages are not created alongside until they are needed, although when you select a Create Web Site option, a `Default.aspx` page and the corresponding code-behind `Default.aspx.vb` are created automatically. However, for any further pages that you create, only the .aspx page is added, unless you check the Place Code in Separate File option, which is unchecked by default.

> **This runs contrary to what happens in Visual Studio .NET 2005, where when you create a new Web Form, a new code-behind file is automatically created at the same time.**

The code is stored in a separate file, which is identified by a .vb suffix or (if you're using C#) a .cs suffix. So if you created a `Default.aspx` page, then the code-behind file for that page would be called `Default.aspx.vb`. Not all languages in the .NET Framework actually support the code-behind model, most notably J#, but the two main languages that most developers use and the only two considered in this book both use code-behind.

The Page Directive

You've already met the `Page` directive in Chapter 9 when you learned about the idea of using inheritance with the .NET Framework, to inherit certain features from classes. The `Page` directive also refers to where your separate code-behind file is stored. Look at the same directive and the same attributes once again, but this time from a slightly different angle:

```
<%@Page Language="VB" CodeFile="Default.aspx.vb" Inherits="_default"%>
```

You're interested in two particular attributes of `Page`, namely `Inherits` and `CodeFile`.

- `Inherits`: This attribute tells you which class you want to inherit from. It's vital that the `Inherits` attribute matches a class in the code-behind file.

- `CodeFile`: This attribute specifies the name of the code-behind file. Typically you would expect the code-behind file to be kept in the same folder, but it's possible to keep it separate and specify a URL inside this attribute as well.

If you want to use code-behind, you must include these two attributes at all times. If you want to add a code-behind file manually to an .aspx file, then once you've added these two attributes, next you need to create the code-behind file itself.

Partial Classes

If you check the contents of a typical code-behind file, and you can do this by creating a new ASP.NET web site and then viewing the contents of `Default.aspx.vb`, which is created automatically, you will see the following three lines:

```
Partial Class _Default
    Inherits System.Web.UI.Page
    ...
End Class
```

Any code you create should be placed within a *partial class*. Although this section won't go into partial classes too much, it is necessary to talk a little about them. In the last chapter you saw classes as being cookie cutters that define the shape of the cookies. So what is a partial class? Half a cookie cutter? Well in some ways, yes is the answer. If you've played around with ASP.NET 1.x at all, you'll have noticed that there was a lot more than just three lines of code in the code-behind file. In the previous version of ASP.NET if you stuck your control in the page, under certain conditions your code-behind file didn't always see it. Partial classes mean that at compilation time your code-behind file and the Web Form are now merged into one class file, thus making sure this kind of scenario didn't happen. It also means you only need these three lines of code to make it work. So your code-behind file is one half of the cookie cutter and the Web Form is the other half, and together they make the whole. Let's leave that analogy before it gets squeezed any more.

Event Handlers/Functions

You place the code in the partial class; however, this is not quite enough to make it work. The code also should be placed within an event handler or a subroutine or function of some sort. All code in ASP.NET is run in reaction to an event of some sort. If you don't actually place your code in an event handler, you'll probably need a call to your subroutine or function placed within an event handler. The most common one is the `Page_Load` event handler (see the following code) that occurs when the page is first loaded up:

```
Sub Page_Load (ByVal Sender As Object, ByVal e as EventArgs) Handles Me.Load
 ...
End Sub
```

Of course you don't have to type this in; if you double-click the page in Design View, the `Page_Load` event handler will be added for you. This is just another good reason for using Visual Web Developer. In previous versions of this book we've used humble Notepad as our editor to make changes to the code. This isn't because we endorse a firmly Luddite/anti-progress view of the world, but because Notepad

made no changes to our HTML code (unlike the majority of HTML editors), and because it is something everybody with a version of Windows automatically had. With code-behind, things become slightly more complex, in that you have two files that basically refer to the same page (see Figure 10-1). You can still of course manage them via Notepad, but the features in Visual Web Developer make it much easier to manage the two separate pages (and see them as connected entities).

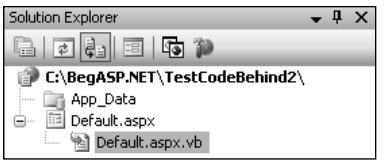


Figure 10-1

Of course, you might think, well why not stick with Notepad and also stick with the single-file model? The following list reiterates some of the advantages of using code-behind files:

- Separation of the content (user interface) from the code. It is practical to have a designer working on the markup while a programmer writes code.
- Better security, because code is not exposed to the designers or others who are working only with the page content.
- Code can be easily reused for multiple pages.

However, this doesn't mean that code-behind is always the perfect solution to all your problems; using a single file for your code and content is still the more sensible option within some scenarios:

- Single-file is best suited for pages where the code consists primarily of event handlers for the controls on the page.
- Where there is little code it can be easier to view a single-file page because both the code and the HTML are in the same place.

There are also some reasons of convenience to consider, too, namely single-file pages are easier to send to another programmer because there is only one file, they're also easier to rename, and managing files is slightly easier, because the page is self-contained in a single file, and there are therefore fewer pages to manage. Generally, though, you really should be placing your code in a separate code-behind file, because the advantages outweigh the disadvantages for the most part.

Creating a Code-Behind File

That's enough talk. In the next Try It Out you get down to the business of creating an incredibly simple code-behind file that interacts with a sample page containing a `TextBox`, `Button`, and `Label` control. You'll see how you can manipulate all of these controls in the same way as you might expect to when using a single file.

Try It Out Creating a Code-Behind File

1. Open VWD and create a new web site called TestCodeBehind in the Chapter directory (C:\BegASPNET2\Chapters\Begin\Chapter10).

2. Go to Solution Explorer and click the plus symbol (+) next to `Default.aspx` to expand the tree to reveal the file `Default.aspx.vb` (refer to Figure 10-1).

> **Once again I stress that `Default.aspx` is the only file that has the code-behind file automatically created for you. If you create another Web Form, you must make sure to check the Place Code in a Separate File option, which is unchecked by default.**

3. Go back to the `Default.aspx` file first and add two `Label` controls, a `TextBox` control, and a `Button` control, as shown in Figure 10-2.

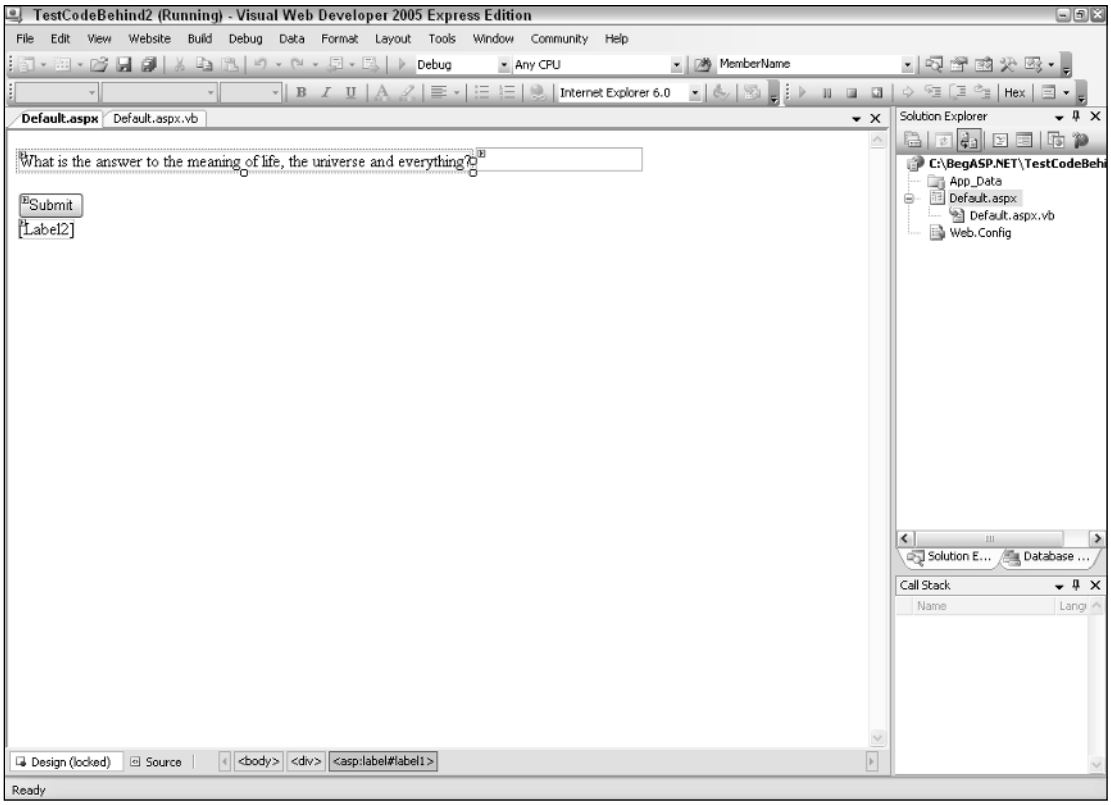


Figure 10-2

You'll need to adjust the source HTML to read as follows:

```
    <asp:Label ID="Label1" runat="server" Text="What is the answer to the meaning
of life, the universe and everything?:"></asp:Label>
    <br /><br />
    <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>
    <br /><br />
    <asp:Button ID="Button1" runat="server" Text="Submit" />
    <br /><br />
    <asp:Label ID="Label2" runat="server" Text=""></asp:Label>
```

4. Go back to Design View and double-click anywhere on the background of `Default.aspx` other than on the controls. Doing so will open up into the code-behind file, shown in Figure 10-3.

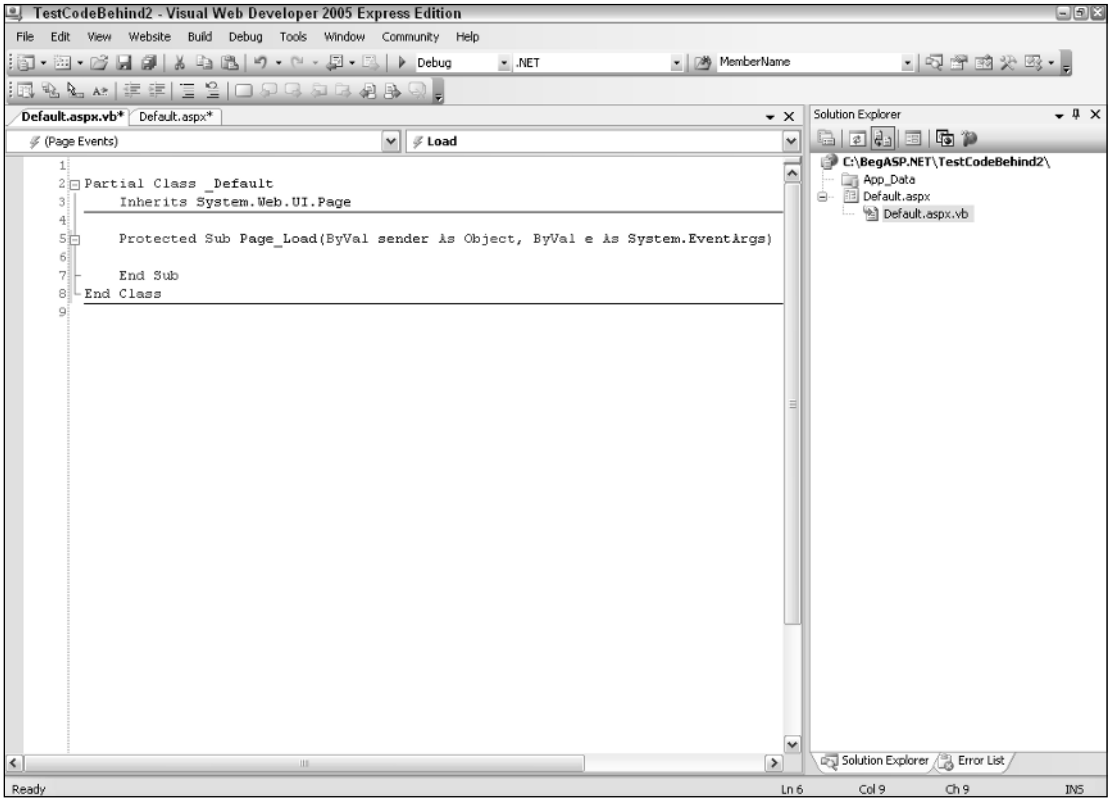


Figure 10-3

5. Add the following code to the `Page_Load` event handler:

```
    If (Page.IsPostBack) Then
          If TextBox1.Text = "42" Then
              Label2.Text = "So you read Douglas Adams as well..."
          Else
              Label2.Text = "No, I'm not sure that's it"
          End If
      End If
```

6. Click the green arrow to run it and enter a value or lengthier sentence into the text box, as shown in Figure 10-4.

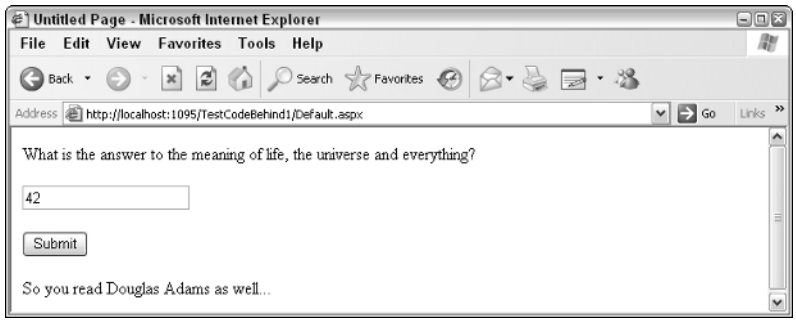


Figure 10-4

How It Works

It all seems very simple; instead of putting your code within `<script>` tags, you place it within a separate page, connected by the `Page` directive tag. Indeed, if you check at the top of the Source View for `Default.aspx` you can see that the following had already been created:

```
<%@Page ... CodeFile="Default.aspx.vb" Inherits="_Default" %>
```

This refers to the code-behind file `Default.aspx.vb`. There the following code is run when the `Page_Load` event is called (when the page is viewed). This is just the normal kind of code talked about in Chapter 9:

```
        If (Page.IsPostBack) Then
             If TextBox1.Text = "42" Then
                 Label2.Text = "So you read Douglas Adams as well..."
             Else
                 Label2.Text = "No, I'm not sure that's it"
             End If
         End If
```

It says if the page has been posted back/submitted, check the contents of the `TextBox` control. If it equals `42`, then you have your correct answer, and you set the `Label2` control's `Text` property accordingly. If the contents of the `TextBox` control do not equal `42`, you display a different answer (`"No, I'm not sure that's it"`).

However, there is a bit more going on beneath the covers, namely the method by which your code is compiled.

Compilation in ASP.NET 2.0

Compilation is another one of those subjects that I don't really want to go into in depth, because you don't need to know too much about it, however you should be aware of its presence. What happens when you submit your Web Form to the server is that your Web Form and ASP.NET pages first have to

be translated into a language the server can understand. This is known as *compilation*. You how this process works in .NET 2.0 in Figure 10-5.

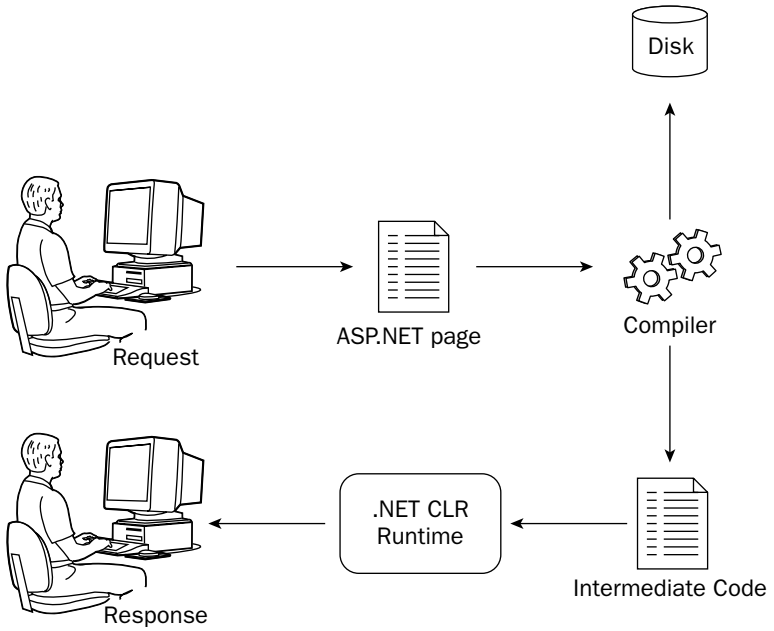


Figure 10-5

The compiler changes your code into something known as *intermediate code*, or Microsoft Intermediate Language (MSIL). This language is something that is independent of any PC it is run on. The .NET CLR (Common Language Runtime) is able to take this intermediate code and change it into executable code that it can run and provide output for. The output is then sent back to the user as a response. (There's actually a bit more to this process, as you'll see in Chapter 14.)

During the process of compilation, your pages are approved syntactically, so if you've made any typos such as the following, they will be spotted at compile time:

```
If (Page.IsPostBack)
```

Your code can be compiled in two ways:

- **Pre-Runtime Compilation:** Normal (the "old way," the default way in ASP.NET 1.1)—Code-behind files are compiled into an assembly and stored in the `\bin` directory. Web Forms and .aspx pages are compiled when needed.
- **Full Runtime Compilation:** Code-behind files and any other associated code can now be placed in the `App_Code` folder. ASP.NET 2.0 will then create and maintain references to the assembly that is generated from these files at runtime.

There is actually a third option called deployment pre-compilation, which is for full compilation of your project prior to deployment. You'll learn a little more about this in Chapter 16.

The App_Code Folder

If you create an `App_Code` folder in your project, any code you place in that project will automatically be compiled when you run the project. It's a far more robust solution than the old `\bin` folder, and for that reason we recommend using it for any code other than code-behind. The reason we suggest not using it for code-behind is that it is easier in VWD to keep your code files attached to the page they are related to; otherwise viewing them could be a pain.

So not only can you organize your code and in which pages it is placed, but ASP.NET 2.0 dictates a different structure for ordering where those pages are placed.

Data Layers

While you've looked at how code and content can be successfully separated, there is a third dimension to our discussions, namely that of the data. Throughout this book we've paused to reflect briefly on various aspects of the history of the Internet and the Web, while trying to keep you away from a huge lecture on the entire subject. Once again you're going to have another quick history lecture to help you understand the purpose of the next ASP.NET 2.0 feature.

Two-Tier Applications

We don't really want to rewind too far back, so let's jump in halfway. Once HTML started getting beyond the universities, it became necessary to provide something more than just static text and images. One of the first ways in which web pages were made dynamic was to be able to access a database. The browser was one tier, and the database was the second tier. In this scenario, the browser dealt with rules about the business/application and user interface.

The term *business rules* is used to encompass any part of the application logic that isn't the user interface or the database. If the application isn't being used for a business, then the term *application logic* might be more applicable, although they mean the same thing.

The data retrieval and manipulation was performed by another separate database application, such as SQL Server or Microsoft Access. It would handle the data storage and retrieval device for the application. These two-tier applications were also commonly know as *client-server* applications. A typical client-server application is depicted in Figure 10-6.

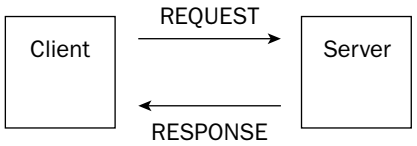


Figure 10-6

The other popular variation on the two-tier application saw the business rules/application logic being executed on the database system. Such applications would commonly use *stored procedures* to manipulate the database (or in some cases triggers). A stored procedure is a query that is stored on the database. It can be called by the client application and then run on the server. It would contain rules about the business as well. For example, if you had a league table on Wrox United that awarded three points for a win and one point for a draw, then in the database query it would somehow have to record that when one side scores more goals than another side, it is worth three points. This is a business rule. It doesn't matter to the database how many points you add on to the win; however, your league table would fail to work properly if you added two or five points for a win.

Three-Tier Applications

The big difference with three-tier applications is that business rules are no longer located on either the client or the database. They are stored and run on a system in between the client and the server. The advantage of this is that the business rules server can ensure that all of the business processing is done correctly. There is now a third layer interface, business rules and data. The introduction of the data tier is illustrated in Figure 10-7.

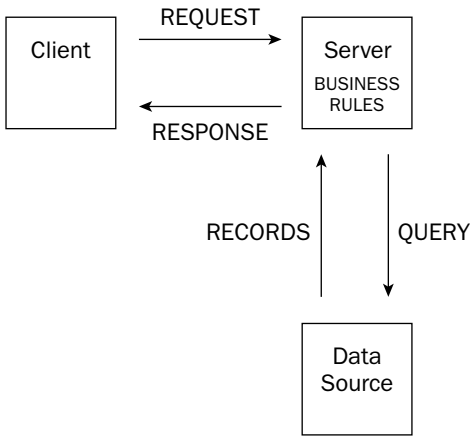


Figure 10-7

In a three-tier application the client never accesses the data storage system directly. You can make changes to the business rules and this would mean you could change any part of the system without having to alter the other two parts. As the three different sections of the application communicate via interfaces, and as long as the interface between the code and application front-end remains the same, the internal workings of each part can be changed without affecting the rest of the application. The advantages of doing this are

similar to those for keeping code and content separate. Typically a database is managed by a database administrator (DBA), and it might even be managed by a separate company. The web developer as jack-of-all-trades would previously have been required to know the intimate workings of the database, when really he shouldn't be interfering there at all. So this brings us to the end of our little excursion, because you can now look at a new feature in ASP.NET 2.0 that allows you to separate your applications more simply into three tiers.

What's New in ASP.NET 2.0

In ASP.NET 2.0, you are no longer restricted to binding only to data controls; you can also bind to separate business controls via the `ObjectDataSource` control.

Using the ObjectDataSource Control

The new ASP.NET `ObjectDataSource` control allows you to declaratively bind data controls such as the `GridView`, `DataList`, and `DropDownList` controls to a separate business control or a data component. Previously you could only bind the controls directly to a database. This new development enables the separation of your business rules from your content and your data.

`ObjectDataSource` is a more difficult control to explain than a `GridView` or `DropDownList` control, so rather than wasting excessive verbiage, it's quicker to show you exactly what the `ObjectDataSource` control does in an example. We're actually going to do two examples to show it in action. The first example we'll show you how to create a data component to return a list of players from the Players table. We'll split this Try It Out into two sections, the first section where we create the ObjectDataSource itself and the second where we bind our ObjectDataSource control to a GridView control. The resulting output will be completely non-editable. In the second example, we'll use the Try It Out to create a data component that can not only read from the Wrox United database but also write data to it. We will create and bind the data component in this same example which will make it quite lengthy.

The data component that you create in both examples will consist of an XSD schema file (.xsd). This file describes the data you require and defines which methods will be used to read and write data. This doesn't require any code or knowledge of XML schemas because when you run the application, the .xsd file is compiled for you and performs all of the tasks needed.

Let's start by creating the data component for our read-only example.

Try It Out — Creating the Data Component

1. Open Visual Web Developer and select Open Web Site. From the C:\BegASPNet2\Chapters\Begin\Chapter10 folder, select `ObjectDataSource` and click OK.
2. In Solution Explorer, right-click the name of your web site, select Add ASP.NET Folder, and select `App_Code`.
3. Right-click the `App_Code` folder and select Add New Item from the list.
4. From the Visual Studio installed templates, click DataSet.
5. Rename the DataSet `ods.xsd` and click Add.
6. Next, VWD will start the TableAdapter Configuration Wizard. Be patient here, because this one really does take a while to kick in.

7. When it finally arrives, select ConnectionString(Web.config) from the drop-down list (see Figure 10-8) and click Next.

Figure 10-8

8. Next you get a page where you can choose to use SQL statements or stored procedures. Select the Use SQL statements radio button (as shown in Figure 10-9) and click Next.

Figure 10-9

9. On the next wizard screen you can define the SQL statement. Type the following SQL statement into the "What data should be loaded into the table" area of the dialog:

```
SELECT PlayerID, FirstName, LastName, Position, DateJoined, DateLeft FROM Players
```

10. After entering the SQL statement, click Next. You can now define which methods the component will expose. Uncheck the Fill a DataTable checkbox and make sure that the Return a DataTable checkbox is checked (see Figure 10-10). In the Method name box, type **GetPlayers**. This method is used later to retrieve the data. Uncheck the final checkbox.

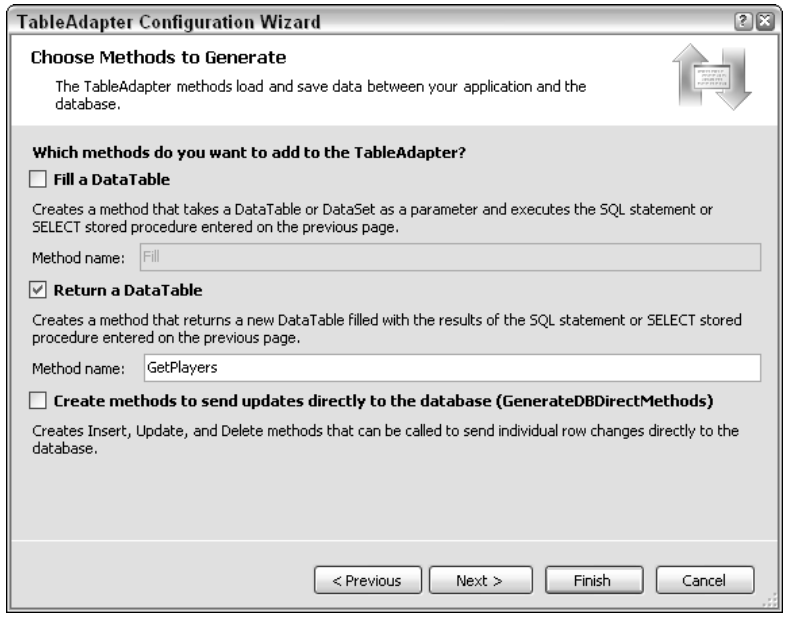


Figure 10-10

11. Click Finish. In Figure 10-11, you can see the data component in the designer. It shows both the data you selected and the method you created.

Figure 10-11

12. Save the data component and close the component designer.

13. Select Build ➪ Build Web Site to compile the component (note this won't produce anything viewable).

How It Works

The data component is now usable as a data source within a Web Form. You've used the wizard to create the component for you, to select the fields from the database, and also to name the method that you want to be able to call this component by.

The next step is to bind to this component. To do this, you can create and configure an `ObjectDataSource` control. You can then add controls, such as the `GridView` control, to the page and bind them to the data source control.

Try It Out Binding to the ObjectDataSource Control

1. Open the `Default.aspx` from Solution Explorer and switch to Design View.
2. Open the Toolbox and from the Data section drag an `ObjectDataSource` control onto the page.
3. Select the Toolbox again, and from the Data section drag a `GridView` control onto the page.
4. Click the black arrow on the top-right corner of the `ObjectDataSource` control. The Common Tasks box appears with the words Configure Data Source. Click this.
5. In the dialog that appears, there is a single drop-down list asking you to choose your business object (see Figure 10-12). There should only be one, the odsTableAdapters.PlayersTableAdapter; select that and click Next.

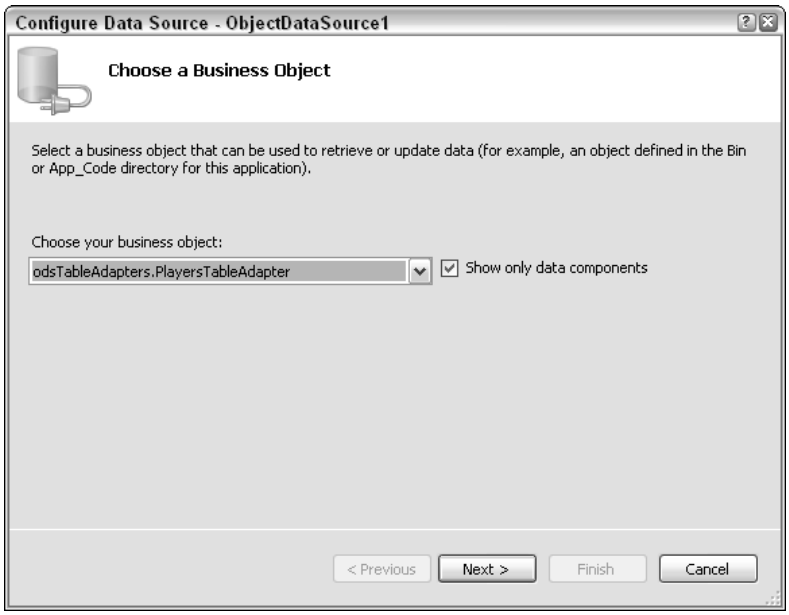


Figure 10-12

6. On the next screen (shown in Figure 10-13), under the Select tab in the Choose a method drop-down box the `GetPlayers(), returns PlayersDataTable` method should be displayed. Select this and click Finish (the other methods are automatically picked for you).

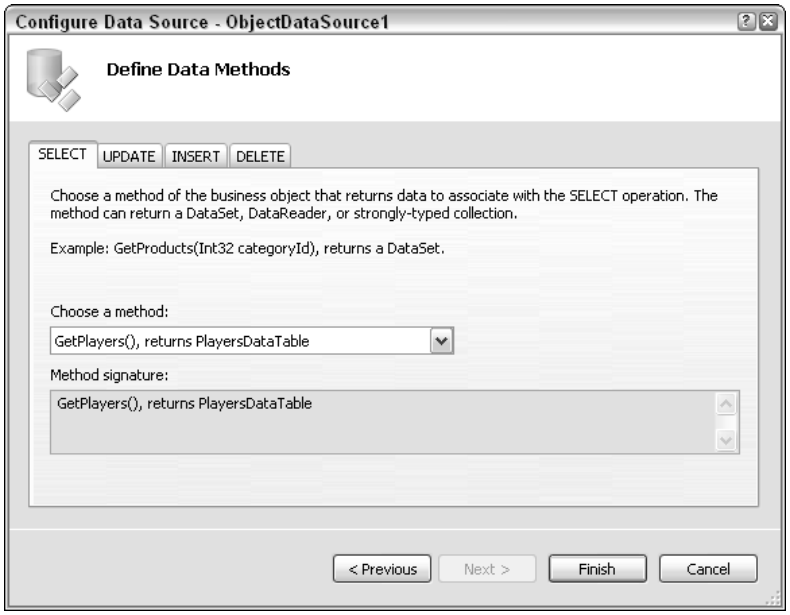
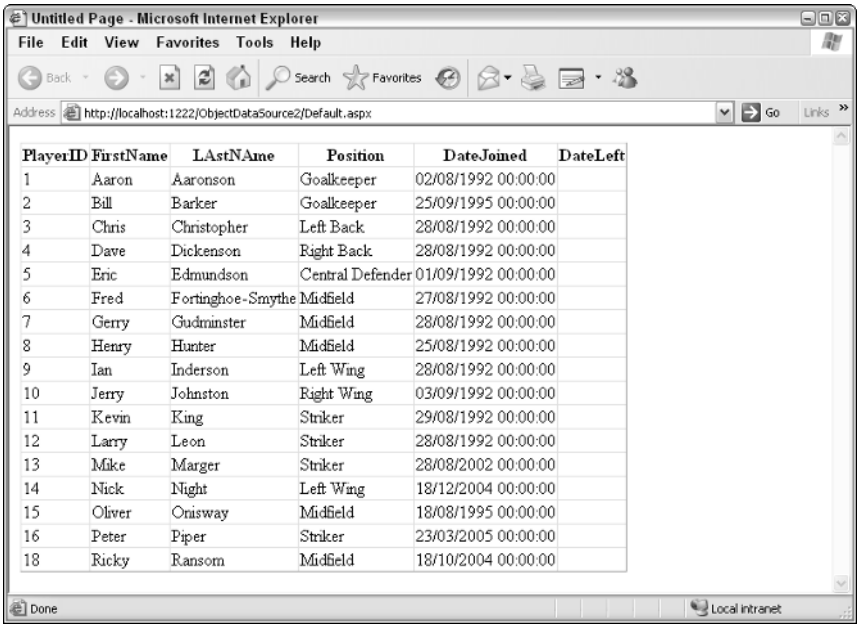


Figure 10-13

7. Click the black arrow on the top-right corner of the `GridView` control and from the Choose Data Source list that appears, select `ObjectDataSource1`. The Grid will update in Design View.
8. Open the Properties window and check that the `DataKeyNames` property is set to `PlayerID`.
9. Run the application, and you will see Figure 10-14 in your browser:



PlayerID	FirstName	LAstNAme	Position	DateJoined	DateLeft
1	Aaron	Aaronson	Goalkeeper	02/08/1992 00:00:00	
2	Bill	Barker	Goalkeeper	25/09/1995 00:00:00	
3	Chris	Christopher	Left Back	28/08/1992 00:00:00	
4	Dave	Dickenson	Right Back	28/08/1992 00:00:00	
5	Eric	Edmundson	Central Defender	01/09/1992 00:00:00	
6	Fred	Fortinghoe-Smythe	Midfield	27/08/1992 00:00:00	
7	Gerry	Gudminster	Midfield	28/08/1992 00:00:00	
8	Henry	Hunter	Midfield	25/08/1992 00:00:00	
9	Ian	Inderson	Left Wing	28/08/1992 00:00:00	
10	Jerry	Johnston	Right Wing	03/09/1992 00:00:00	
11	Kevin	King	Striker	29/08/1992 00:00:00	
12	Larry	Leon	Striker	28/08/1992 00:00:00	
13	Mike	Marger	Striker	28/08/2002 00:00:00	
14	Nick	Night	Left Wing	18/12/2004 00:00:00	
15	Oliver	Onisway	Midfield	18/08/1995 00:00:00	
16	Peter	Piper	Striker	23/03/2005 00:00:00	
18	Ricky	Ransom	Midfield	18/10/2004 00:00:00	

Figure 10-14

How It Works

You started by creating an instance of an `ObjectDataSource` control. To give it its functionality you attached it to the `GetPlayers()` method that was specified in the data component. The `GetPlayers()` method was created in the previous Try It Out. This method returns the results of the SQL statement, available as a `DataTable` object. The `DataTable` object is an object that the `GridView` (and indeed all data controls) can bind to. If you go back and look at the source that has been created, you can see the source for the two controls you added to your form.

```
<div>
        <asp:ObjectDataSource ID="ObjectDataSource1" runat="server"
OldValuesParameterFormatString="original_{0}"
            SelectMethod="GetPlayers"
TypeName="wroxunitedTableAdapters.PlayersTableAdapter">
        </asp:ObjectDataSource>

    </div>
        <asp:GridView ID="GridView1" runat="server" AutoGenerateColumns="False"
DataKeyNames="PlayerID"
            DataSourceID="ObjectDataSource1">
            <Columns>
                <asp:BoundField DataField="PlayerID" HeaderText="PlayerID"
InsertVisible="False"
                    ReadOnly="True" SortExpression="PlayerID" />
                <asp:BoundField DataField="FirstName" HeaderText="FirstName"
SortExpression="FirstName" />
```

```
                <asp:BoundField DataField="LastName" HeaderText="LastName"
SortExpression="LastName" />
                <asp:BoundField DataField="Position" HeaderText="Position"
SortExpression="Position" />
                <asp:BoundField DataField="DateJoined" HeaderText="DateJoined"
SortExpression="DateJoined" />
                <asp:BoundField DataField="DateLeft" HeaderText="DateLeft"
SortExpression="DateLeft" />
            </Columns>
        </asp:GridView>
```

The `GridView` control binds each of the fields in the dataset to a column in a table on the display. The `ObjectDataSource` takes five attributes. The `ID` and `runat` attributes are standard, the `OldValuesParameterFormatString` is set to the original setting, the `SelectMethod` attribute specifies the name of the actual method, and the `TypeName` specifies the PlayersTableAdapter. These are all the instructions needed to be able to bind the return PlayersTable to the `GridView` control. The final display looks the same as a normal `GridView` control; it's only the plumbing underneath that has routed your data from the `ObjectDataSource` control that is different.

The Wrox United ObjectDataSource

This data so far has been static; so as we mentioned previously, in this next Try It Out you go one further and use the `ObjectDataSource` control to be able to edit and update your squad's details. In the Admin section of the Wrox United site there is a page called `EditSquad.aspx`, which is used to change the players' details. However, it uses the `SqlDataSource` control for the details. This can be replaced with an `ObjectDataSource` control. It has the insert, update, select, and delete methods to map neatly to the methods in a simple class.

Try It Out — The Wrox United ObjectDataSource

1. Open the Wrox United application from the chapter samples (C:\BegASPNET2\Chapters\Begin\Chapter10\WroxUnited) in Visual Web Developer.
2. Right-click the `App_Code` folder and select Add New Item from the list.
3. From the Visual Studio installed templates, click DataSet.
4. Rename the DataSet `wroxunited.xsd` and click Add.
5. Next, VWD will start the TableAdapter Configuration Wizard. Be patient here, because this one really does take a while to kick in.
6. When it finally arrives, select wroxunited (Web.config), and click Next.
7. Next, you get a page where you can choose to use SQL statements or stored procedures. Select the Use SQL statements radio button and click Next.
8. On the next wizard screen you can define the SQL statement. Type the following SQL statement into the "What data should be loaded into the table" area of the dialog:

```
SELECT PlayerID, FirstName, LastName, Position, PictureURL, DateJoined, DateLeft
FROM Players
WHERE PlayerID = @PlayerID
```

9. After entering the SQL statement, click Next. You can now define which methods the component will expose. Uncheck the Fill a DataTable checkbox and make sure that Return a DataTable checkbox is checked. In the Method name box, type **GetPlayers**. This method is used later to retrieve the data. Make sure the final checkbox "Create methods to send update directly to the database" box is checked.
10. Click Next and the click Finish, save the data component, and close the component designer.
11. Select Build ➪ Build Web Site to compile the component.
12. Open the Admin folder of WroxUnited and open the file `EditSquad.aspx`.
13. In Design View scroll down, select the second `SqlDataSource` control (shown in Figure 10-15), `DetailsDataSource`, and delete it.

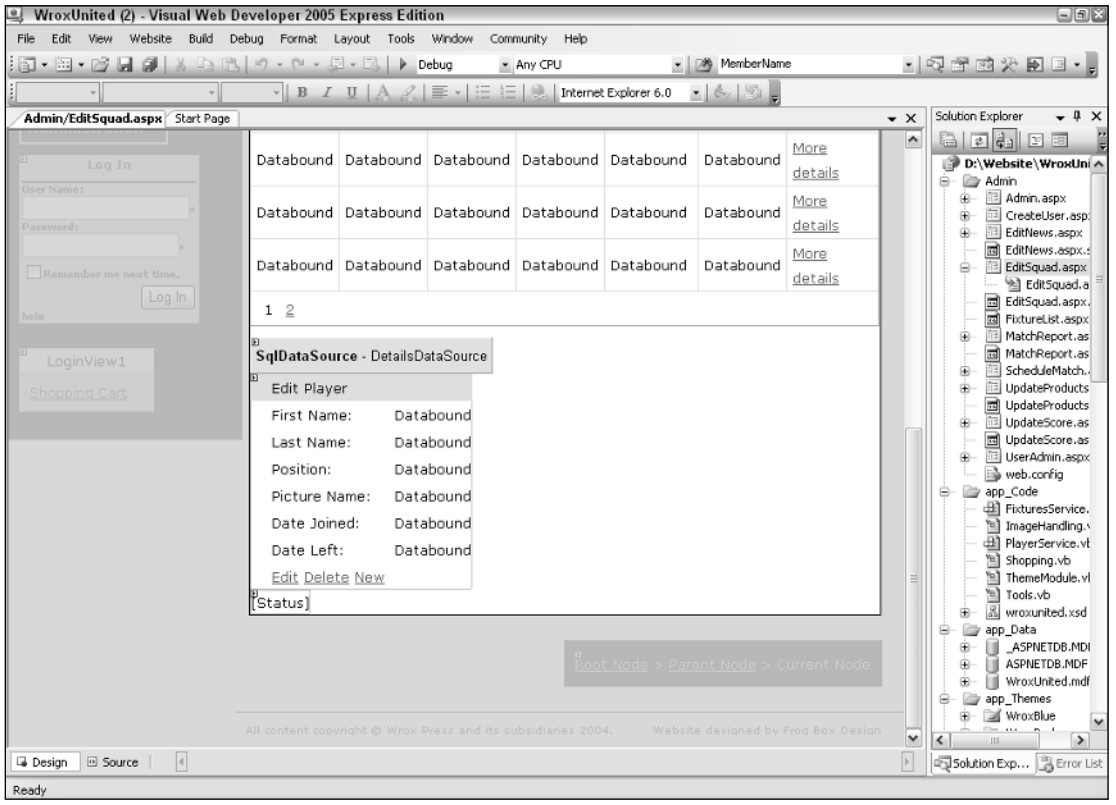


Figure 10-15

14. From the Data Section of the Toolbox, drag an `ObjectDataSource` control where the `SqlDataSource` used to be.

15. Click the black arrow at the top right of the `ObjectDataSource` control, and from the Common Tasks menu select Configure Data Source.

16. In the opening dialog select wroxunitedTableAdapters.PlayersTableAdapter and click Next.

17. In the Select tab pick the "GetPlayers(Int32 PlayerID), returns PlayersDataTablemethod is selected from the drop-down list box and click Next.

18. In the Define Parameters dialog select "Control" from the Parameter Source: dropdown list box and select GridView1 in Control view. The parameters on the left of the dialog will now show GridView.SelectedValue. Click Finish.

19. Right-click the `ObjectDataSource` control in Design View and select Properties.

20. In the Properties window change the `(ID)` property so that it reads `"DetailsDataSource"`.

21. Open `EditSquad.aspx.vb` and amend code in the procedure parameters to read as follows in the following three subs:

```
Sub DetailsDataSource_Updated(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.ObjectDataSourceMethodEventArgs )
 ...
End Sub
Sub DetailsDataSource_Inserted(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.ObjectDataSourceMethodEventArgs )
 ...
End Sub
Sub DetailsDataSource_Deleting(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.ObjectDataSourceMethodEventArgs )
 ...
End Sub
```

22. Save and close the file.

23. Run the application, log in as an administrator (dave\dave@123), and navigate to the `EditSquad.aspx` page. It works in the same way as before except that you are now using an `ObjectDataSource` control.

How It Works

You haven't changed much between this and the previous example. You built a data component, and you then added an `ObjectDataSource` control into the `EditSquad.aspx` page. You added methods for the Update, Insert, and Delete methods via the wizard. The code that provided your functionality in the classes was already in existence; all you had to do was change the references from the `SqlDataSource` control to the `ObjectDataSource` control. Then you ran it, and the WroxUnited application was able to use the `ObjectDataSource` instead.

User Controls

Your final problem is that of making your code easy to reuse, and this is addressed by *user controls*. Again, these are something that existed in ASP.NET 1.x, but this is something that also has been improved upon in ASP.NET 2.0. So what are user controls? Well in a nutshell, user controls are reusable Web Forms. They've been through several name changes and evolutions from scriptlets to pagelets, before arriving at user controls. They can be thought of as mini-scripts or mini-pages, or pages within your pages, but however you choose to think of them the key is that they can be called up as many times as you need them.

If you browse the Wrox United site you can see several examples of user controls, and one, the `News` control, is visible on the front page. In fact, if you look at the front page (shown in Figure 10-16), it is a multitude of components garnered from different sources.

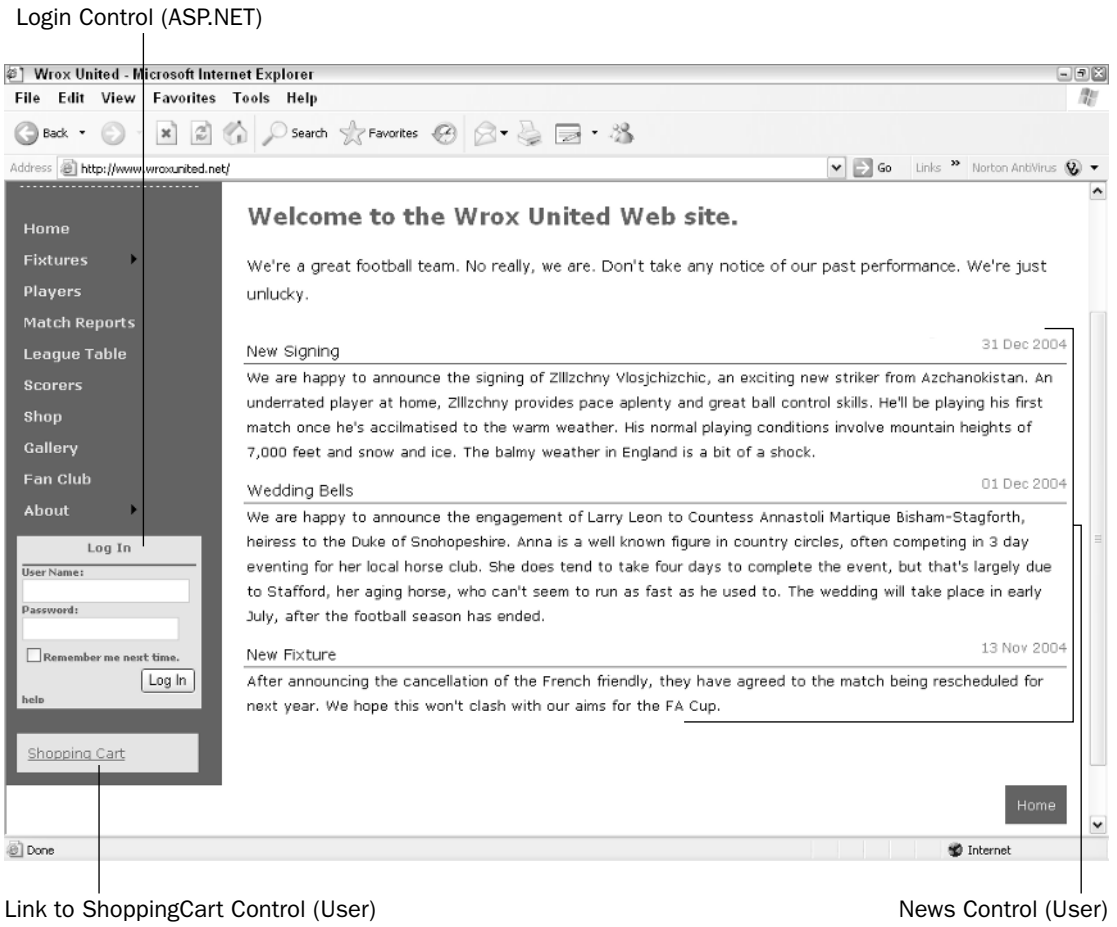


Figure 10-16

The `News` control is a user control, the `Login` control is an ASP.NET control, the shopping cart is a link to a user control, and the menu is derived from the site master, which itself is an ASP.NET control. So the entire site front page and design is reusable. If you click the Shopping Cart link, you will see the second user control, shown in Figure 10-17.

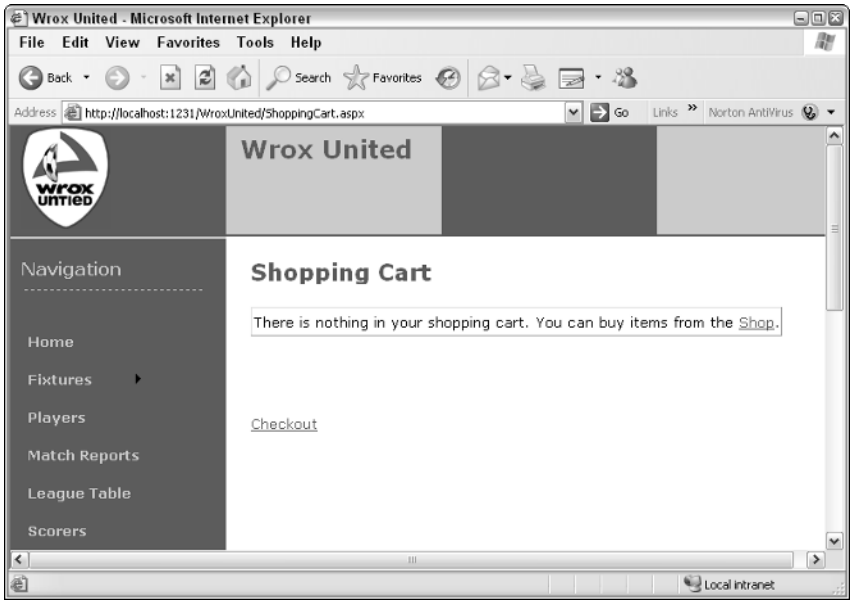


Figure 10-17

And there are a couple more in the administrative section of the site too, but you get the idea! The idea is that these controls can be used in multiple pages, or called from different places, and rather than having to cut and paste the code individually each time, you can just call on this one section of code over and over again. One question that might be on your lips is how do they differ from the normal ASP.NET server controls, such as the `TextBox` control or the `Login` control that you looked at earlier?

Very little is the answer. The main difference is that you have to provide the code behind the control yourself, whereas ASP.NET server controls come fully working out of the box. You can add properties to user controls and set them as attributes, just like you would with a normal ASP.NET server control.

So why isn't everything an ASP.NET server control? Well, ASP.NET 2.0 ships with a multitude of controls designed for the most common scenarios and situations. ASP.NET 2.0 adds greatly to the number of server controls. For example, in ASP.NET 1.1 if you wanted a `Login` control you had to stitch together a username text box, a password text box, a button, and a label for messages within a panel, so you had to create this as a user control. In version 2.0, the `Login` control comes as a server control. However, it just isn't possible to anticipate everything that a user might want or need. So therefore it makes sense to have the flexibility to create your own.

If you view the source code in Internet Explorer for the home page (`Default.aspx`) in WroxUnited.net, you'll see no indication that a user control has been used; it's all HTML elements and some occasional script, which is just as it should be. If you were using a Flash plug-in or a Java applet, you would see some indication with an `<object>` tag or on older browsers possibly an `<embed>` tag. So there's no worry about extra download time being taken either.

If you look at the actual page that is sent to the server, you can see the user control is included with a simple two lines of code that we've highlighted (this source code page is available for download at `www.wrox.com`):

```
<%@ Page Language="VB"  MasterPageFile="~/site.master" AutoEventWireup="false"
codefile="Default.aspx.vb" Inherits="_Default" %>
<%@ Register TagPrefix="uc1" TagName="News" Src="News.ascx" %>
<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="server">

    <h2>Welcome to the Wrox United Web site.</h2>
    <p>We're a great football team. No really, we are. Don't take any notice
    of our past performance. We're just unlucky.</p>

    <uc1:news id="News1" runat="server" ItemsToShow="3"></uc1:news>

</asp:Content>
```

This page starts giving you some clues as to how user controls work.

User Control Structure

User controls are stored in separate files with a separate .ascx extension. Any time you see this extension you know that you are dealing with a user control. To create a user control you need to add a `@Register` directive to the top of your Web Form identifying where you can find your user control:

```
<%@Register TagPrefix="WroxUnited" TagName="MyControl" %>
```

You need to add a new tag specifying where the control will go on your page. It will be composed of the `TagPrefix`, followed by a colon, followed by the `TagName`, an ID, and the now familiar `runat=server` attribute:

```
<WroxUnited:MyControl id="mycontrol1" runat="server">
</WroxUnited:MyControl>
```

Lastly, you need to specify the user control itself in a separate .ascx file. Unlike Web Forms, you don't need to specify extra `<html>` and `<body>` tags, because the contents of this control will be added to the body of the containing main page. In fact, all you need to have is the controls themselves that you want to include. For example, you could include the controls from the code-behind example used earlier in the chapter:

```
    <asp:Label ID="Label1" runat="server" Text="What is the answer to the meaning
of life, the universe and everything?:"></asp:Label>
    <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>
    <br /><br />
    <asp:Button ID="Button1" runat="server" Text="Submit" />
    <br />
    <asp:Label ID="Label2" runat="server" Text=""></asp:Label>
```

Of course, user controls can have code-behind files as well, just like Web Forms:

```
Sub Page_Load()
       If (Page.IsPostBack) Then
            If TextBox1.Text = "42" Then
                Label2.Text = "So you read Douglas Adams as well..."
            Else
                Label2.Text = "No, I'm not sure that's it"
            End If
        End If
End Sub
```

This control can then be bolted into your web pages wherever you specify the `@Register` directive and add a tag for the control.

A Simple User Control

In the next Try It Out, you're going to start by creating a trivial "Hello World"-style user control to get you used to the idea of including them in your pages. This code does no more than encapsulate the code behind from the first example we created in the chapter as a user control. You'll see how you can place the user control in one web page, and then a second web page.

Try It Out — Creating a Simple User Control

1. Open VWD and create a new ASP.NET web site called SimpleUserControl in the chapter directory (C:\BegASPNET\Chapters\Begin\Chapter10).
2. In Solution Explorer, right-click the web site and select Add New Item. Select Web User Control, enter the name **SimpleUserControl.ascx**, and check the Place Code in Separate File option, as shown in Figure 10-18.

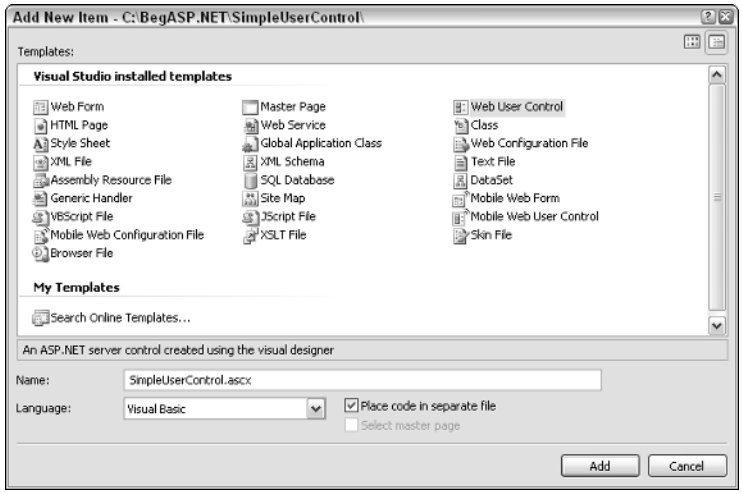


Figure 10-18

3. Now you need to add the controls to the page. Once again, drag two `Label` controls, a `TextBox` control, and a `Button` control, as shown in Figure 10-19.

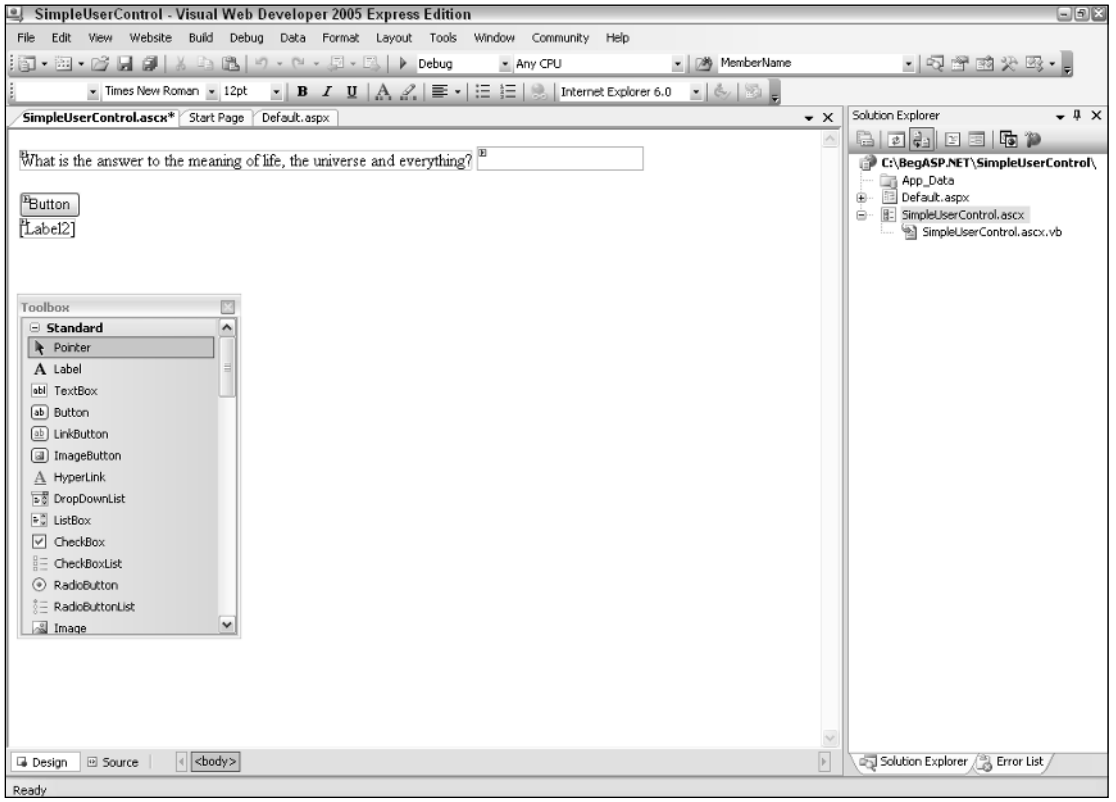


Figure 10-19

You can cut and paste the relevant code from the first Try It Out in this chapter into Source View if you still have it at hand:

```
<asp:Label ID="Label1" runat="server" Text="What is the answer to the meaning of
life, the universe and everything?:"></asp:Label>
    <asp:TextBox ID="TextBox1" runat="server"></asp:TextBox>
    <br /><br />
    <asp:Button ID="Button1" runat="server" Text="Submit" />
    <br />
    <asp:Label ID="Label2" runat="server" Text=""></asp:Label>
```

4. Double-click the page again and this time add the following code-behind to `SimpleUserControl.ascx.vb`:

```
Partial Class SimpleUserControl
```

```
    Inherits System.Web.UI.UserControl
       Sub Page_Load()
          If (Page.IsPostBack) Then
               If TextBox1.Text = "42" Then
                   Label2.Text = "So you read Douglas Adams as well..."
               Else
                   Label2.Text = "No, I'm not sure that's it"
               End If
           End If
        End Sub
End Class
```

5. Next you need to add this control to a page. From Solution Explorer drag the `SimpleControlUser.ascx` into Design View for `Default.aspx` (see Figure 10-20).

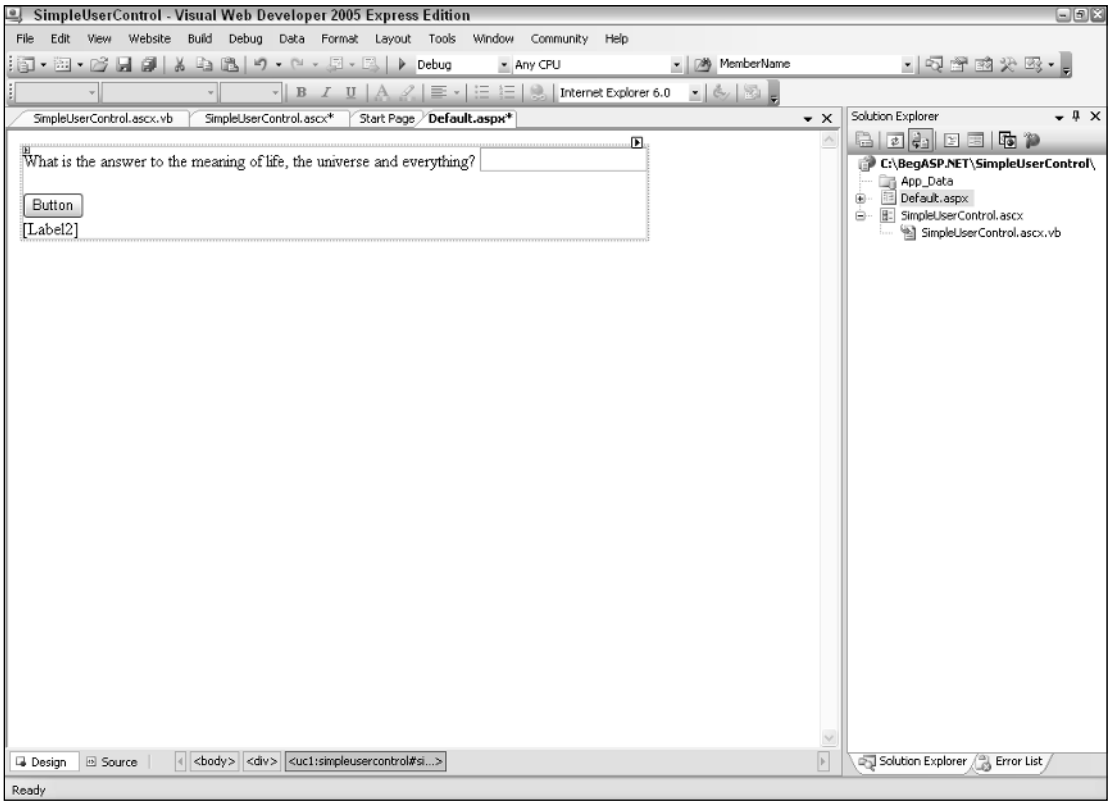


Figure 10-20

6. Click the green arrow to run `Default.aspx`; it works in exactly the same way as it did in the first Try It Out of this chapter, as evidenced in Figure 10-21.

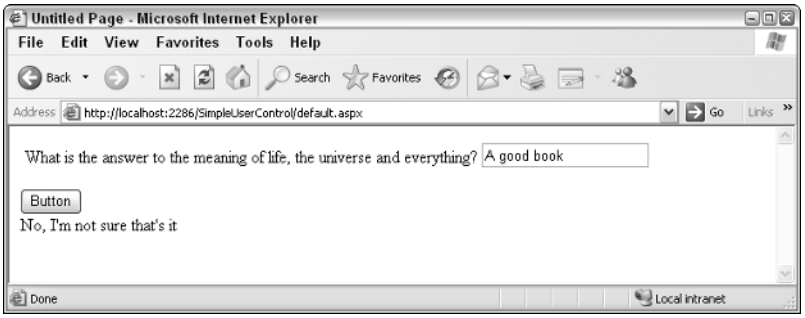


Figure 10-21

7. Now go to Solution Explorer and right-click the project. Select Add New Item and add a new Web Form to the page called `secondpage.aspx`.

8. Go to Design View and drag `SimpleUserControl.ascx` into this page. Next, go to Solution Explorer and right-click `secondpage.aspx` and select Set As Start Page.

9. Run the project again. You should see what appears in Figure 10-22. Your control has been successfully duplicated with no extra lines of code being required.

Figure 10-22

How It Works

This hopefully shows you just how easy it is to reuse code in your pages. If you go to `Default.aspx` and view the source you will see the following:

```
<%@ Page Language="VB" AutoEventWireup="false" CodeFile="Default.aspx.vb"
Inherits="_Default" %>
<% Register Src="SimpleUserControl.ascx" TagPrefix="uc1"
TagName="SimpleUserControl" %>

<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN"
"http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd">

<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
    <title>Untitled Page</title>
```

```
</head>
<body>
    <form id="form1" runat="server">
    <div>
    <uc1:SimpleUserControl id="SimpleUserControl1 runat="server" />
    </div>
    </form>
</body>
</html>
```

The highlighted lines of code are the only two lines that have been added to the original source code. The first registers the user control and specifies a tag prefix of `uc1` (short for user control one) and a `TagName` of `SimpleUserControl`. The control is then inserted into the page along with an `id` attribute and a `runat=server` attribute.

There's nothing to stop you from copying this tag and pasting it again and again in the page, although it might make your page a little illogical, with several versions of the user control. Note that this example got you to cut and paste the old code from the code-behind page. This was quite deliberate because this was the old way of transferring replicated code. Each time you want to transfer the code, you would cut and paste it manually. Not only is cutting and pasting more labor-intensive, but it is also far more prone to mistakes, because if you altered the code in one page, it would need to be altered in all of the rest. With user controls, any changes you need to make can just be made to the .ascx file and the .ascx.vb file themselves, and then every time the user control is called, it automatically uses the new code.

The Wrox United News User Control

You're now going to move onto a more complex user control, and one that is used on the Wrox United web site. You're going to re-create the `News` control that you find on the main Wrox United site. This control scans the News table and selects the most up-to-date stories and displays them on the front page, with the most recent being displayed first.

Before you launch into the coding, it's worth saying a little bit about why we chose to make this a user control, while other bits and pieces we chose not to. A `News` control is something that is going to be common on many web sites (although technically speaking user controls shouldn't be used across several applications — as you will see at the end of this chapter — because there is something better served for t hat purpose). It is also something that will quite likely be called upon at several places throughout the application (although you only call upon it once within the Wrox United application), and the principle will remain the same throughout; it will display a list of articles in order, with the most recent first. Of course, not all things you will design on this site will be suitable for reuse and for creating as user controls, but the `News` control is a content delivery mechanism and content is the driving force behind most web sites. In the following Try It Out, you create your own `News` user control and drop it into your own blank page.

Try It Out — Using the News Control

1. Open Visual Web Developer and select Open Web Site. From the Chapter10 folder (C:\BegASPNET\Chapters\Begin\Chapter10), select `WroxUnitedNewsControl` and click OK. This contains the connection string information that you will need for this example.

2. Go to Visual Web Developer and right-click the top item in Solution Explorer. Select Add New Item and select Web User Control. Type **NewsUserControl.ascx** in the Name text box. Make sure the Place Code in Separate File checkbox is selected, as depicted in Figure 10-23.

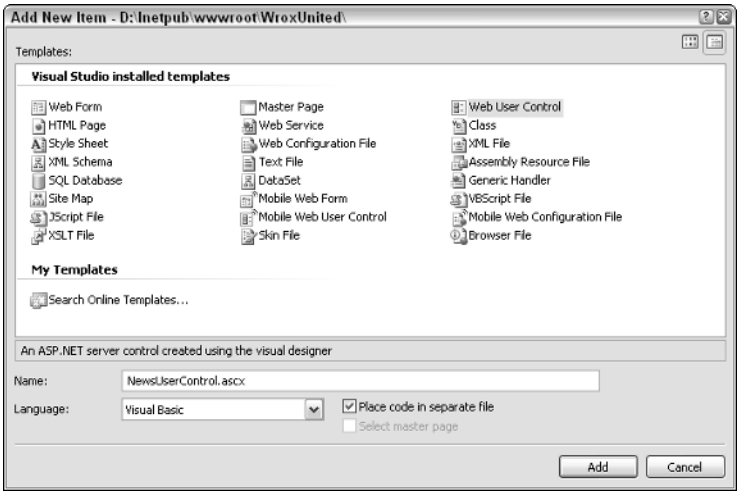


Figure 10-23

3. Go to Design View and drag a `SqlDataSource` control from the Data section of the Toolbox menu. Don't, however, click to configure the Data Source from the Common Tasks box that appears. Instead, switch to source view, and add the following to the SqlDataSource:

```
ConnectionString="<%$ConnectionStrings:WroxUnited%>"
```

4. From the Data section of the Toolbox menu, add a `Repeater` control below the `SqlDataSource` and select `SqlDataSource1` to be the `Repeater`'s Data Source (see Figure 10-24).

5. First we'll add the template to the HTML. With the `Repeater` control you have to switch to Source View to add the template. Switch to Source View and add the following code:

```
<asp:Repeater ID="Repeater1" Runat="server" DataSourceID="SqlDataSource1">
    <ItemTemplate>
        <div class="newsItem">
            <span class="newsDate"><%#Eval("DateToShow", "{0:dd MMM yyyy}")%>
            </span>
            <span class="newsTitle"><%#Eval("Title")%></span>
        </div>
        <span class="newsContent">
            <%#Eval("Description") %>
        </span>
    </ItemTemplate>
</asp:Repeater>
```

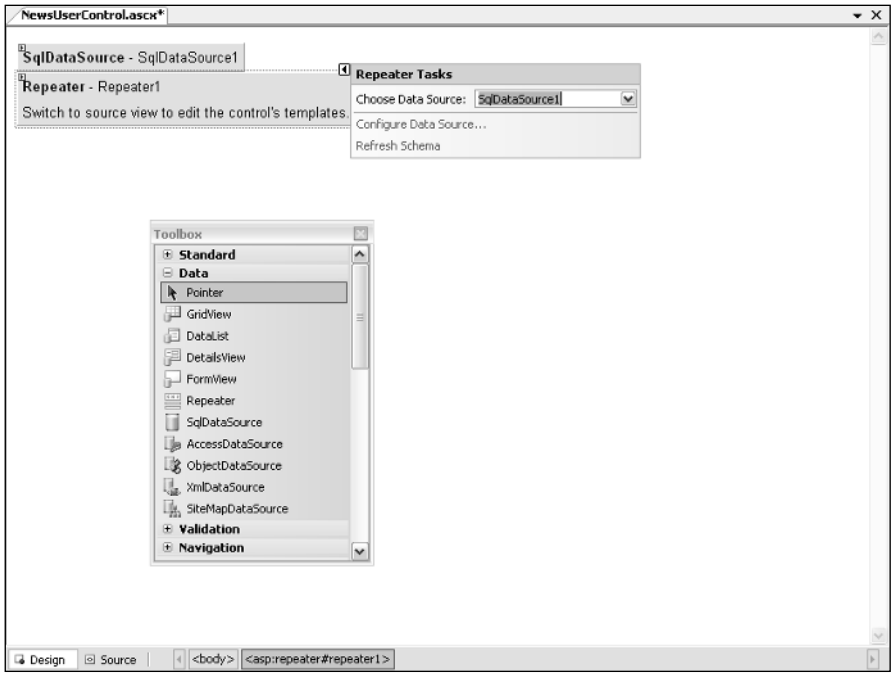


Figure 10-24

6. Next we need to add the namespace. Go to the code-behind file `NewsUserControl.ascx.vb` and add a reference to the `System.Data` namespace at the top of the file:

```
Imports System.Data
```

7. Now we'll add the code. Still in the code-behind file add the following code for an `ItemsToShow` property, which governs how many items are shown on the screen at the same time:

```
Partial Class NewsControl
    Inherits System.Web.UI.UserControl
    Private _itemsToShow As Integer = 5
    Public Property ItemsToShow() As Integer
        Get
            Return _itemsToShow
        End Get
        Set(ByVal value As Integer)
            _itemsToShow = value
        End Set
    End Property
```

8. Select (Page Events) from the left-hand drop-down box.

9. Select the `Pre_Render` method from the top of the screen in the right drop-down list box, and add the following code to it:

```
Private Sub Page_PreRender(ByVal sender As Object, ByVal e As System.EventArgs)
Handles Me.PreRender
```

```
        Dim sel As String = String.Format("SELECT Top {0} * FROM [News] WHERE " & _
          " DateToShow <= '{1}' ORDER BY DateToShow DESC", _itemsToShow, _
          DateTime.Now.ToString("yyyy/MM/dd"))
        SqlDataSource1.SelectCommand = sel
    End Sub
```

10. Now go to Solution Explorer and create a new Web Form called `NewsDisplay.aspx`. Go to Design View and drag your `NewsUserControl.ascx` into the Web Form.

11. Run it — it's fairly raw without any styles, but you will see five news items, as shown in Figure 10-25.

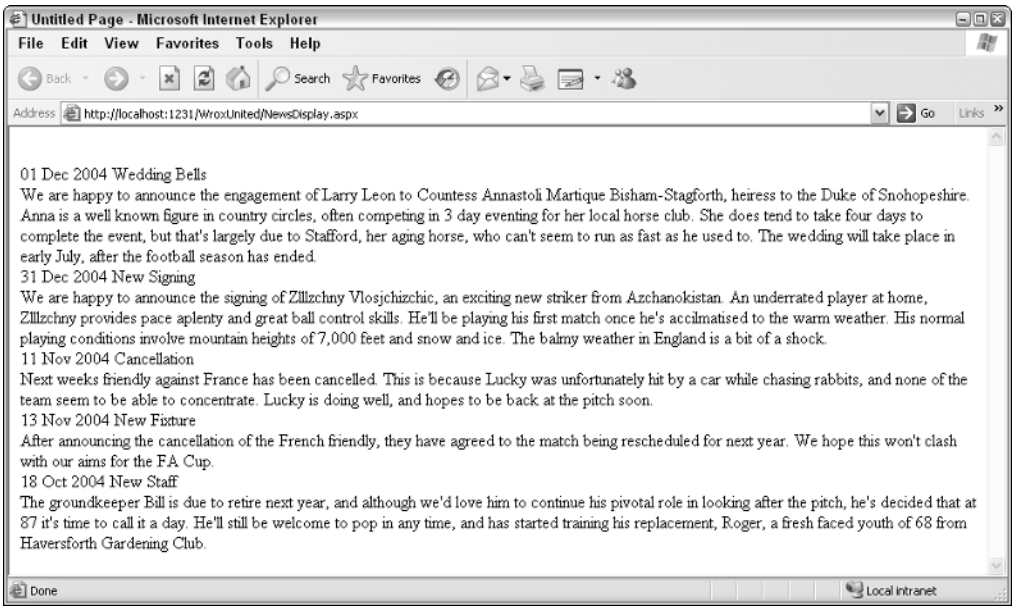


Figure 10-25

12. Go back to Source View and add an `ItemsToShow` attribute, and set it to `2`:

```
<div>
 <uc1:NewsUserControl id="NewsUserControl1" runat="server" ItemsToShow="2">
 </uc1:NewsUserControl>
</div>
```

13. Save the page and run it again, and you will see the output shown in Figure 10-26. If you want to improve the "rough and ready" look of this control, as we have, drag the site.css file from the templates folder in the directory into the aspx file to apply the style sheet.

Figure 10-26

How It Works

You have a `News` control that not only can you drop in any page (it is used on the front page of the Wrox United site), but also allows you to configure the number of items shown via a single attribute. The following code has been created in the user control, a `SqlDataSource` control that queries the news table together with a `Repeater` control that displays each of the individual news items:

```
<%@ Control Language="VB" AutoEventWireup="false" codefile="News.ascx.vb"
Inherits="NewsControl" %>
<asp:SqlDataSource id="SqlDataSource1" Runat="server"
    ConnectionString="<%$ ConnectionStrings:WroxUnited %>">
</asp:SqlDataSource>

<asp:Repeater ID="Repeater1" Runat="server" DataSourceID="SqlDataSource1"
        <ItemTemplate>
        <div class="newsItem">
            <span class="newsDate"><%#Eval("DateToShow", "{0:dd MMM yyyy}")%>
            </span>
            <span class="newsTitle"><%#Eval("Title")%></span>
        </div>
        <span class="newsContent">
            <%#Eval("Description") %>
        </span>
    </ItemTemplate>
</asp:Repeater>
```

It's the code-behind that provides the main functionality, though. Once again the relationship between the code-behind and the main control is shown. You added an `ItemsToShow` property to the code-behind and exposed it as a public property. This has the effect of creating an attribute that you can set via the Web Form:

```
    Private _itemsToShow As Integer = 5
    Public Property ItemsToShow() As Integer
        Get
```

```
            Return _itemsToShow
        End Get
        Set(ByVal value As Integer)
            _itemsToShow = value
        End Set
    End Property
```

You set the default to `5`, so if the attribute isn't set you automatically display five items instead. The property allows you to both get and set the separate values.

What allows you to display the contents of the control is the code that occurs in the `Pre_Render` event. This is similar to the `Page_Load` event, except it occurs just before the controls on a page are rendered. Because you want to display these at the last possible moment, you place two statements here. The first one provides a SQL statement that selects the top news items ordered by date, and restricted by the `_itemsToShow` variable that you created at the top of the class:

```
Dim sel As String = String.Format("SELECT Top {0} * FROM [News] WHERE " & _
  " DateToShow <= '{1}' ORDER BY DateToShow DESC", _itemsToShow,
DateTime.Now.ToString("yyyy/MM/dd"))
SqlDataSource1.SelectCommand = sel
```

The second sets this SQL to the `SelectCommand` property of your data source, and this restricts the number of items shown by your user control.

Composite Controls

You've looked at how user controls are nested inside pages, but it doesn't stop there. You can nest user controls inside user controls. These are known as composite controls. If you consider a scenario where you require a group of user controls, such as, say, a `News` control and a `Login` control, and a `Fixture viewer` control. Rather than having to place references to these controls separately each time, you could place them in a single user control and use that control instead. This further enhances the code-reuse within the application.

Assemblies and Custom Server Controls

.NET also provides the capability to pre-compile code components into a central location that can be accessed from anywhere within the site. These components, like user controls, can contain one or more classes; however, the crucial difference is that ASP.NET uses the compiled *assemblies* rather than the code inside the component itself at runtime (in other words, the component isn't compiled at the same time as the main application, but rather has to be done beforehand). .NET assemblies can use any of the .NET-compliant languages, and the assemblies are compiled into .dll files. These .dll files are then placed within the `App_Code` folder, and can be used by ASP.NET as part of the program.

Custom server controls are a specific version of assemblies. You have already seen how ASP.NET provides such controls as `TextBox`, `Label`, `CheckBox`, and radio button controls to aid in the development of user interfaces. Although the vast majority of server controls should cover you for most situations, and also the fact that in ASP.NET 2.0, there is an even wider range of server controls, there are still times when you

might need to create controls that extend the user interface still further. Custom controls are controls that generate a visible user interface. If you consider that when ASP.NET was created, the ASP.NET server controls are actually just custom controls that someone at Microsoft has already created for you and distributed with ASP.NET 2.0. A main difference between user controls and custom controls is that user controls are intended to be confined to the application they were created for, whereas custom controls can be used with any application. Hence they are pre-compiled into assembly files, making them more portable. They also inherit from the `System.Web.UI.Control` namespace rather than the namespace specific to the application. Typical examples of custom controls include `TreeView` controls and custom file open dialogs for a particular file type.

The creation of custom controls is something you have to worry about less now, given the vast amount of controls provided with ASP.NET 2.0, and for that reason they are not covered in this book.

> *For in-depth discussion of custom controls, consult* Professional ASP.NET 2.0 *by Bill Evjen, et al, from Wrox Press.*

Summary

This chapter has taken a slightly more theory-heavy slant than previous chapters. I make no apologies for this; the only way developers can learn their trade well is by learning the best practices. This chapter has been all about componentization and code reuse. You have looked at four strategies for these. The first was the use of code-behind. The main reason for using code-behind is to separate the web page's design, style, and user interface from the main structure and the code of the web site. The second was using the `ObjectDataSource` control to create a separate business layer and data layer in your application. This was the next step, separating your application into an interface, a business rules layer, and a data layer. Third was the idea of centralizing all of our data access code into one component that could be deployed across different applications. Finally, you looked a user controls and how the use of user controls promotes code-reuse.

While this chapter has delved a lot into theory, it has been teaching you the way you should code and the techniques you should employ. Good applications are ones that contain as little code as possible, that don't repeat the same code and ultimately run quicker, have fewer bugs and are easier to maintain, and possibly even easier for the end-user to use. The next chapter examines another new feature in ASP.NET 2.0, that of profiles and roles.

Exercises

1. Create a new web site and a new page called `CodeBehind.aspx` with a single label, but making sure that you don't check the box marked Placed Code in a Separate File. Now create a code-behind file manually for that page that displays the content of the label.
2. How would you go about adding an image to accompany each news item? Note that it shouldn't display if there is no news image present for that article.

11

Roles and Profiles

Back in Chapter 4, you learned how ASP.NET handles simple user accounts, how access to a site can be controlled on a user-by-user basis, and how to group users into roles and control access to a site through the use of roles. Using the ASP.NET Web Site Administration Tool, you have the ability to define user accounts, administer roles, and set security permissions all in one central location. This chapter revisits the concept of roles and looks at how accounts and roles are used in Wrox United. You also learn how to control program logic and flow based on which roles the current user is a member of, all using code.

Additionally, because you should now feel comfortable working with .NET code, this chapter takes you on a tour of user profiles. The user profiles that you can create in ASP.NET can store additional information on a user-account-by-user-account basis; for example, a user's favorite football team or favorite color. You'll recall that, back in Chapter 5, the concepts of styling controls and pages using central themes were discussed; in this chapter, one of the items you'll be adding to user profiles is the preferred theme to use for a specific web site.

In this chapter, you learn how to:

- Manage site accessibility on a role-by-role basis in code
- Use roles effectively in a site, using the Wrox United site as an example
- Employ user profiles to store additional information about a user
- Work with profiles in code to store and apply favorite themes to a site

This chapter revisits Wrox United and introduces the Fan Club page to the site. In this page, you'll learn how to display different content depending on which role a user is a member of, and how to update a user's profile. You'll also make use of the powerful `LoginView` control, which simplifies the process of displaying different content dependent on role membership.

The Importance of Roles

A *role* is a key concept to understand when you do any work on a system that involves working with user accounts. In any organization, user accounts are likely to be assigned to roles that relate to the type of user account. For example, if you look at the local user accounts set up on your PC, you will find lists of different types of groups; for example, users, power users, and administrators. In a simple Windows domain-based network, you may find that all corporate users are members of the Domain Users role. Certain user accounts in a network may be members of a different group — for example, your system administrators may be members of the Domain Administrators group, enabling them to administer the users in the company domain. Figure 11-1 displays the groups available to a fairly basic Windows XP installation; each user account can be a member of zero or more groups.

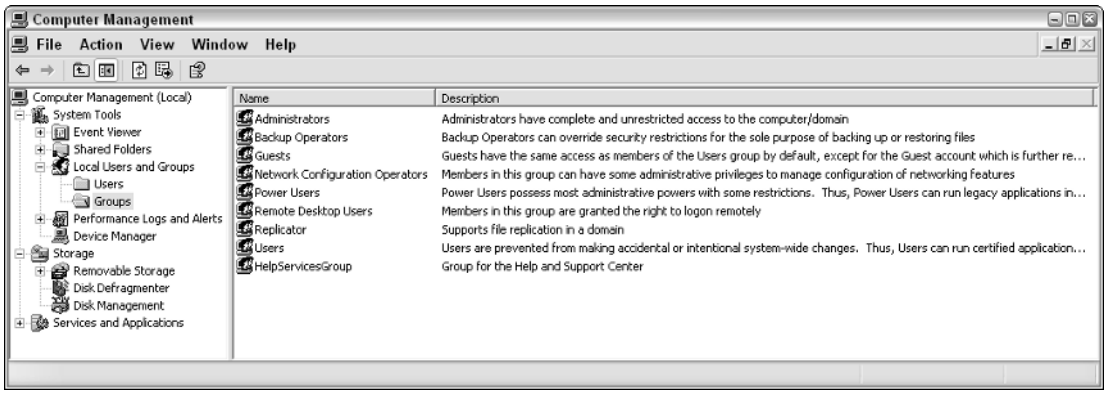


Figure 11-1

Because each user account can be a member of more than one group, if required, Figure 11-2 shows an example of an account on the same machine.

Figure 11-2

Notice that the user displayed here is a member of both the Power Users and Remote Desktop Users groups. This means that the user (called Chris) can log in via a Remote Desktop session (if remote connections are allowed), and can perform most day-to-day administration tasks, with some restrictions, required on the computer.

The ability to group users together into related roles simplifies the process of administration. If my administrator wanted to grant a specific permission to all the members of the development team at the office where I work, he could either assign those permissions to each one of the 12 user accounts individually, or he could add us all to a "Developers" role, and grant that one permission to the role. It's a simple and logical way to work, and you will almost always have to consider which roles a user is a member of when you develop an application.

One of the most important roles you will come across is that of the Administrator. An Administrator can pretty much do anything to an application or a system. For this reason, you can rejoice in the ability to log in as an Administrator to fix a problem that can only be fixed with a specific set of permissions. However, you need to be very aware of permissions when you develop applications because it's potentially dangerous from a security perspective. Code running with full privileges can modify a system to the point where the system is completely destroyed — you don't want to end up deleting the entire contents of your Windows directory, or formatting your hard drive accidentally.

The best practice to adopt is that of lowest-privilege; start with a low-privilege user account and add only those permissions that are required by the application. The default settings in ASP.NET mean that the code that runs ASP.NET web applications will have a limited set of privileges by default, and IIS6 (the web server provided with Windows Server 2003) is locked down tight when you first install it, so you have to actually enable ASP.NET when you install it just to run ASP.NET web applications. That doesn't mean that you can sit back and keep running as an administrator the whole time — try logging in as a user who is only a member of Power Users, or, better still, the Users group, and test your code regularly. Never assume that an application is working without having tested it as a completely different user.

Introducing Roles in Wrox United

In the full Wrox United application, you'll recall that roles have been configured to enable different levels of access to the site. Each user account that is defined has a different level of access, whether it's as a site administrator or a fan club member. Time to recap a little on what you achieved in Chapter 4 — if you open up the Wrox United application source in VWD and select Website ➪ ASP.NET Configuration, you'll see the list of current users, the list of roles, and you can explore each user account to see their roles. Figure 11-3 shows the list of roles defined in the preconfigured Wrox United application.

> *These screenshots were taken from the user configuration stored in the* `Chapter11` *version of the site, though the configuration is the same in the full version of the site.*

So, that's a total of five different roles. If you look at the users defined in the application, you'll find that there are seven different users: ChrisH, ChrisU, Dan, Dave, Jim, John, and Lou. Now, because users can be members of more than one role, and roles can have more than one member, that's quite a few possible combinations. Clicking the Manage link shown next to each role in Figure 11-3 displays all members of a role. Figure 11-4 displays the list of FanClubMembers.

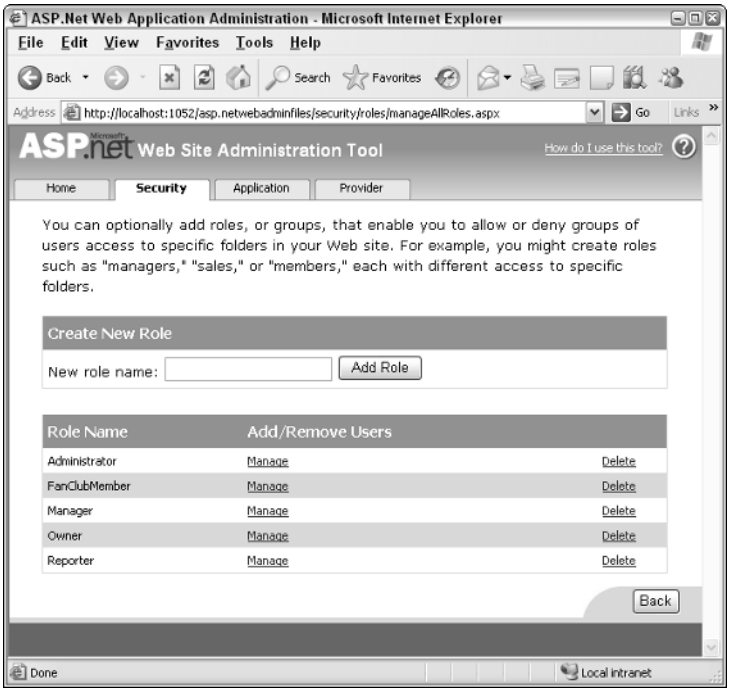


Figure 11-3

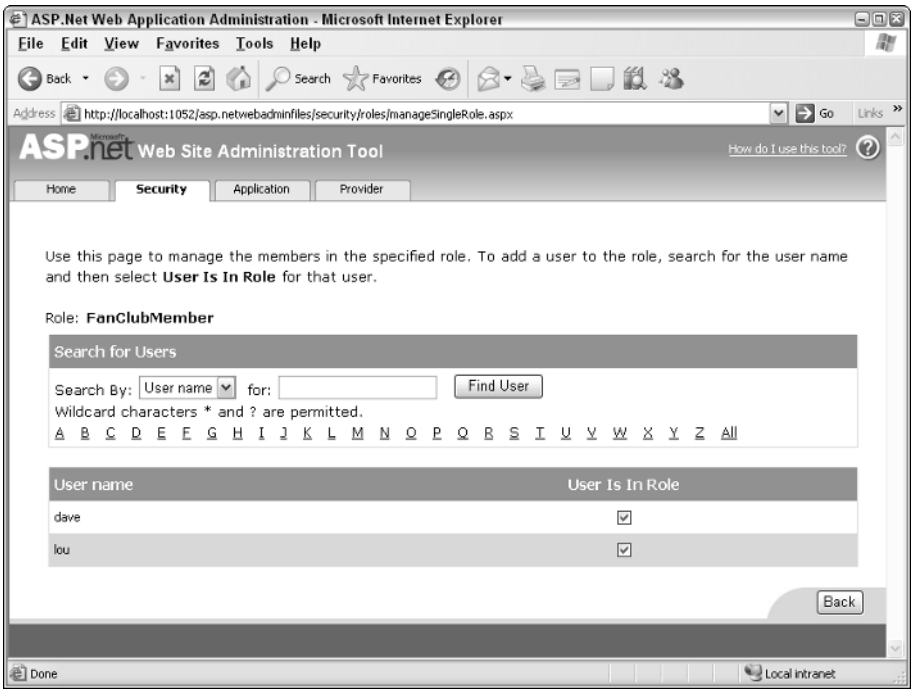


Figure 11-4

You can continue to explore each of the user accounts and roles to see who is a member of each group, so you can discover (among other things) that

- ChrisH, ChrisU, Dave, and John are reporters.
- Dave is a member of all groups, hence he's the "super user" (who can access all areas of the site — great for testing!).
- Lou is only a member of the Fan Club; hence she is the only true fan of the team.
- Dan's the team's manager and Jim's the owner.

After digging through the site configuration, in the Access Rules section, you'll also recall that the Admin section of the site was restricted so that only site administrators could enter that part of the site. Additionally, the Fan Club was restricted so that only members could see the fan club–specific links available in the fan club section.

In the next example, you'll get to use this configuration and try it out for yourself. The Fan Club for Wrox United is a good place to start.

In the following Try It Out, you build the skeleton for the Fan Club page and see how different users will see a different version of the page, depending on whether they are logged in, and, if the user has logged in, the current user's identity.

Try It Out — The Wrox United Fan Club

1. Open up the chapter version (in C:\BegASPNET2\Chapters\Begin\Chapter11\WroxUnited folder) of the Wrox United application and run the site by pressing Ctrl+F5.
2. Log in to the site as Lou; use the password lou@123. There is a link to the Fan Club (`FanClub.aspx`) in the menu on the left (shown in Figure 11-5), and to the two sub-pages, `FanClubMatchReport.aspx` and `FanClubPictures.aspx`.

   At the moment, the pages are looking a bit empty, so it's time to start adding some code.
3. Open up `FanClub.aspx` in Visual Web Developer and switch to Design View.
4. Drag a `LoginView` control onto the page, as shown in Figure 11-6.
5. Rename the control `FCLoginView`.
6. You're going to create three different views on this page:
   - **AnonymousTemplate:** Anonymous visitors will be asked to purchase a Fan Club membership before they can access the fan club pages.

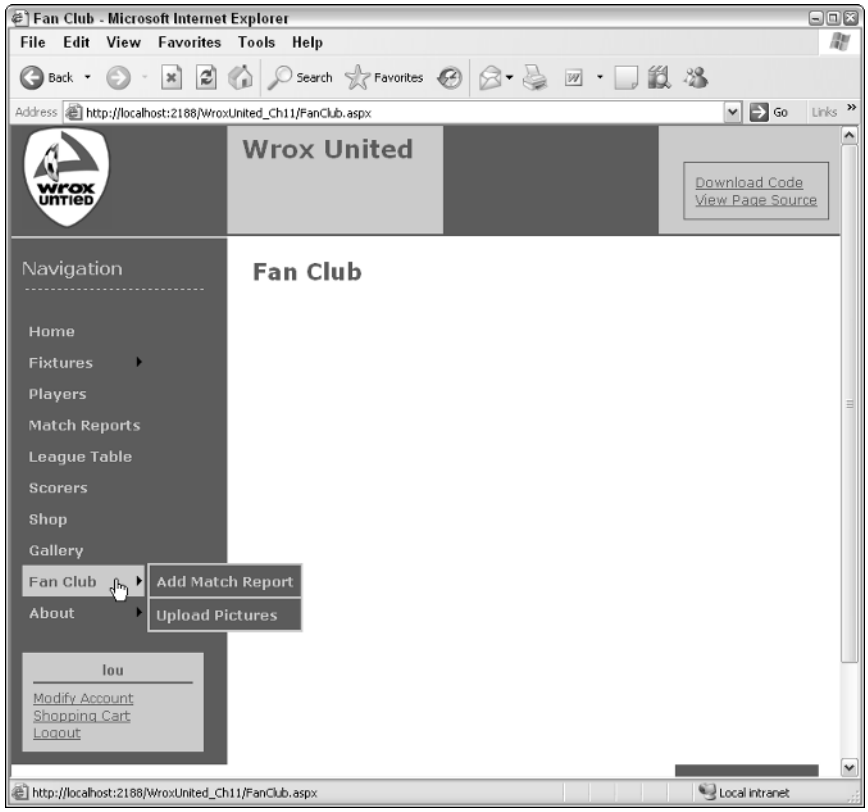


Figure 11-5

- **Administrator/Manager/Owner/Reporter:** All logged-in users who are not members of the Fan Club will be told to contact the administrator of the site to gain access to the fan club.
- **FanClubMembers:** Members of the Fan Club will be able to change their passwords and to update their profiles (you add this part later in the chapter).

7. In the Common Tasks box of the `LoginView` control (the flyout highlighted in Figure 11-6), click the Edit RoleGroups link. In the dialog that appears (shown in Figure 11-7), you can enter the details for the two custom role groups. Click the Add button to add a new group, then click the ellipsis next to the Roles property on the right and enter `FanClubMember` in the dialog that appears.

8. Repeat the process and enter `Administrator`, `Owner`, `Manager`, and `Reporter`, each on separate lines in the pop-up, as depicted in Figure 11-8.

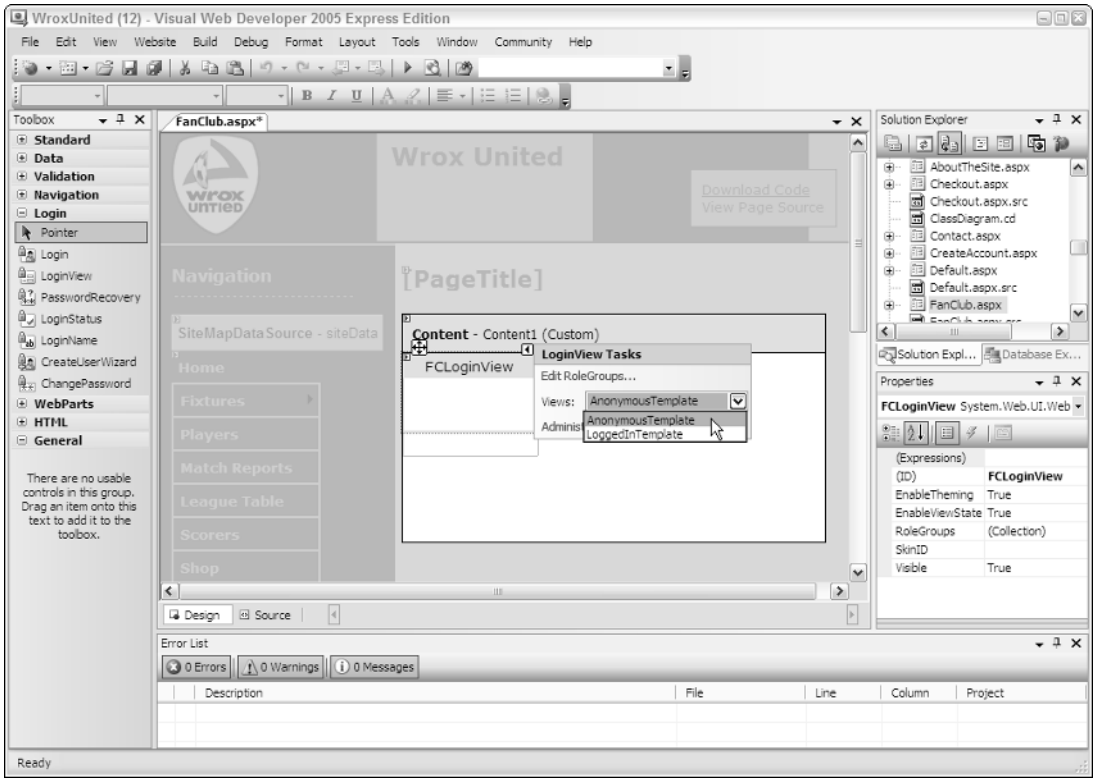


Figure 11-6

Click OK to close the dialogs and you'll be returned to the Design View for the page.

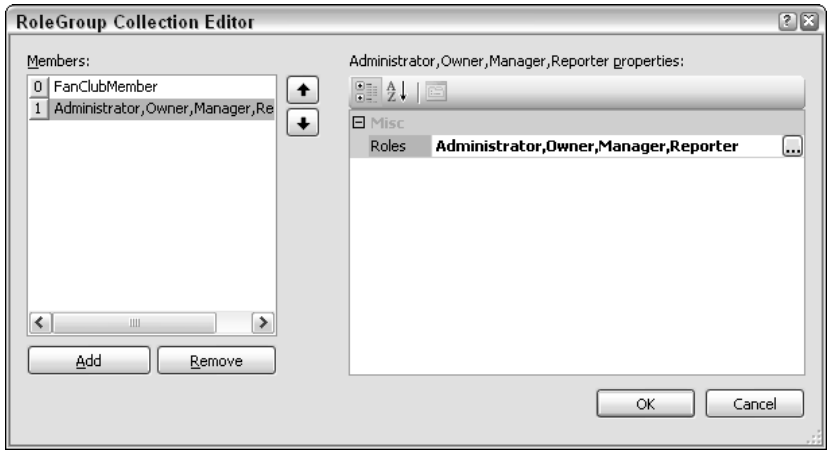


Figure 11-7

Figure 11-8

9. Back in the Common Tasks box of the `LoginView` control (refer to Figure 11-6), select the AnonymousTemplate from the View drop-down and enter just a few words of text in the body of the control (see Figure 11-9).

   When you flick back to Source View you will now see the following code:

```
<%@ Page Language="VB" MasterPageFile="~/site.master" AutoEventWireup="false"
CodeFile="FanClub.aspx.vb" Inherits="FanClub" Title="Fan Club" %>
<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="Server">
  <asp:LoginView ID="FCLoginView" runat="server">
    <RoleGroups>
      <asp:RoleGroup Roles="FanClubMember">
      </asp:RoleGroup>
      <asp:RoleGroup Roles="Administrator,Owner,Manager,Reporter">
      </asp:RoleGroup>
    </RoleGroups>
    <AnonymousTemplate>
      This is the anonymous template
    </AnonymousTemplate>
  </asp:LoginView>
</asp:Content>
```

10. Stay in Source View and enter the following lines of code — this will make sure you have some visible content displayed no matter who views the site:

```
  <asp:LoginView ID="FCLoginView" runat="server">
    <RoleGroups>
      <asp:RoleGroup Roles="FanClubMember">
        <ContentTemplate>
          <p>
            Welcome back
            <asp:LoginName ID="FCLoginName" runat="server" />
            .</p>
          <p>
            There are always lots of exciting things happening with the fan club,
            most of which you already know from the email we regularly send out.
            One that hasn't made it to the email yet is the proposed end of season
            BBQ - a great excuse for a summer party (not that we really need an
            excuse). This will be open to all members of the public and tickets
            will be heavily discounted for fan club members as a thank you for all
            of the great support you've given the club. The date hasn't yet been
            set, but keep your eyes on your inbox for more details.
```

```
            </p>
          </ContentTemplate>
        </asp:RoleGroup>
        <asp:RoleGroup Roles="Administrator,Owner,Manager,Reporter">
          <ContentTemplate>
            To see the Fan Club features you need to be a member. As special users
            you get free entry to the fan club – talk to the admin people to get set
            up.
          </ContentTemplate>
        </asp:RoleGroup>
      </RoleGroups>
      <AnonymousTemplate>
        <p>
          The fan club provides a way for you to show your devotion to the club, and
          gains you exclusive privileges. You get discounts on match tickets and at
          the club store, as well as having the opportunity to meet up with
          like-minded fans.
        </p>
        <p>
          Membership to the Fan Club can be bought from
          the <a href="Shop.aspx"> Club Shop</a>. Once membership has been received
          we'll enable your account as a Fan Club Member.
        </p>
      </AnonymousTemplate>
    </asp:LoginView>
```

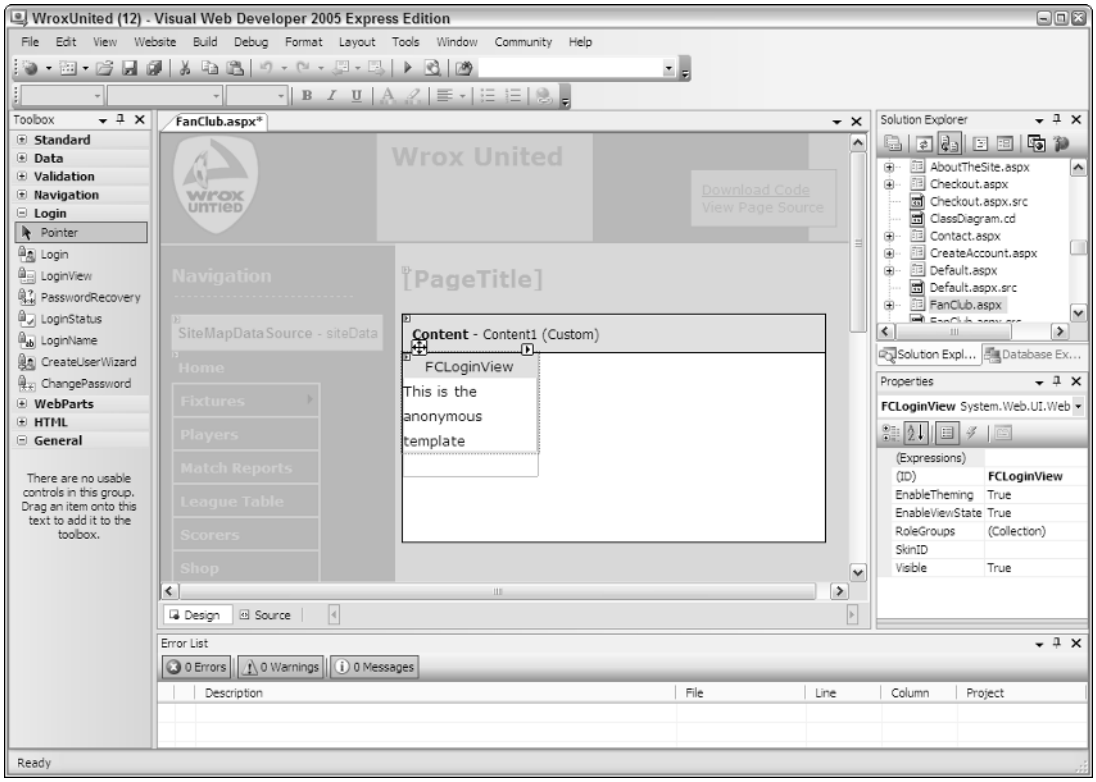


Figure 11-9

11. Time to run the page and see how this works! Launch the site from VWD and, before you log in, go to the Fan Club page as an anonymous user. You should see the screen shown in Figure 11-10.

12. Log in to the site as ChrisH, using the password chrish@123. You will now see the screen in Figure 11-11.

13. Finally, log out, and then log back in as Lou, using password lou@123. You'll be presented with the welcome screen shown in Figure 11-12.

How It Works

The `LoginView` control, which you first met in Chapter 4, is a great way of displaying content that is directly related to the user who is currently viewing a page. In this example, you've added code so that three possible views are available of the Fan Club home page.

Figure 11-10

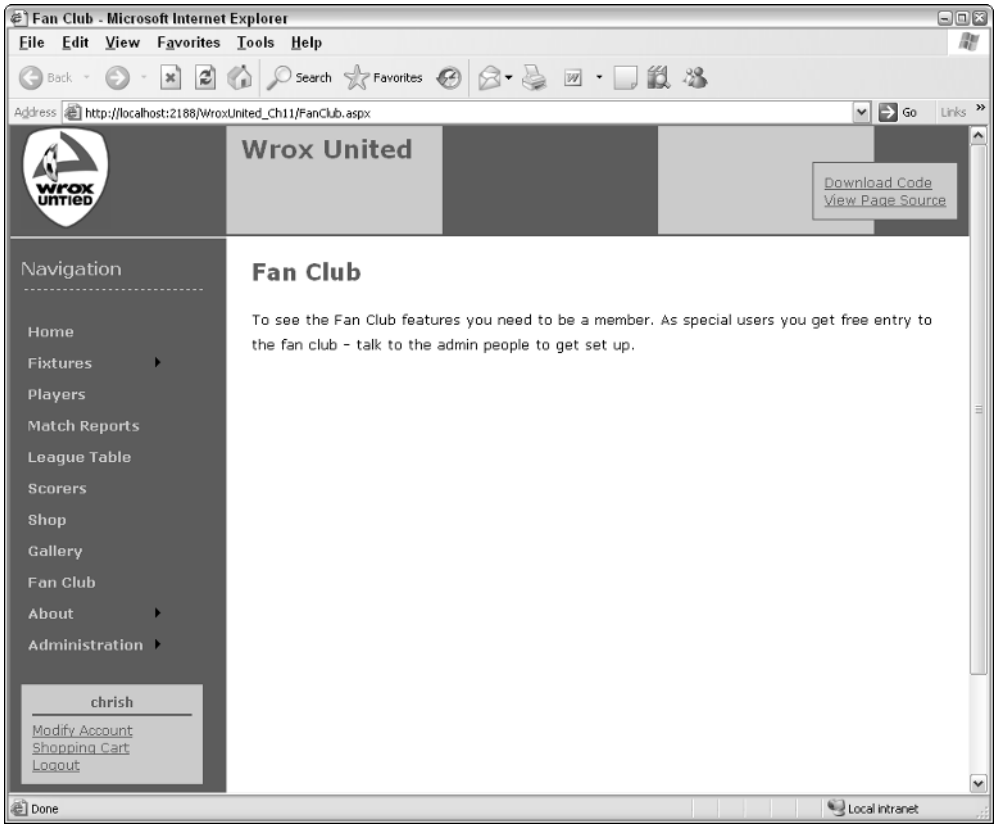


Figure 11-11

If the user is anonymous, the anonymous template is used:

```
<AnonymousTemplate>
  <p>
    The fan club provides a way for you to show your devotion to the club, and
    gains you exclusive privileges. You get discounts on match tickets and at
    the club store, as well as having the opportunity to meet up with like
    minded fans.
  </p>
  <p>
    Membership to the Fan Club can be bought from
    the <a href="Shop.aspx">Club Shop</a>. Once membership has been received
    we'll enable your account as a Fan Club Member.
  </p>
</AnonymousTemplate>
```

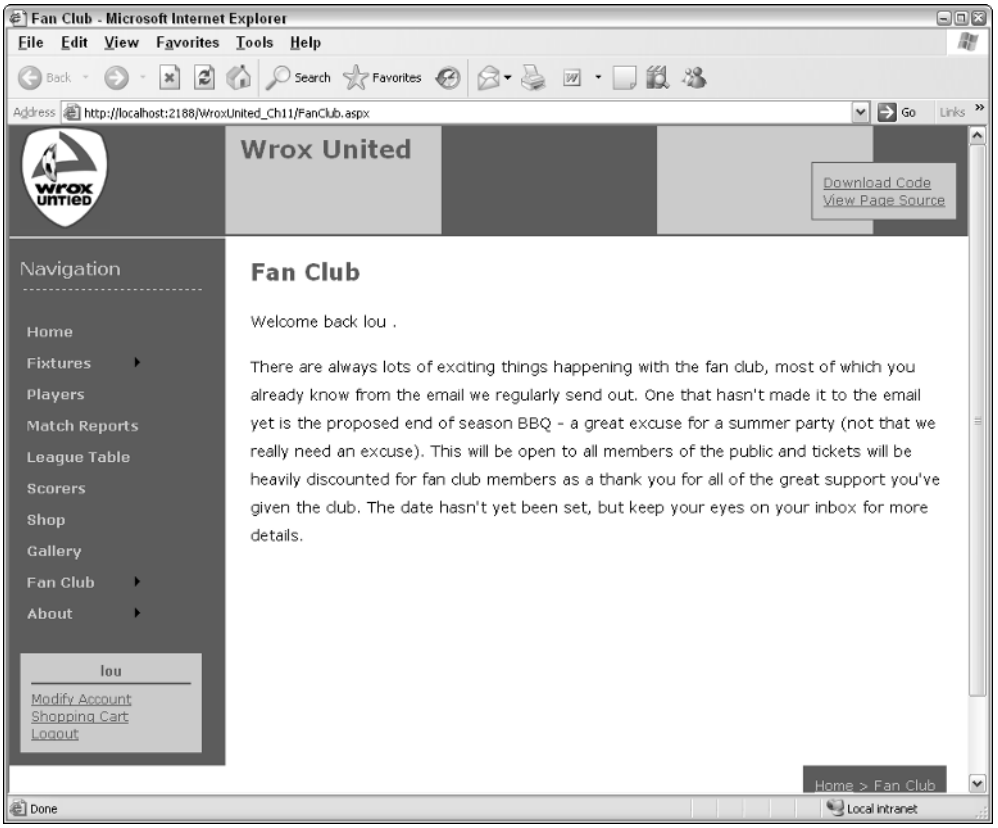


Figure 11-12

If the user has logged in, it's fairly safe to assume that he is a member of a group, and hence he will see a different page depending on which roles he belongs to:

```
<RoleGroups>
  <asp:RoleGroup Roles="FanClubMember">
    <ContentTemplate>
      <p>
        Welcome back
        <asp:LoginName ID="FCLoginName" runat="server" />
        .</p>
      <p>
        There are always lots of exciting things happening with the fan club,
        most of which you already know from the email we regularly send out.
        One that hasn't made it to the email yet is the proposed end of season
        BBQ - a great excuse for a summer party (not that we really need an
        excuse). This will be open to all members of the public and tickets
        will be heavily discounted for fan club members as a thank you for all
        of the great support you've given the club. The date hasn't yet been
        set, but keep your eyes on your inbox for more details.
      </p>
    </ContentTemplate>
  </asp:RoleGroup>
```

Fan Club members will see a custom page with some text. There's not a lot on here yet, but that will change later in this chapter when you learn about user profiles. These profiles can be used to store additional information about a user, so the fan club page will become a central place for site members to come so that they can modify their profiles.

If the user is a member of one of the other roles (Administrator, Owner, Manager, or Reporter), the user will see a different display:

```
    <asp:RoleGroup Roles="Administrator,Owner,Manager,Reporter">
      <ContentTemplate>
        To see the Fan Club features you need to be a member. As special users
        you get free entry to the fan club - talk to the admin people to get set
        up.
      </ContentTemplate>
    </asp:RoleGroup>
  </RoleGroups>
```

If you wanted to extend this part of the site, perhaps you could include a button or a link that would fire an e-mail to the site administrator, indicating your interest in joining the fan club.

This example demonstrates how simple and easy it is to change the appearance of a page, depending on who is logged in to the site. There are some drawbacks to this technique, however, which you'll see when you look at extending the display for fan club members to show and edit their profile details.

So, you can change the display of a site by user roles. The next step is to lock down parts of the site by role, and work with role-level access to the site.

Configuring Page-Level Authorization

Managing general application access via the Web Site Administration Tool (see Figure 11-13) controls access to folders. Previously (back in Chapter 4), you learned how to restrict access to the pages contained within the Admin folder to deny all unapproved users access to those pages.

This general level of restriction is fine for hiding the contents of a directory, but configuring who can access each page is controlled in the `Web.config` file for each folder.

In the Admin folder in the code for the full Wrox United application, you will find a `Web.config` file. The following statements appear in this file:

```
<system.web>
  <authorization>
    <deny users="*" />
  </authorization>
</system.web>
<location path="Admin.aspx">
  <system.web>
    <authorization>
```

```
        <allow roles="Reporter,Administrator,Owner,Manager" />
      </authorization>
    </system.web>
  </location>
```

The first part of this extract reflects the setting applied in the site administration tool, denying all users access:

```
      <deny users="*" />
```

The second part of the extract applies access permissions to a specific page — the `Admin.aspx` page, in this case. The users who are allowed to view the `Admin.aspx` page include anyone who is a member of any of the Reporter, Administrator, Owner, or Manager roles:

```
        <allow roles="Reporter,Administrator,Owner,Manager" />
```

And so the pattern continues for the remainder of the configuration file, where access to each page is controlled by the configuration file, enabling access permissions to be set for each role against each page in the hierarchy.

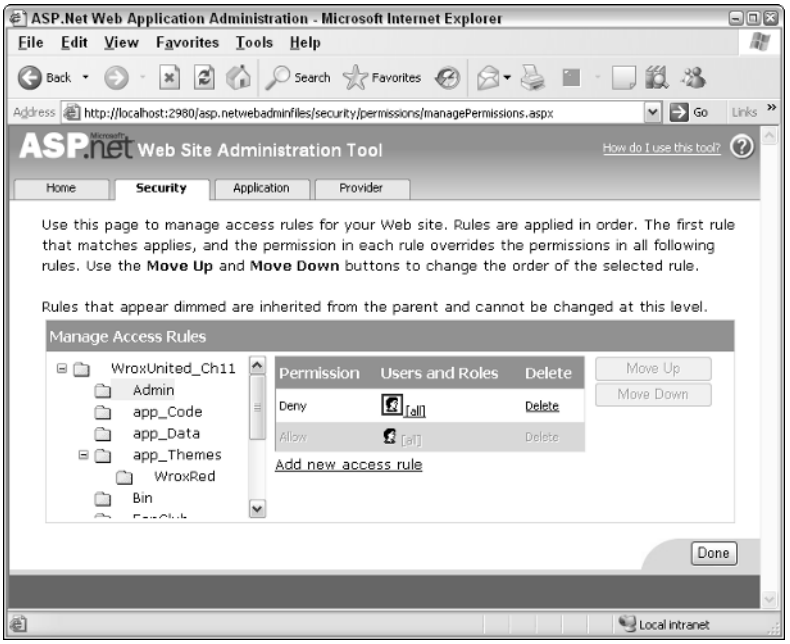


Figure 11-13

Controlling Page Visibility

There may be some situations where you will want to allow a user to know of the existence of a page, even if the user is denied access to it. In this way, you can offer a link to users, but when they click that link, they are prompted to log in as a user with sufficient privileges before they can view the page. In order to achieve this, a `roles` attribute (see the shaded lines in the following code) can be added to the `web.sitemap` file, which ensures that a link will be visible to certain users to specified pages, even if the user is unable to view the content of the page itself. As an example:

```
<siteMapNode title="Administration" url="Admin/Admin.aspx"
             roles="Reporter,Owner,Manager,Administrator">
  <siteMapNode title="Edit News" url="Admin/EditNews.aspx"
               description="Edit club news"
               roles="Reporter,Owner,Manager,Administrator" />
  <siteMapNode title="Schedule Match" url="Admin/ScheduleMatch.aspx"
      description="Schedule a Match"
      roles="Manager,Owner" />
```

Notice that the `roles` attribute on the `Admin.aspx` page states that Reporters, Owners, Managers, and Administrators should be aware of the existence of the `Admin.aspx` page. Contrast this with the `ScheduleMatch.aspx` page, and you'll see that only Managers or Owners can see the link to be able to schedule matches.

If you log in to the site as ChrisH, you're a member of the Reporter role, so even if all access to all admin pages is revoked, you will still see links to the `Admin.aspx` and `EditNews.aspx` pages, but you won't see a link to the `ScheduleMatch.aspx` page.

Because the `Web.config` file and the `roles` attributes in the `web.sitemap` work together to control both visibility and access, the best way to understand how they work together is to see them in an example!

For this Try It Out, make sure you are using the Chapter 11 version of the Wrox United code. The code that has been supplied for this example has been modified slightly for the purposes of this example.

Try It Out — Configuring Visibility, Access, and Authorization

1. First, take a look at the code in the `web.sitemap` file. This file contains the same code that is used in the live Wrox United application. This is an extract from that file, highlighting the use of the `roles` attribute:

```
...
    <siteMapNode title="Fan Club" url="FanClub.aspx">
      <siteMapNode title="Add Match Report" url="FanClub/FanClubMatchReport.aspx"
                   description="Add a match report"
                   roles="FanClubMember" />
      <siteMapNode title="Upload Pictures" url="FanClub/FanClubPictures.aspx"
          description="Upload pictures or video of a match"
          roles="FanClubMember" />
    </siteMapNode>
...
```

```
    <siteMapNode title="Administration" url="Admin/Admin.aspx"
                 roles="Reporter,Owner,Manager,Administrator">
      <siteMapNode title="Edit News" url="Admin/EditNews.aspx"
                   description="Edit club news"
                   roles="Reporter,Owner,Manager,Administrator" />
      <siteMapNode title="Schedule Match" url="Admin/ScheduleMatch.aspx"
          description="Schedule a Match"
          roles="Manager,Owner" />
      <siteMapNode title="Edit Squad" url="Admin/EditSquad.aspx"
          description="Edit the players in the squad"
          roles="Owner" />
      <siteMapNode title="Update Score" url="Admin/MatchScore.aspx"
          description="Edit the score for a match in progress"
          roles="Reporter" />
      <siteMapNode title="Match Report" url="Admin/MatchReport.aspx"
          description="Upload or edit a match report"
          roles="Reporter" />
      <siteMapNode title="Shop" url="Admin/UpdateProducts.aspx"
                   description="Update products"
                   roles="Administrator" />
    </siteMapNode>
...
```

2. The next step is to take a look at the `Web.config` stored in the root of the Admin folder — notice that no specific locations are defined in this file, hence the only permission currently active on that folder is to deny access to all users:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <system.web>
    <authorization>
      <deny users="*" />
    </authorization>
  </system.web>
</configuration>
```

The result of these two configuration specifications is demonstrated if you run the site and log in, as I have, as ChrisH (password chrish@123). Take a look at Figure 11-14.

I'm a reporter, so I can see the Administration link, and I can see the links to Edit News, Update Score, and Match Report. However, if I click any of those links, I go straight back to the front page of the site — access has been denied!

3. The next step is to allow access to certain resources in the Admin section of the site by role. Open up the `Web.config` for the Admin folder and add just the following highlighted code:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
  <system.web>
    <authorization>
      <deny users="*" />
    </authorization>
  </system.web>
```

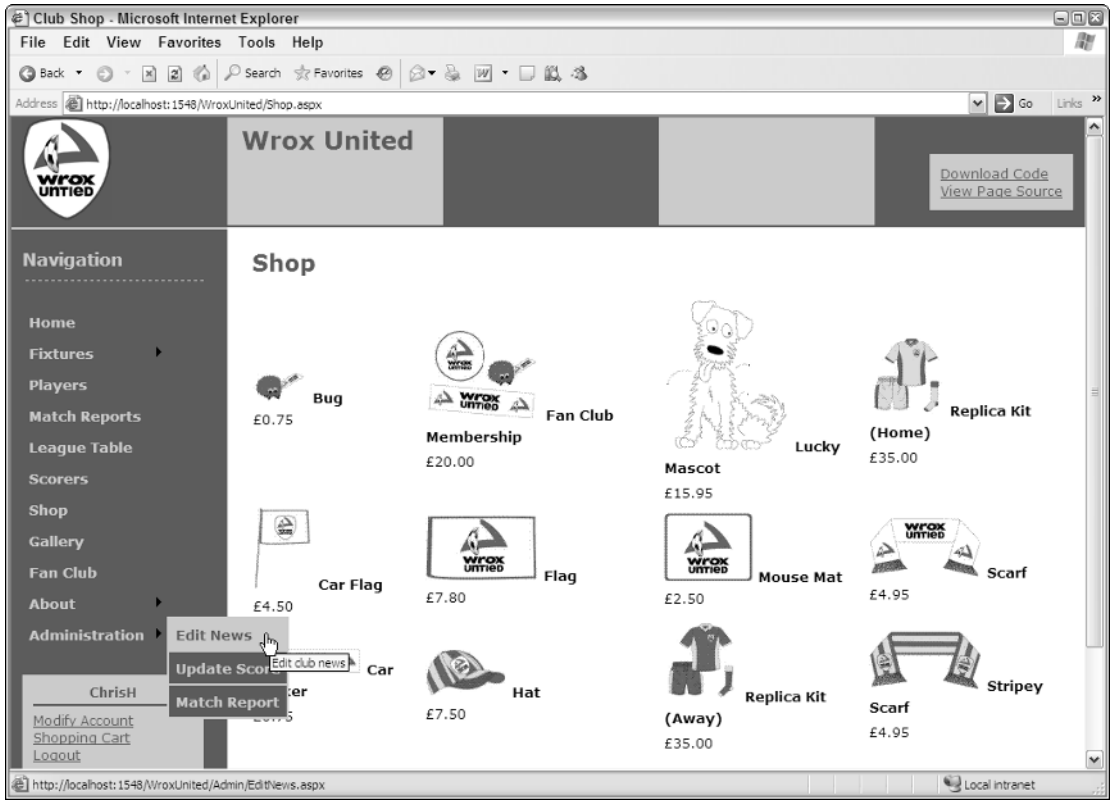


Figure 11-14

```
    <location path="Admin.aspx">
      <system.web>
        <authorization>
          <allow roles="Reporter,Administrator,Owner,Manager" />
        </authorization>
      </system.web>
    </location>
</configuration>
```

Log in to the site again as ChrisH and you will now be able to click the Administration link itself and see the `Admin.aspx` page, shown in Figure 11-15.

The only problem is that you still can't actually update scores or match reports until you add the remaining permissions.

Figure 11-15

4. Add the following code to complete the `Web.config` file for the Admin section — and notice that one of the permissions isn't quite correct:

```
...
   <location path="Admin.aspx">
    <system.web>
      <authorization>
        <allow roles="Reporter,Administrator,Owner,Manager" />
      </authorization>
    </system.web>
  </location>
  <location path="EditNews.aspx">
    <system.web>
      <authorization>
        <allow roles="Reporter,Administrator,Owner,Manager" />
      </authorization>
    </system.web>
  </location>
  <location path="MatchScore.aspx">
    <system.web>
```

```
        <authorization>
          <allow roles="Reporter" />
        </authorization>
      </system.web>
    </location>
    <location path="MatchReport.aspx">
      <system.web>
        <authorization>
          <allow roles="Reporter" />
        </authorization>
      </system.web>
    </location>
    <location path="EditSquad.aspx">
      <system.web>
        <authorization>
          <allow roles="Owner,Reporter" />
        </authorization>
      </system.web>
    </location>
    <location path="ScheduleMatch.aspx">
      <system.web>
        <authorization>
          <allow roles="Owner,Manager" />
        </authorization>
      </system.web>
    </location>
    <location path="UpdateProducts.aspx">
      <system.web>
        <authorization>
          <allow roles="Administrator" />
        </authorization>
      </system.web>
    </location>
    <location path="UserAdmin.aspx">
      <system.web>
        <authorization>
          <allow roles="Administrator" />
        </authorization>
      </system.web>
    </location>
    <location path="CreateUser.aspx">
      <system.web>
        <authorization>
          <allow roles="Administrator" />
        </authorization>
      </system.web>
    </location>
</configuration>
```

In the permissions for the `EditSquad.aspx` page, notice that the Reporter role has just been granted access. The `web.sitemap` page hasn't been modified, so see if you can guess what will be displayed when the page is run! Try it again, logging in as ChrisH once more and see what happens (see Figure 11-16).

Figure 11-16

Here's the final result — not only can you see the Edit Squad link, but you can actually go to the Edit Squad page and modify members of the squad! Make just one last change to fix this problem. After all, reporters aren't supposed to be able to modify membership of a team.

5. Open the Admin folder's `Web.config` file once more and edit the following highlighted line:

```
<location path="EditSquad.aspx">
  <system.web>
    <authorization>
      <allow roles="Owner" />
    </authorization>
  </system.web>
</location>
```

Run the site again, and you will find that if you log in as any of the users who are only members of the Reporters role (ChrisH, John, or ChrisU), you will be able to view the Edit News, Update Score, and Match Report links and page content.

6. One last change to make. This time, modify the `web.sitemap` file as follows:

```
    <siteMapNode title="Match Report" url="Admin/MatchReport.aspx
                 description="Upload or edit a match report"
                 roles="Reporter" />
    <siteMapNode title="Shop" url="Admin/UpdateProducts.aspx"
                 description="Update products"
                 roles="Administrator, Reporter" />
</siteMapNode>
```

Now run the page one last time and log in as a Reporter. You will be able to see the link to the Shop page in the Administration section, but if you click the link, you will be taken straight back to the default page!

Before finishing the example, fix this by removing the Reporter role from the `SiteMapNode` for the `UpdateProducts.aspx` page.

How It Works

This example highlights the somewhat delicate nature of keeping your `web.sitemap` and `Web.config` file data up to date with current business case requirements. If you want to allow users to browse a site anonymously, a common configuration decision is to prompt users when it's time for them to log in, then display a link that they will want to click but forcing them to authenticate before enabling them to view the page.

In this example, you have seen that the settings for authorization will control which links are available to each user role. The `web.sitemap` file then can be used to display additional links to a user — links to content that the user doesn't have permission to access, to indicate that a facility exists (in this case, the Update Products facility in the Admin section) but that the user needs to log in as a sufficiently privileged user before the link will work.

Here's a look at the most important bits in the code. From the `Web.config` file for the Admin folder on the site, the shaded lines of code specify that only administrators can add or update products:

```
    <location path="UpdateProducts.aspx">
      <system.web>
        <authorization>
          <allow roles="Administrator" />
        </authorization>
      </system.web>
    </location>
```

Compare this with the addition to the `siteMapNode` that was made in the last part of the example:

```
   <siteMapNode title="Shop" url="Admin/UpdateProducts.aspx"
                description="Update products"
                roles="Administrator, Reporter" />
```

This particular combination results in a reporter being able to see a link, but being unable to access the contents of the link.

If the opposite is true, and the authorization level specified in the `Web.config` file contains more roles than the `web.sitemap` file, the authorization will take precedence. Hence, when you changed the permissions for the `EditSquad.aspx` page and logged in as a Reporter, the link appeared in the navigation menu, and the page could be accessed:

```
<location path="EditSquad.aspx">
  <system.web>
    <authorization>
      <allow roles="Owner,Reporter" />
    </authorization>
  </system.web>
</location>
```

Working with Roles in Code

Up to this point in the chapter, all of the customization that you've looked at has concerned the use of configuration files to lock down access to parts of the site based on user roles. In addition to these techniques, it's possible to work with roles programmatically in code. This technique has been employed to some extent in the process of applying discounts to shop prices for members of the Fan Club. Many other different methods exist that you can use for working with roles, but the most commonly used is the `IsInRole()` method.

The following code extract (which you will encounter again in Chapter 13) shows this in action:

```
Public ReadOnly Property MemberDiscount() As Double
  Get
    If HttpContext.Current.User.IsInRole("FanClubMember") Then
      Return SubTotal * MemberDiscountPercentage
    Else
      Return 0
    End If
  End Get
End Property
```

This code resides within the `Shopping.vb` class file used when users purchase items from the shop. The important piece in this code is the statement that applies the discount to users who are members of the Fan Club, using the `User.IsInRole()` method call.

The `IsInRole()` method takes, as an input, a string that is the name of the role to test. As the name of the method suggests, the result will indicate whether or not the user belongs to the role, hence the return value for the method is either `true` (yes, the user belongs to the requested role) or `false` (no, the user is not a member of that role). This useful technique is used again as part of the shopping process:

```
If Context.User.IsInRole("FanClubMember") Then
  SubTotalLabel.Text = String.Format("Sub-Total:{0,35:C}", Profile.Cart.SubTotal)
  MemberDiscount.Text = String.Format("Member Discount:{0:C}", _
                                      Profile.Cart.MemberDiscount)
  DiscountPanel.Visible = True
End If
```

In this extract (from `ShoppingCart.ascx.vb`), the same test is made. There are slight differences between the two calls. The first employs the `HttpContext.Current` object:

```
If HttpContext.Current.User.IsInRole("FanClubMember") Then
...
```

And the second call employs the `Context` object:

```
If Context.User.IsInRole("FanClubMember") Then
...
```

You don't really need to worry about why there is a difference between the two method calls in the context of this chapter, because the actual method that is being called is the same in both cases. However, in case you are of a more inquisitive nature, here's what's going on.

In the first case, because the code lives within a separate class file (not a code-beside file for an aspx page or ascx user control), the code could theoretically be called by a different application entirely, outside of the Web environment. When users request a web page, they do so within a context. This context will contain a small amount of information along with each request that the user makes, which is understood by the web server. If the user is anonymous, the server will know that the current context represents an anonymous user; if the user has logged in, this small bit of information indicates that the request has come from an authenticated user. So, the context of a logged-in user states that the request comes from a specific user ID, which ASP.NET can interrogate to find out which roles the user belongs to.

The current context is freely available to web pages and user controls, but classes need to be told a bit more information before they will compile. The actual context that's being used on the web page is the current context of the HTTP request, hence the class needs to have the `HttpContext.Current` version of the context, rather than the context that is available to all requests to a web page.

Enabling User Profiles

Enabling roles on a web site is a good way to open up or hide resources to users, and it also provides limited metadata about the users themselves. Just by being a member of the Reporters group, you can assume that John regularly attends matches and submits scores as they happen. However, this is very limited metadata, and it doesn't give us much more insight into who John is, or what he is interested in. This is where you can start to adopt ASP.NET's user profiles technology to store more information about a user.

For example, if you are a member of a web site that sells a wide variety of goods, you can buy goods from that site by creating a very basic user profile that validates your e-mail address, and can be used to process and track orders. However, on many shopping sites, you can take this "enrollment" process much further and supply additional information to your user account and say, "I like products like this." When you revisit the site, you may then find that the front page changes to show you more items that you are interested in buying, and less of those you're not so bothered about.

This sort of information can be used to extend a simple user account by creating a user profile for storing this additional information; hence I can specify that I have no interest in owning a PlayStation or Xbox, because I only play games on my PC, and the site will be less likely to show me offers related to PS2 or

Xbox editions of games. Furthermore, the sales team behind the web site may send out targeted e-mails to customers who have expressed an interest in a certain type of product, with the aim of increasing sales.

One of the uses for user profiles is to create areas of a site that are tailored specifically to the currently logged-in user, giving that user a more personalized view of the site. This technique — called *personalization* — can be used to develop a My Site style area of a web site, where you can amend your own user profile settings, and view information directly relevant to you. In larger corporations, you'll find that the idea of a personalized area of a web or intranet application is quite commonly used — anyone who has ever used SharePoint Portal Server (or similar Portal-style application) will be familiar with the idea of a My Site area.

As far as SharePoint is concerned, the My Site area of a portal can be highly customized to display your calendar and inbox (linked to an Exchange server), or to store custom lists of links to areas of the portal that you may be interested in. Although you're not going to build anything as involved as this in this book, SharePoint Portal Server is one of the best examples of personalization I've come across, and doubtless the many other Portal-style applications available for purchase will offer similar levels of personalization.

ASP.NET 2.0 has some great tools available for developing simple profiles with relative ease, so in the next section of this chapter, you'll explore how these tools can be used to customize a site, and you'll look at how the Wrox United application uses profiles.

Building a Profile

There are two parts to building a profile. The first is to define what items you want to store. The second is to add functionality to a page to both add and edit information in a user profile.

To define which items you want to store in a profile, you add a list of items, and the type of data each item will contain, to the root `Web.config` file for a site, for example:

```
<profile enabled="true">
  <properties>
    <add name="MemberName"/>
    <add name="Name"/>
    <add name="Address"/>
    <add name="City"/>
    <add name="County"/>
    <add name="PostCode"/>
    <add name="Country"/>
    <add name="Mailings" type="System.Boolean"/>
    <add name="Email"/>
    <add name="Theme"/>
    <add name="Cart" serializeAs="Binary" type="Wrox.Commerce.ShoppingCart"
allowAnonymous="true"/>
  </properties>
</profile>
```

The list of profiles specified is actually the set of properties to be stored for all registered users of the Wrox United application. The default type of data to store is textual data (string data), so for those items without a specific `type` attribute, the data type is assumed to be `string`.

Two items on this list are not strings. The first is the `Mailings` property. This is a `Boolean` value (`true` or `false`) that can be used to store a simple choice — does the user want to receive e-mail concerning the current news about the club or not? You can control the input for this value on a web page by simply including a checkbox that the user can click as a simple yes or no response to a question. This is an example of using a standard .NET type, and you could equally add profile properties using different types, such as storing an age in an `Integer`, or a date of birth in a `DateTime`.

The other non-string data type being used in this case is a custom type called Wrox.Commerce.ShoppingCart. This type is explained in more detail in Chapter 13. For now, you should know that this type will store details of the current user's shopping cart, so that if they fill the cart with items on one visit to the site, but choose not to purchase those items at that time, the data about the items stored in the cart will remain. In this way, when they next log in, the items are still in their cart. It also dictates whether anonymous users can fill a shopping cart. Because this is set to `true`, anyone coming to the site can fill a basket with items, so it's up to you to make sure that you create a profile for them when they check out. You'll come back to this point a bit later in this chapter in the section titled "Managing Anonymous Shopping Carts."

> *A custom type is an object that has been defined by code to meet the requirements of a specific scenario. The code is contained in a class that has been developed to describe the properties and methods available to objects based on that particular type definition. For example, a* `String` *object has a* `ToString()` *method, but a* `DateTime` *object has* `ToString()`, `ToShortDateString`, *and* `ToLongDateString()` *methods, among others. You can write a custom type, like the* `ShoppingCart` *in this example, that has a specific set of properties and methods available, so a* `ShoppingCart` *object will have an* `Update()` *method and a* `SubTotal()` *method.*

To store some data in a profile, the following syntax can be used in a code file for a web page:

```
Profile.Name = "Chris Hart"
```

Or, similarly, you can use this syntax to use a value entered by a user to populate the `Name` information in the `Profile`:

```
Profile.Name = txtName.Text
```

This will cause the profile to store whatever the user has entered as the value of a text box on a page. So, to retrieve a value from a profile and display it on a page, you use the opposite syntax:

```
txtName.Text = Profile.Name
```

This is all quite simple, so the next section looks at it in context.

Profiles in Wrox United

When it comes to employing profiles in a live site, you need first to create a definition for the profile properties, and then a page where you can add and edit the items in a user profile. On the Wrox United site, this is controlled on the Fan Club page, so take a look at how this page is constructed.

Earlier in this chapter, you built the skeleton for the `FanClub.aspx` page and made use of the `<asp:LoginView>` control to display different content depending on who is logged in to the page. In this Try It Out, you build on the code from earlier; you will add code to the `FanClub.aspx` page, and use some settings from the `Web.config` file so that you can store details about each user in their profile.

Try It Out — Using Profiles in Wrox United

1. Open up the `Web.config` file from the root of the Chapter 11 version of the Wrox United application. Look down at the bottom of the code and you will see the following code:

```
    <!--
      Define the user profile properties
    -->
    <profile enabled="true">
      <properties>
        <add name="MemberName"/>
        <add name="Name"/>
        <add name="Address"/>
        <add name="City"/>
        <add name="County"/>
        <add name="PostCode"/>
        <add name="Country"/>
        <add name="Mailings" type="System.Boolean"/>
        <add name="Email"/>
        <add name="Theme"/>
        <add name="Cart" serializeAs="Binary" type="Wrox.Commerce.ShoppingCart"
             allowAnonymous="true"/>
      </properties>
    </profile>
  </system.web>
</configuration>
```

   In the profile definition for Wrox United, you have specified that users can store their name, address details, whether they would like to receive mailings from the site, their e-mail address, their favorite theme for the site, and there is also a `Cart` property. The `Cart` property will be used each time the user wants to purchase items from the store.

2. The next step is to add some code to the `FanClub.aspx` page so that users can both store new profile properties and view or edit existing properties. Open up the page and add the following highlighted lines of code — there's quite a lot of code to add, but as you'll see, all you'll be doing is adding controls to the page and laying them out in a table:

```
<asp:LoginView ID="FCLoginView" Runat="server"
  OnViewChanged="FCLoginView_ViewChanged">
    <RoleGroups>
      <asp:RoleGroup Roles="FanClubMember">
```

```
<ContentTemplate>
  <p>
    Welcome back
    <asp:LoginName ID="FCLoginName" runat="server" />
    .</p>
  <p>
    There are always lots of exciting things happening with the fan club,
    ...
    set, but keep your eyes on your inbox for more details.
  </p>
  <h3>
    User Settings</h3>
  <p>
    Your user details are shown below.</p>
  <asp:ChangePassword ID="ChangePassword1" runat="server">
  </asp:ChangePassword>
  <br />
  <table border="0">
    <tr>
      <td>Name:</td>
      <td><asp:TextBox ID="txtName" runat="server" Columns="30" />
          <asp:RequiredFieldValidator ID="rfv1" runat="server"
           ControlToValidate="txtName"
           Text="*" ErrorMessage="You must enter a value for your name" />
      </td>
    </tr><tr>
      <td>Address:</td>
      <td><asp:TextBox ID="txtAddress" runat="server" Columns="25" Rows="5"
           TextMode="multiLine" />
          <asp:RequiredFieldValidator ID="RequiredFieldValidator1"
           runat="server" ControlToValidate="txtAddress" Text="*"
           ErrorMessage="You must enter a value for the address" />
      </td>
    </tr><tr>
      <td>City:</td>
      <td><asp:TextBox ID="txtCity" runat="server" />
          <asp:RequiredFieldValidator ID="RequiredFieldValidator2"
           runat="server" ControlToValidate="txtCity"
           Text="*" ErrorMessage="You must enter a value for the city" />
      </td>
    </tr><tr>
      <td>County:</td>
      <td><asp:TextBox ID="txtCounty" runat="server" />
          <asp:RequiredFieldValidator ID="RequiredFieldValidator3"
           runat="server" ControlToValidate="txtCounty"
           Text="*" ErrorMessage="You must enter a value for the county" />
      </td>
    </tr><tr>
      <td>Postcode:</td>
      <td><asp:TextBox ID="txtPostCode" runat="server" />
          <asp:RequiredFieldValidator ID="RequiredFieldValidator4"
           runat="server" ControlToValidate="txtPostCode" Text="*"
           ErrorMessage="You must enter a value for the post code" />
      </td>
```

```
            </tr><tr>
              <td>Country:</td>
              <td><asp:TextBox ID="txtCountry" runat="server" />
                  <asp:RequiredFieldValidator ID="RequiredFieldValidator5"
                   runat="server" ControlToValidate="txtCountry" Text="*"
                   ErrorMessage="You must enter a value for the country" />
              </td>
            </tr><tr>
              <td>Subscribe to email updates:</td>
              <td><asp:CheckBox ID="chkMailing" runat="server" /></td>
            </tr><tr>
              <td>Email:<br /></td>
              <td><asp:TextBox ID="txtEmail" runat="server" />
                  <asp:RequiredFieldValidator ID="RequiredFieldValidator6"
                   runat="server" ControlToValidate="txtEmail"
                   Text="*" ErrorMessage="You must enter a value for the email" />
                  <asp:RegularExpressionValidator ID="rev1" runat="server"
                   ControlToValidate="txtEmail"
                 ValidationExpression="\w+([-+.']\w+)*@\w+([-.]\w+)*\.\w+([-.]\w+)*"
                   Text="*" ErrorMessage="Please enter a valid email address" />
              </td>
            </tr><tr>
              <td>Membership Alias:</td>
              <td><asp:TextBox ID="txtAlias" runat="server" />
                  <asp:RequiredFieldValidator ID="RequiredFieldValidator7"
                   runat="server" ControlToValidate="txtAlias" Text="*"
                  ErrorMessage="You must enter a value for the membership alias" />
              </td>
            </tr>
          </table>
          <br />
          <asp:ValidationSummary ID="vs" runat="server" DisplayMode="BulletList" />
          <br />
          <asp:Button ID="btnSaveChanges" runat="server"
            OnClick="btnSaveChanges_Click" Text="Save Changes" />
          <asp:Button ID="btnCancelChanges" runat="server"
            OnClick="btnCancelChanges_Click"
            CausesValidation="false" Text="Cancel Changes" />
        </ContentTemplate>
      </asp:RoleGroup>
...
    </RoleGroups>
...
  </asp:LoginView>
```

3. You also need to add code to the `FanClub.aspx.vb` file so that the `btnSaveChanges` and `btnCancelChanges` buttons have event handlers that will run code each time they are clicked. Right-click `FanClub.aspx` and select View Code, then add the following highlighted methods to the `FanClub.aspx.vb` file:

```
Partial Class FanClub
  Inherits System.Web.UI.Page
```

```
    Private Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) _
      Handles Me.Load

      If Not Page.IsPostBack Then
        DisplayProfileProperties()
      End If
    End Sub

    Sub btnCancelChanges_Click(ByVal sender As Object, ByVal e As System.EventArgs)
      DisplayProfileProperties()
    End Sub

    Sub btnSaveChanges_Click(ByVal sender As Object, ByVal e As System.EventArgs)
      Profile.Name = CType(FCLoginView.FindControl("txtName"), TextBox).Text
      Profile.Address = CType(FCLoginView.FindControl("txtAddress"), TextBox).Text
      Profile.City = CType(FCLoginView.FindControl("txtCity"), TextBox).Text
      Profile.County = CType(FCLoginView.FindControl("txtCounty"), TextBox).Text
      Profile.PostCode = CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text
      Profile.Country = CType(FCLoginView.FindControl("txtCountry"), TextBox).Text
      Profile.Mailings = CType(FCLoginView.FindControl("chkMailing"), _
                          CheckBox).Checked
      Profile.Email = CType(FCLoginView.FindControl("txtEmail"), TextBox).Text
      Profile.MemberName = CType(FCLoginView.FindControl("txtAlias"), TextBox).Text
      Server.Transfer(SiteMap.CurrentNode.Url)
    End Sub

    Sub FCLoginView_ViewChanged(ByVal sender As Object, ByVal e As System.EventArgs)
      DisplayProfileProperties()
    End Sub

    Private Sub DisplayProfileProperties()
      Dim NameBox As TextBox = CType(FCLoginView.FindControl("txtName"), TextBox)

      If Not (NameBox Is Nothing) Then
        CType(FCLoginView.FindControl("txtName"), TextBox).Text = Profile.Name
        CType(FCLoginView.FindControl("txtAddress"), TextBox).Text = Profile.Address
        CType(FCLoginView.FindControl("txtCity"), TextBox).Text = Profile.City
        CType(FCLoginView.FindControl("txtCounty"), TextBox).Text = Profile.County
        CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text = _
          Profile.PostCode
        CType(FCLoginView.FindControl("txtCountry"), TextBox).Text = Profile.Country
        CType(FCLoginView.FindControl("chkMailing"), CheckBox).Checked = _
          Profile.Mailings
        CType(FCLoginView.FindControl("txtEmail"), TextBox).Text = Profile.Email
        CType(FCLoginView.FindControl("txtAlias"), TextBox).Text = Profile.MemberName
      End If
    End Sub
  End Class
```

4. Run the site again and log in as Lou, password lou@123. Go to the home page for the Fan Club and you will see what is shown in Figure 11-17 at the bottom of the page.

5. Now enter some details and click the Save Changes button. If you log out and log back in again, you'll see that the information is saved, as shown in Figure 11-18.

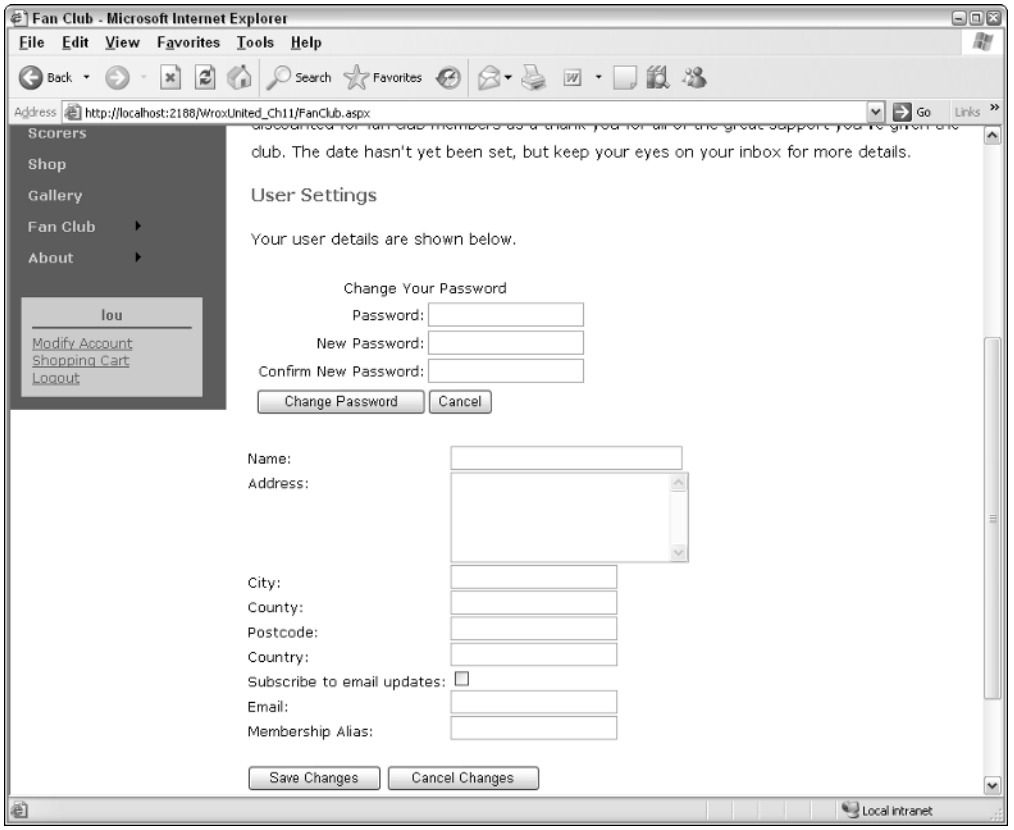


Figure 11-17

How It Works

The `Web.config` file contains the definition for each of the profile properties employed in the Wrox United application. These include (among others) the name of the user, the address, and the e-mail address. The capability to store data for each user in a profile is controlled by the code in the `FanClub.aspx` page.

When users update their profile by clicking the Save Changes button, the following code is run:

```
Sub btnSaveChanges_Click(ByVal sender As Object, ByVal e As System.EventArgs)
  Profile.Name = CType(FCLoginView.FindControl("txtName"), TextBox).Text
  Profile.Address = CType(FCLoginView.FindControl("txtAddress"), TextBox).Text
  Profile.City = CType(FCLoginView.FindControl("txtCity"), TextBox).Text
  Profile.County = CType(FCLoginView.FindControl("txtCounty"), TextBox).Text
  Profile.PostCode = CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text
  Profile.Country = CType(FCLoginView.FindControl("txtCountry"), TextBox).Text
  Profile.Mailings = CType(FCLoginView.FindControl("chkMailing"), _
                     CheckBox).Checked
  Profile.Email = CType(FCLoginView.FindControl("txtEmail"), TextBox).Text
  Profile.MemberName = CType(FCLoginView.FindControl("txtAlias"), TextBox).Text
  Server.Transfer(SiteMap.CurrentNode.Url)
End Sub
```

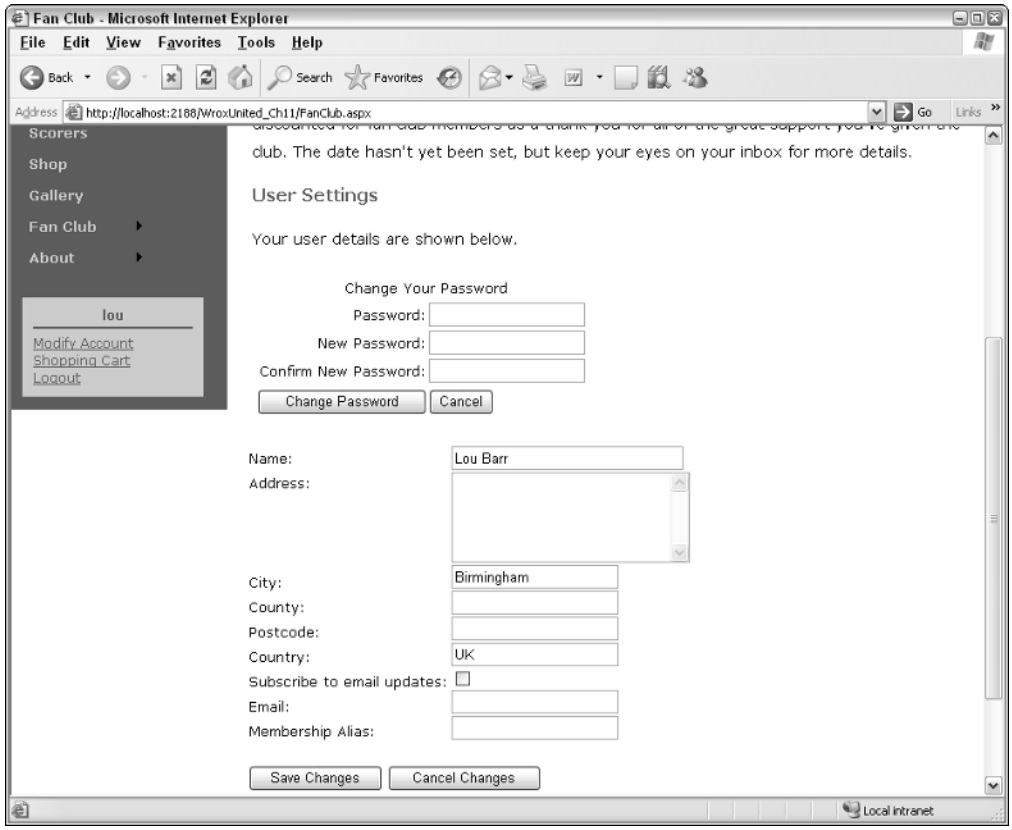


Figure 11-18

This code looks quite messy, and this is because of one very good reason. You've chosen to display these controls only on one view of the page using the `LoginView` control. Here's the syntax for storing just the name:

```
Profile.Name = CType(FCLoginView.FindControl("txtName"), TextBox).Text
```

The yucky syntax used to essentially say "`TextBox.Text`" means "find me the control called `txtName`. When you find it, treat it like a `TextBox` control, then grab the data stored in its `Text` property and use that value to store in the profile." The similar syntax used against the `Mailings` profile property demonstrates this slightly differently:

```
Profile.Mailings = CType(FCLoginView.FindControl("chkMailing"), _
                         CheckBox).Checked
```

This time around, it's a case of "find me a control called `chkMailing`, treat it as a `CheckBox` control, and set the `Mailings` property of the profile to the value of the `Checked` property of the `CheckBox`."

After the profile has been populated with data, the code will then call a method, the `Server.Transfer` method, which will run the code that would run if the specified page were requested:

```
Server.Transfer(SiteMap.CurrentNode.Url)
```

The `Server.Transfer()` method stops the current page from executing, and runs the content on the specified page, which in this case is like reloading the current page again to refresh the current view of the page.

At several points in the page life cycle, the display of the profile properties is updated. For example, each time the view of the Fan Club changes, the following code is run:

```
Sub FCLoginView_ViewChanged(ByVal sender As Object, ByVal e As System.EventArgs)
  DisplayProfileProperties()
End Sub
```

This calls the following method:

```
Private Sub DisplayProfileProperties()
  Dim NameBox As TextBox = CType(FCLoginView.FindControl("txtName"), TextBox)

  If Not (NameBox Is Nothing) Then
    CType(FCLoginView.FindControl("txtName"), TextBox).Text = Profile.Name
    CType(FCLoginView.FindControl("txtAddress"), TextBox).Text = Profile.Address
    CType(FCLoginView.FindControl("txtCity"), TextBox).Text = Profile.City
    CType(FCLoginView.FindControl("txtCounty"), TextBox).Text = Profile.County
    CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text = _
      Profile.PostCode
    CType(FCLoginView.FindControl("txtCountry"), TextBox).Text = Profile.Country
    CType(FCLoginView.FindControl("chkMailing"), CheckBox).Checked = _
      Profile.Mailings
    CType(FCLoginView.FindControl("txtEmail"), TextBox).Text = Profile.Email
    CType(FCLoginView.FindControl("txtAlias"), TextBox).Text = Profile.MemberName
  End If
End Sub
```

The convoluted syntax for retrieving the value of each control should be a bit more familiar from the code used earlier in this How It Works section, but there's one addition here. Notice that there is a test to see if the `txtName` text box exists on the currently visible version of the page:

```
Dim NameBox As TextBox = CType(FCLoginView.FindControl("txtName"), TextBox)

If Not (NameBox Is Nothing) Then
```

So, if the `txtName` box is visible (which it will be if the user is logged in as a member of the FanClub Member role), then the profile data is retrieved. If the user is anonymous, or is a member of other roles (and not the FanClubMember role), then the profile will not exist. To avoid errors at run-time, you don't want to try to retrieve data that does not exist, so this check is essential (just try removing it and accessing the page as an anonymous user to see the mess that happens if you're not careful!).

One last thing to consider before moving on — in the layout code (on `FanClub.aspx`), there were some controls that you may not be familiar with yet:

```
<table border="0">
  <tr>
    <td>Name:</td>
    <td><asp:TextBox ID="txtName" runat="server" Columns="30" />
        <asp:RequiredFieldValidator ID="rfv1" runat="server"
         ControlToValidate="txtName"
         Text="*" ErrorMessage="You must enter a value for your name" />
    </td>
  </tr><tr>
```

In the layout code, each `TextBox` control had a validation control next to it. In this example, the `txtName TextBox` had a `RequiredFieldValidator` control next to it, which will ensure that users fill in data for each of the required fields before saving profile changes. Essentially, the text box is marked as "Required," as the validator's name suggests. If no value is entered, there will be a small red asterisk displayed next to the text box.

You'll meet validation controls in more detail in Chapter 15, where you can see how they are used to minimize data entry errors and protect your code from malicious user input.

So, you've stored some simple data in a user profile. If you want to know where exactly this data is stored, you will find it in the `AspNetDB.mdf` database. Take a look in the aspnet_Profiles table and you will see that data, similar to Figure 11-19, is stored in your database.

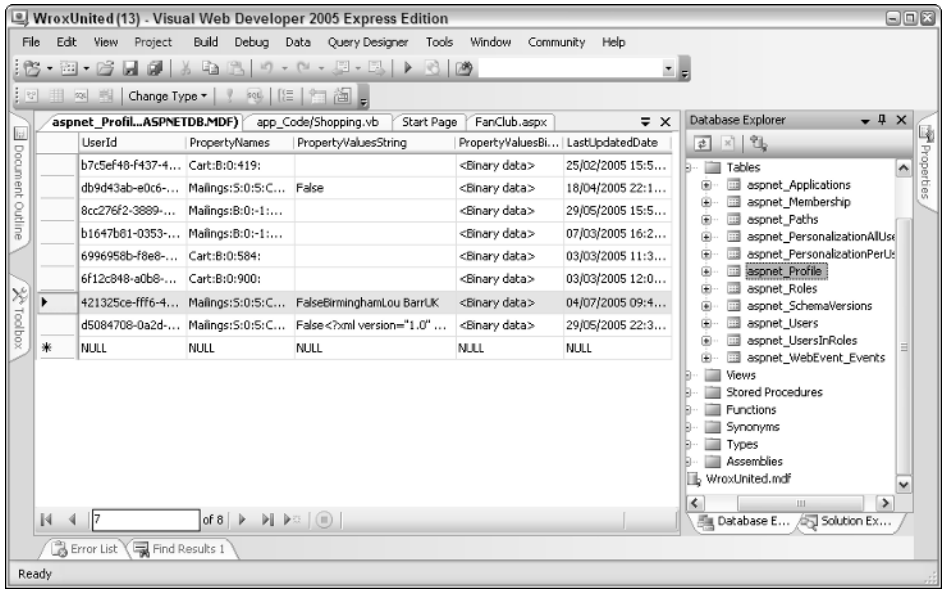


Figure 11-19

In Figure 11-19, you can see that the Lou profile currently has some properties set, as you specified in the example. You will not need (or want) to edit this data by hand, but it's useful to know where it's stored.

Storing Preferences

There's one last example that you can play with in this chapter, and that goes way back to the discussions you will recall from Chapter 5. In that chapter, along with page styling and CSS, you learned the concept of storing layout and style preferences in themes. These themes can be switched on a page-by-page basis as was discussed in that chapter. However, you can also store data about which theme a user may prefer to use for a site in a user profile, enabling users to personalize their viewing experience a bit more. In the following Try It Out, you have a go at including this functionality in the Wrox United application.

Try It Out Storing Theme Preference in Profiles

1. Add the following highlighted lines of code to the `FanClub.aspx` page:

```
</tr><tr>
  <td>Membership Alias:</td>
  <td><asp:TextBox ID="txtAlias" runat="server" />
      <asp:RequiredFieldValidator ID="RequiredFieldValidator7"
        runat="server" ControlToValidate="txtAlias" Text="*"
        ErrorMessage="You must enter a value for the membership alias" />
  </td>
</tr>
<tr>
  <td>Theme:</td>
  <td><asp:DropDownList ID="ThemeList" runat="server">
        <asp:ListItem Text="Default" Value="" />
        <asp:ListItem Text="Wrox Red" Value="WroxRed" />
        <asp:ListItem Text="Wrox Blue" Value="WroxBlue" />
      </asp:DropDownList>
  </td>
</tr>
```

2. The other piece of the puzzle is to add some code to store and retrieve the theme preference from the user's profile. Modify `FanClub.aspx.vb` to include the following highlighted lines of code to the `btnSaveChanges_Click` event handler:

```
Sub btnSaveChanges_Click(ByVal sender As Object, ByVal e As System.EventArgs)
  Profile.Name = CType(FCLoginView.FindControl("txtName"), TextBox).Text
  Profile.Address = CType(FCLoginView.FindControl("txtAddress"), TextBox).Text
  Profile.City = CType(FCLoginView.FindControl("txtCity"), TextBox).Text
  Profile.County = CType(FCLoginView.FindControl("txtCounty"), TextBox).Text
  Profile.PostCode = CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text
  Profile.Country = CType(FCLoginView.FindControl("txtCountry"), TextBox).Text
  Profile.Mailings = CType(FCLoginView.FindControl("chkMailing"), _
    CheckBox).Checked
  Profile.Email = CType(FCLoginView.FindControl("txtEmail"), TextBox).Text
  Profile.MemberName = CType(FCLoginView.FindControl("txtAlias"), TextBox).Text
```

```
    Profile.Theme = CType(FCLoginView.FindControl("ThemeList"), _
      DropDownList).SelectedValue

    Server.Transfer(SiteMap.CurrentNode.Url)
End Sub
```

3. Now modify the `DisplayProfileProperties` method to include the code that will retrieve and display the currently stored value for the `Theme` property from the user's profile:

```
Private Sub DisplayProfileProperties()
  Dim NameBox As TextBox = CType(FCLoginView.FindControl("txtName"), TextBox)

  If Not (NameBox Is Nothing) Then
    CType(FCLoginView.FindControl("txtName"), TextBox).Text = Profile.Name
    CType(FCLoginView.FindControl("txtAddress"), TextBox).Text = Profile.Address
    CType(FCLoginView.FindControl("txtCity"), TextBox).Text = Profile.City
    CType(FCLoginView.FindControl("txtCounty"), TextBox).Text = Profile.County
    CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text = _
      Profile.PostCode
    CType(FCLoginView.FindControl("txtCountry"), TextBox).Text = Profile.Country
    CType(FCLoginView.FindControl("chkMailing"), CheckBox).Checked = _
      Profile.Mailings
    CType(FCLoginView.FindControl("txtEmail"), TextBox).Text = Profile.Email
    CType(FCLoginView.FindControl("txtAlias"), TextBox).Text = Profile.MemberName
    CType(FCLoginView.FindControl("ThemeList"), DropDownList).SelectedValue = _
      Profile.Theme
  End If
End Sub
```

At this stage, you've added all the required code to store the preference. The thing that's missing is the ability to actually switch the theme on the pages on the site.

4. Right-click the `App_Code` folder and add a new item. Select Class from the list of available templates, and call it `ThemeModule.vb`, as shown in Figure 11-20.

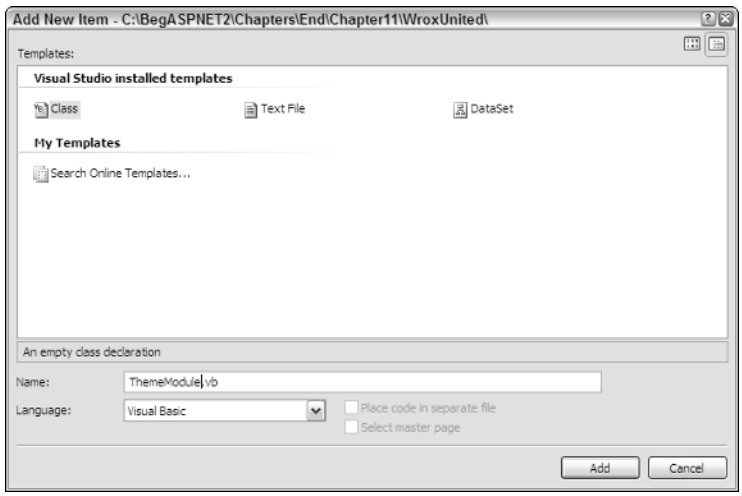


Figure 11-20

5. Enter the following code into the new Class file:

```
Imports Microsoft.VisualBasic
Imports System
Imports System.Web
Imports System.Web.UI

Namespace Wrox.Web.GlobalEvents

  Public Class ThemeModule
    Implements IHttpModule

    Public Sub Dispose() Implements System.Web.IHttpModule.Dispose
    End Sub

    Public Sub Init(ByVal context As System.Web.HttpApplication) _
      Implements System.Web.IHttpModule.Init

      AddHandler context.PreRequestHandlerExecute,  _
        New EventHandler(AddressOf app_PreRequestHandlerExecute)

    End Sub

    Private Sub app_PreRequestHandlerExecute(ByVal Sender As Object, _
      ByVal E As EventArgs)

     HttpContext.Current.Trace.Write("ThemeModule", "app_PreRequestHandlerExecute")
      Dim p As Page = TryCast(HttpContext.Current.Handler, Page)

      If p IsNot Nothing Then
        Dim pb As ProfileCommon = DirectCast(HttpContext.Current.Profile, _
                                  ProfileCommon)
        p.Theme = pb.Theme
      End If

    End Sub

  End Class
End Namespace
```

6. Save the file, then open up `Web.config` and add the following highlighted code, just below the `System.Web` node:

```
<system.web>
  <httpModules>
    <add name="Page" type="Wrox.Web.GlobalEvents.ThemeModule"/>
  </httpModules>
```

7. Run the page once more and you will see that there is now a drop-down box (shown at the bottom of Figure 11-21) on the page enabling you to select different themes to store in your user profile.

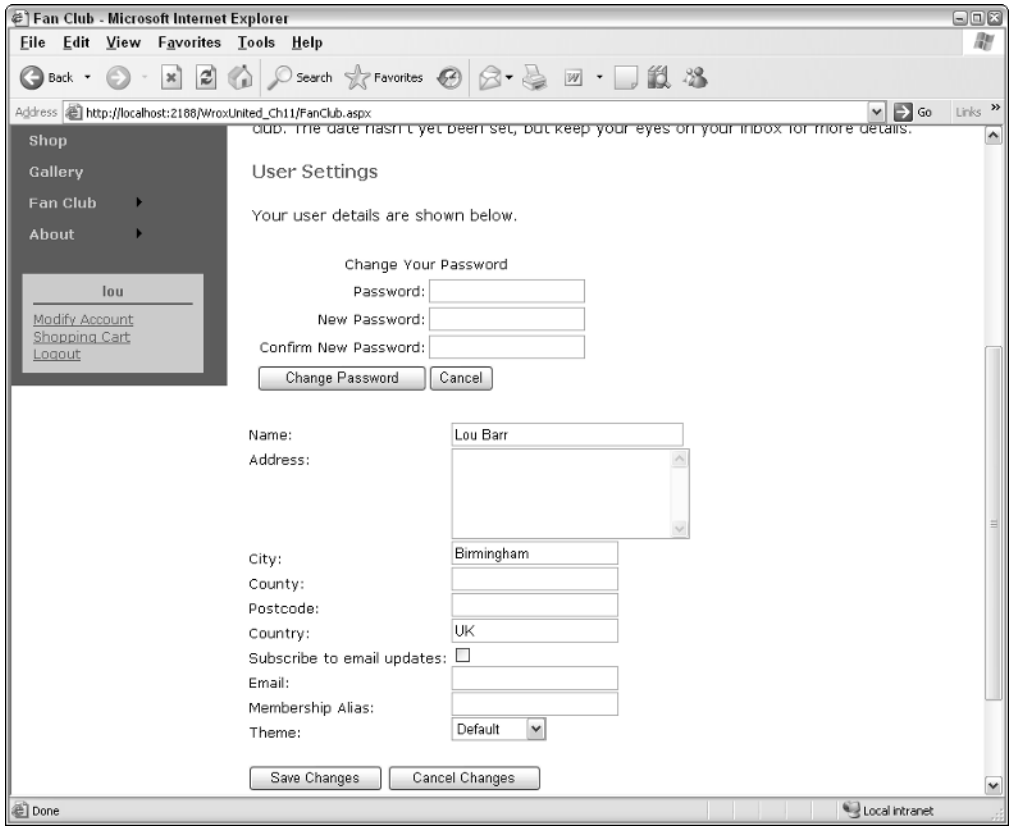


Figure 11-21

How It Works

In this example, you've extended the basic `FanClub.aspx` page so that users can store their preferred theme in their profile. This facility is available only to registered members of the Fan Club.

Amending the layout code was a simple process of adding a `DropDownList` control to the page:

```
<asp:DropDownList ID="ThemeList" runat="server">
  <asp:ListItem Text="Default" Value="" />
  <asp:ListItem Text="Wrox Red" Value="WroxRed" />
  <asp:ListItem Text="Wrox Blue" Value="WroxBlue" />
</asp:DropDownList>
```

The value for the theme is stored as a simple string of text in the user's profile, and is set in the same way as any other profile setting:

```
Profile.Theme = CType(FCLoginView.FindControl("ThemeList"), _
  DropDownList).SelectedValue
```

This code means "find me the `ThemeList` control, it's a `DropDownList`, so get me its `SelectedValue` property." In this case, the `DropDownList` control's `SelectedValue` property will be whatever the `Value` property for the selected item is set to, so, for example, if the user selected the item with the text "Wrox Red," the value stored would be `WroxRed`.

So, at this stage the profile has been updated with the user's preference, but the last bit of this exercise gave the site the capability to apply the selected theme to each page. The technique used in this case was to use an `HttpModule` to do this.

> **An `HttpModule` contains code that is processed every time any page in an application is processed. The module can be enabled and disabled via the `Web.config` file. The module code can handle events that are raised each time a page is requested.**

In this case, the event that is intercepted is processed before the code on a page is processed, and the requested page's theme can be changed to match the theme specified in the user's profile.

> *This section of the code is getting to be quite advanced in terms of programming techniques. Don't worry if you don't fully understand how this works — you will encounter more code like this in Professional ASP.NET 2.0, so you can treat this as a taste of what you can expect when you start to unleash the full power of ASP.NET.*

Take a look at the code in the `HttpModule` and see how it works:

```
Imports Microsoft.VisualBasic
Imports System
Imports System.Web
Imports System.Web.UI

Namespace Wrox.Web.GlobalEvents

  Public Class ThemeModule
    Implements IHttpModule
```

The first part of the code in the file imports a few useful namespaces that contain classes you'll need later in the code. The `ThemeModule` class is configured to reside within the `Wrox.Web.GlobalEvents` namespace. Additionally, the `ThemeModule` class implements the `IHttpModule` interface, which turns this simple class into a class that can be used as an `HttpModule`, provided you then implement the required methods, because there are some specific methods that all `HttpModules` must implement in order to work correctly.

In this case, two methods have to be implemented: the `Init()` method and the `Dispose()` method. Here's the `Dispose()` method first — because there's nothing that you need to do in this method, the empty method signature will just sit there in the file not bothering anyone:

```
    Public Sub Dispose() Implements System.Web.IHttpModule.Dispose
    End Sub
```

Notice that there's a specific `Implements` keyword that specifies that this particular `Dispose()` method implements the required `IHttpModule.Dispose` method, as required by all `HttpModules`. Now compare that to the code in the `Init()` method:

```
    Public Sub Init(ByVal context As System.Web.HttpApplication) _
      Implements System.Web.IHttpModule.Init

      AddHandler context.PreRequestHandlerExecute,  _
        New EventHandler(AddressOf app_PreRequestHandlerExecute)

    End Sub
```

At the top of this method is an `Implements` statement (which has wrapped onto the next line in this printed book due to page width restriction). The `Init()` method in this case implements the `IHttpModule.Init` method as required.

The code within the method itself here is a bit tricky to grasp at first. There's only one line to consider, which declares a new event handler. The event handler will run each time the current context is at the `PreRequestHandlerExecute` stage in the request life cycle — in plain English, that's pretty early in the request stage! This line of code means that each time the appropriate event fires, you can add an event handler that will be processed. This event handler is the last method declared in the code:

```
    Private Sub app_PreRequestHandlerExecute(ByVal Sender As Object, _
      ByVal E As EventArgs)

      Dim p As Page = TryCast(HttpContext.Current.Handler, Page)

      If p IsNot Nothing Then
        Dim pb As ProfileCommon = DirectCast(HttpContext.Current.Profile, _
                                    ProfileCommon)
        p.Theme = pb.Theme
      End If

    End Sub

  End Class
End Namespace
```

This last method handles that `PreRequestHandlerExecute` event. The first line in this method gets the currently requested page object so that you can interact with it:

```
      Dim p As Page = TryCast(HttpContext.Current.Handler, Page)
```

Notice the `TryCast` method used here — this method attempts to cast the current `Handler` object to a `Page` object type, which means that if the requested item is a page, the cast will be successful and the `p` object will contain an object reference to the requested page. However, if the item requested is not a page, the cast fails, and the p object is set to `NULL` (or nothing in VB.NET terms).

As long as the `Page` object exists (and is not set to `Nothing`), you can then try to apply the theme to the page by obtaining the current profile properties and using that profile's `Theme` property:

```
If p IsNot Nothing Then
  Dim pb As ProfileCommon = DirectCast(HttpContext.Current.Profile, _
                                       ProfileCommon)
  p.Theme = pb.Theme
End If
```

Notice the `DirectCast` notation in this case, which will throw an exception if the attempted cast fails. The only case when this would happen would be if you disabled profiles in the `Web.config` file, which would surely make this example a bit pointless! The `Theme` property of the page is set, at the end of this method, to the value stored in the profile property called `Theme`.

Finally, there was a new section added to the `Web.config` file that enabled the `HttpModule` itself:

```
<system.web>
  <httpModules>
    <add name="Page" type="Wrox.Web.GlobalEvents.ThemeModule"/>
  </httpModules>
```

The `<httpModule>` section can be filled with many different modules that you may want to run; in this example, there is just one module — the `ThemeModule`. The `ThemeModule` class that was declared is added in the `type` attribute, along with the namespace that it resides in, so that .NET knows exactly which `ThemeModule` you want to run.

That's about it for this example — it's a tricky piece of code, but it's a neat way to make themes switch instantly on pages, and to stay switched for all pages on a site, because the module will run for each requested page on a site.

Managing Anonymous Shopping Carts

Earlier this chapter briefly mentioned the presence of the following profile property:

```
<profile enabled="true">
  <properties>
    <add name="MemberName"/>
     ...
    <add name="Cart" serializeAs="Binary" type="Wrox.Commerce.ShoppingCart"
                     allowAnonymous="true"/>
```

The `allowAnonymous` flag that is stored against the `Profile.Cart` value for each user session indicates that anonymous users can have a shopping cart. In this case, users may visit the site and neglect to log on, or they may be completely new to the site. The user will then happily fill up a basket with items, so it will be up to you to handle either switching the cart to an existing user when they log in, or creating a new profile when the anonymous user logs in and transferring the cart to the newly created user when the user attempts to check out.

There is code that handles this transition in the `Global.asax` file, which handles global events raised by the code. Here's the code as it is used in the Wrox United application:

```
Public Sub Profile_OnMigrateAnonymous(ByVal Sender As Object, ByVal e As _
  ProfileMigrateEventArgs)

  ' get the profile for the anonymous user
  Dim anonProfile As ProfileCommon = Profile.GetProfile(e.AnonymousID)

  ' if they have a shopping cart, then migrate that to the authenticated user
  If anonProfile.Cart IsNot Nothing Then

    If Profile.Cart Is Nothing Then
      profile.Cart = New Wrox.Commerce.ShoppingCart()
      profile.Cart.Items.AddRange(anonProfile.Cart.Items)
    End if

    anonProfile.Cart = Nothing
  End If

  ProfileManager.DeleteProfile(e.AnonymousID)
  AnonymousIdentificationModule.ClearAnonymousIdentifier()

End Sub
```

This code is examined in far more detail in Chapter 13 when you see exactly how the whole shopping experience works, but it's useful to understand that there are consequences that you need to understand when you log in as a user, and the transferring of a shopping cart from one profile to another is the most important, because none of the other properties can actually be set for anonymous users.

Summary

This chapter delved deeper into the world of roles, and introduced the concept of user profiles for storing additional data about a user. The two technologies can sit happily side-by-side, and used together are a great way to control access to a site and for customizing the user experience.

In this chapter, you've had a chance to take more control over the access permitted to users on a fully functional web application. You've had a chance to

- Show or hide resources to selected user roles.
- Display different page content depending on which role views the page.
- Display links to selected pages, but prompt the user for more credentials for authorization.
- Store more information about users in their user profile.
- Store different types of data in a user profile, including the user's preference for site theme.

These techniques will be built upon in the upcoming chapters to form part of the shopping cart functionality built in to the Wrox United site.

Exercises

1. Create a new user account called Admin, and make this user a member of all of the groups. Log in to the Wrox United site as Admin and test to see whether you can access all of the different pages in both the fan club and the administration section.
2. Remove the Admin user from any role other than the Administrator role and test the site again. Ensure that you can access the following pages:
   - `Admin.aspx`
   - `EditNews.aspx`
   - `UpdateProducts.aspx`
3. The Admin user has had a request by a reporter out in the field — he's uploaded a score for a match, but the score has just changed! Unfortunately, the reporter's laptop has run out of battery, so he's asked the Admin to update the score for him. Make sure that the Admin user can update the score of a match.
4. Add a field to the user profile for the Wrox United application called `DateOfBirth`. Give this property a data type of `System.DateTime`. Add an input field to the `FanClub.aspx` page so that users can update their date of birth. Note that you will need to convert the value entered in a text box to a `DateTime` value when you save the data — you might want to try the `DateTime.Parse()` function for this purpose. To retrieve the data, use the `Profile.DateOfBirth.ToShortDateString()` function.

12

Web Services

Web services have been "the next great thing" for a little too long now. They were originally introduced as part of the .NET Framework in its first incarnation (although they have been present in Java for a lot longer). Web services are a method of making information available in a standardized way that could be accessed by any developer's application over the Web. Web services can form a library or shared repository of information that could be anything from the latest weather forecast, a map of your local amenities, a mathematical function calculator, to the tracks and album cover of the CD that you just inserted into your CD-ROM drive. You should be aware, though, that a web service on its own isn't an application. Web services aren't rendered as web pages, or as executable files (`.exe`); they come completely shorn of a user interface. It's up to you as a developer to use them and integrate them into your applications. They are there to save you time and effort by reducing code duplication.

They can be used in one of two ways. You can create a web service that is exposed to the Web, to share with other developers and other applications. Or you can search for a web service that can be added to your own application. (They are similar to plug-ins in that respect.) For example, if your application is a company web site and you want to include directions to company headquarters, rather than scan in a map, or attempt to hand-draw one in a graphics tool, why not use one of the web services that makes sections of maps available online?

The information contained in the web service is wrapped up as an XML document, so that worries about platform-specific concerns, such as whether you're accessing them on an old Windows 98 machine or a turbo-powered Powerbook, simply evaporate. Web services aren't really anything new either; components have been performing a similar trick for many years now. However, there are some crucial differences. Components had to be distributed by the developer, and they had to be downloaded and installed. These things alone meant that they tended to be tied to one platform. This isn't true of web services. A key word that emphasises what web services offer is *standard*. Everything to do with web services is standardized: the method of transmission, the method used to wrap the web service up, the way the web service is defined, all have clear W3C standards associated with the technologies involved. And to make life much easier, all these standards are based on XML. So they're quick and easy to download, and even easier to use.

This chapter looks at the following:

- Introducing web services
- Consuming web services
- What happens in the typical life cycle of a web service
- Testing a web service
- Discovering a web service
- Creating and consuming an example web service that uses a parameter
- Creating a proxy — the old way of doing things
- Web service security

Looking at Web Services

So what's holding them back? The introduction alluded to the fact that web services haven't quite taken off in the way that was expected, and it's true and there are probably several reasons for that, but none that should stop you from using them. One is that developers and businesses don't like giving away their hard work for free. The truth is when businesses create a web service it usually isn't for public consumption. It is for in-house usage only, and even if it is available for the public to use, it is likely to come at a price. On the flipside, with free web services, you have no guarantee that they will still be there in a week or a year's time, so it's no good basing a large application around them. So do you fork out for a web service and increase the cost of your application, or take a gamble that a particular service will still be in existence over the next few years? This dilemma isn't easily remedied.

Second is lack of education. People are still largely unaware of what web services can offer. I recently worked on a customer services application, which had to integrate with an existing contacts manager application and detect when the contacts manager was running and if it had loaded the latest customer information correctly. Rather than use a web service to make this information available, the client chose instead to write to the clipboard (especially awkward considering the users themselves might also be using the clipboard) and then my application had to periodically check the clipboard for the text to indicate that the contacts manager was running. As a result the application was twenty times more complicated than it needed to be.

Third is the lack of a single killer application. Before you started this chapter, could you name five common examples of web services? The problem is that they're too good at the job they do, so they become practically invisible. Where is the Google or Internet Explorer of web services? I don't know, but I might just be using it unwittingly. A good web service should dovetail seamlessly into your application, and your user should never know it's there.

Last is the apparent learning curve required. With web services it's easy to get drawn into listing the mass of technologies involved, and therefore easy to get confused about what you need to know. SOAP, WSDL, UDDI, and DISCO all play valid parts in the process of making a web service available. However, you don't need to know about any of these acronyms to be able to use a web service.

In fact, before you start creating a web service and learning what goes into them, it's a good idea to look at an example first.

Consuming a Third-Party Web Service

Consuming a web service is almost as easy as firing up your browser, typing in a URL of a web service, and pressing return. Perhaps I am oversimplifying a little bit here, but if you browse to the URL of a web service endpoint, you will find that you can use it functionally, albeit without any graphical frills. An *endpoint* is the specific location where the web service can be accessed. So let's do exactly that. Because of the nature of the Web, sites are very often up and down. If you wanted to phone up a plumber on the other side of the city, you'd check your local phone directory for a number — but that plumber may or may not still be in business, and web services are just the same. Several good starting points are the following sites: `http://uddi.microsoft.com`, `www.webservicex.net`, `www.webservicelist.com`, `www.webserviceoftheday.com`, and `www.wsiam.com`. All of these sites provide lists of web services you can browse. More alternatives are available, and if one of these sites is inoperable another will be working.

There are plenty of possibilities to integrate web services into your example site. Wrox United chronicles the football fixtures, results, merchandise, and news of one soccer team. Now Wrox United isn't always the most successful soccer team in the league, and they're usually looking for an excuse on which to hang a particularly poor performance, such as the weather, so it would be nice if you could stick a weather report on the bottom of your match reports, just so you know that if the goalkeeper claims the fifth and sixth goals slipped through his hands, maybe the 85 degree temperature would be a bit of a giveaway.

In the following Try It Out, you start by finding an example weather web service that is freely available.

Try It Out — Consuming an Example Web Service

1. To be able to access a web service you need to locate an .asmx file — you'll learn what one of those is after you've finished this example. Figure 12-1 shows an example of a weather service at `www.webservicex.net/globalweather.asmx`.

Figure 12-1

If for any reason this web service is giving an HTTP error 404, we suggest going back to any of the previous web service directories and typing "Weather" into their searches and using one of the example sites they return, because most weather web services in essence work in the same way.

2. There are two possible web services here. The format and style of this screen are the same for any .asmx web service file you browse. The link to the web service that gives you the weather forecast is called GetWeather. Click this link, and you'll arrive at a screen similar to Figure 12-2.

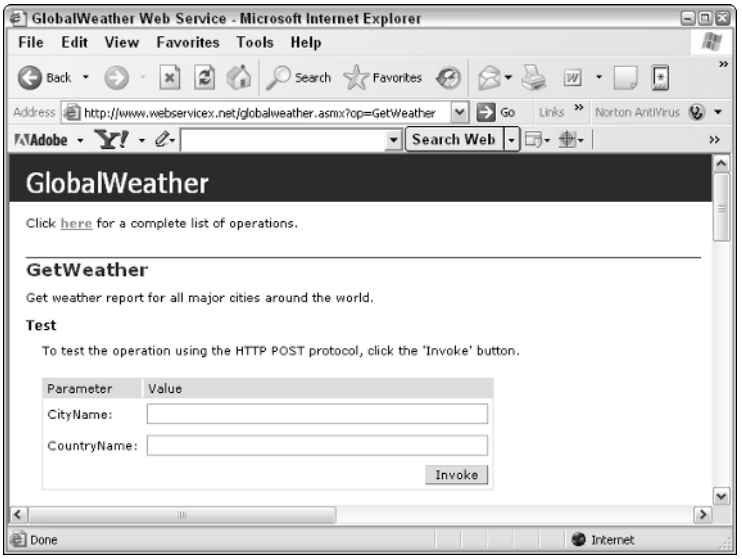


Figure 12-2

3. Supply the name of the city where you live, or closest to where you live, and the name of the country. For me this is Birmingham and United Kingdom. Scroll down and look at the code (see Figure 12-3).

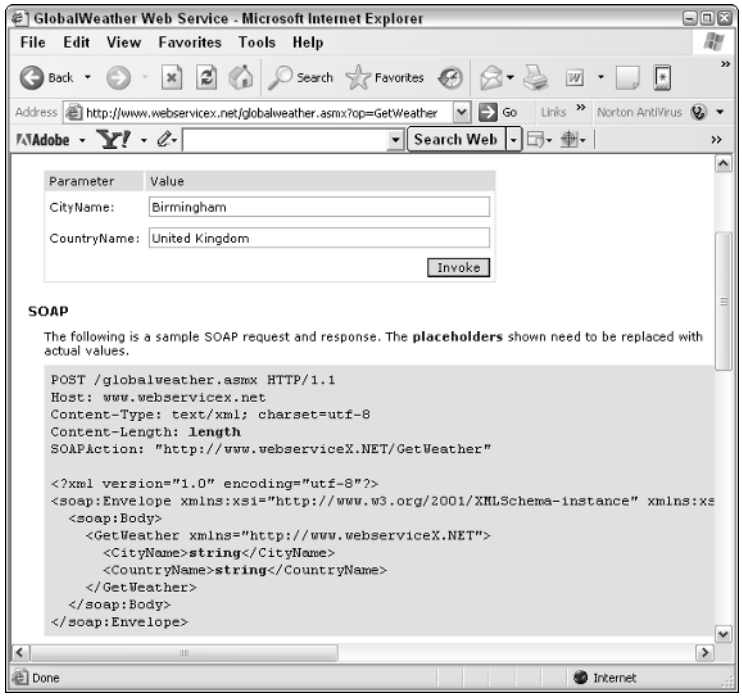


Figure 12-3

4. Click Invoke to get the result, shown in Figure 12-4. It will be customized to where you live and is of course dependent on the weather of the moment!

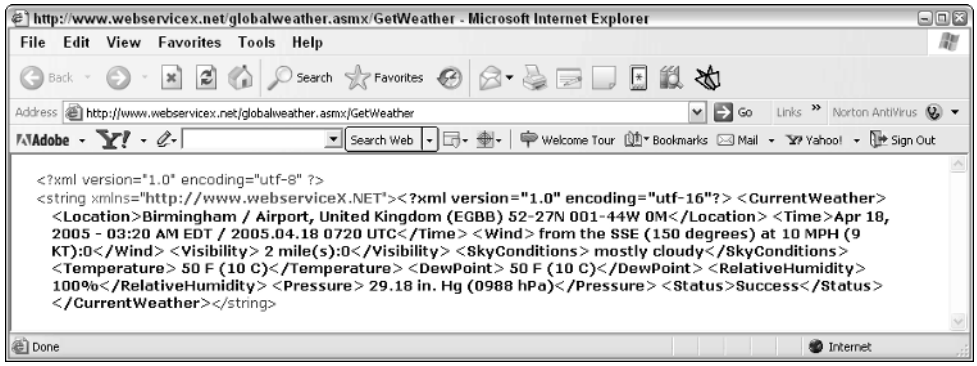


Figure 12-4

How It Works

You've just consumed a web service. We haven't created the capability in the Wrox United application to do weather forecasting, so we've looked elsewhere to get this service. By browsing to an .asmx file, you are able to use the web service, and supply input and get back an answer tailored to your specifics. When you supplied the city name and country name, you probably noticed that your input was wrapped up in an XML document. This is the document broadcast to the server. Although the data can be wrapped up by three different methods, we'll only look at the first on the page:

```
POST /globalweather.asmx HTTP/1.1
Host: www.webservicex.net
Content-Type: text/xml; charset=utf-16
Content-Length: length
SOAPAction: "http://www.webserviceX.NET/GetWeather"

<?xml version="1.0" encoding="utf-16"?>
<soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Body>
    <GetWeather xmlns="http://www.webserviceX.NET">
      <CityName>string</CityName>
      <CountryName>string</CountryName>
    </GetWeather>
  </soap:Body>
</soap:Envelope>
```

Your input is simply substituted for the words `string` in the highlighted code:

```
    <GetWeather xmlns="http://www.webserviceX.NET">
      <CityName>Birmingham</CityName>
      <CountryName>United Kingdom</CountryName>
    </GetWeather>
```

Of course one big drawback is that there isn't a user interface, so you're using a normal interface, and also all your code is returned as one large higgledy-piggledy lump of XML. So it's not exactly something you'd stick into your application as it is, without your users getting indigestion. Also you'll see that the weather report is much too detailed for your match reports. Ideally you'd just want to be able to pick out, say, sky conditions and temperature and probably leave it at that. To be honest a few other pitfalls exist that would make a weather service difficult to integrate into your application. Not least is the fact that the weather service extracts the current weather, and if you were to display this in your match reports, you'd need to make sure you saved the weather in the database alongside the match details, otherwise you'd be reading about Wednesday's match, and seeing Friday's weather!

Later in the chapter you look at creating some web services for the Wrox United application yourself, but for now you only need to understand that web services are freely available for very ordinary chores to all sorts of weird and wonderful things (I've come across a Shakespearean insult generator.) If there is a URL with an .asmx file available, you can access and use the web service in a standard way. And if you can access and use the web service in this standard way, you can stick it in your application just as easily.

The Life Cycle of a Web Service

Having started with a quick example, it's time to look at some theory behind what is happening. This section strips down a web service to its basic essentials, which is a four-stage process. Following that, this section expands upon each stage, and talks a little bit about the technologies and standards used at each step. The four-stage process of a web service is detailed in Figure 12-5.

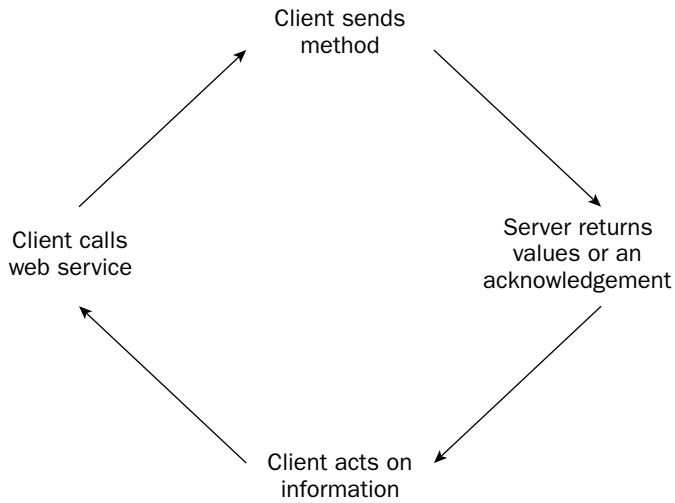


Figure 12-5

1. The client calls web service over a protocol.
2. The client sends the method to the server, which contains instructions on what is needed from the web service.
3. The server returns values and/or an acknowledgment that it has received the method.
4. The client gets the results and acts on the received information. This may involve calling the web service again, or a different web service, with the results received.

This can happen as a cyclical process, where information is sent and received, acted upon, and sent out again. In the next several sections, each step of the process is put under the magnifying class because with web services there are usually quite a few interesting things going on.

Calling the Web Service

When you ran the first example and consumed the simple web service, you did so by typing a URL into a browser. However when you type the URL, you also specify the protocol that you are using (for example, `http://`). This is important, because web services are able to work over a multitude of protocols from SMTP (Simple Mail Transport Protocol) to HTTPS (Secure HTTP). However, using anything other than HTTP is beyond the scope of this book, and you can achieve plenty just using the HTTP protocol, but you shouldn't think that you are restricted in this way.

ASP.NET passes information backward and forward using the HTTP-Request/Response system. Any information is sent to the web service as part of the request, and the server will return anything from the web service as part of the response. Most commonly you can transmit values to a web service via an HTML form and the standard HTML controls.

The request that is sent to the web service contains the following information:

- The web service's URL
- The fact that it is an HTTP request
- The amount of information being sent
- The type of document you want back from the web service
- Information about the client
- The date of the request
- The parameters you want to send to the web service

The browser collects the information from the form and wraps it up in a document ready for transmission. This process is called *serialization*.

Transmitting the Web Service

When you transmit the information required by the web service, as you've seen already, it is serialized in an XML document. This can be done in three different ways:

- `HTTP-GET` via the querystring
- `HTTP-POST` via the body of the form
- `SOAP` via the body of the form

You already know about the first two methods, so this section focuses on the last. When we say serialized in an XML document, this doesn't tell the whole story with `SOAP`. `SOAP` isn't just any type of XML, but a specific dialect specially created for the exchange of messages. `SOAP` used to stand for Simple Object Access Protocol, but these days it is commonly regarded as not standing for anything in particular. So `SOAP` is really short for `SOAP`. A message contained in `SOAP` is nothing more than a well-formed XML document or plain, vanilla text. So what exactly is `SOAP`'s purpose?

`SOAP` is a message template for sending requests and receiving responses to web services between the browser and the web service. Because the Web relies on the HTTP protocol, it commonly excludes anything other than HTTP, and so `SOAP` (XML) documents have to be sent as part of the HTTP data. `SOAP` will send a particular instruction such as "Get me a certain bit of information" wrapped up in the HTTP, and then this information can be retrieved by the web service at the other end.

In the previous Try It Out, underneath the text boxes into which you entered the name of a city and country, you saw some example code. The example code took the three formats: `HTTP-GET`, `HTTP-POST`, and `SOAP`. The `SOAP` document looked like this:

```
POST /globalweather.asmx HTTP/1.1
Host: www.webservicex.net
```

```
Content-Type: text/xml; charset=utf-16
Content-Length: length
SOAPAction: "http://www.webserviceX.NET/GetWeather"

<?xml version="1.0" encoding="utf-16"?>
<soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Body>
    <GetWeather xmlns="http://www.webserviceX.NET">
      <CityName>string</CityName>
      <CountryName>string</CountryName>
    </GetWeather>
  </soap:Body>
</soap:Envelope>
```

The first thing to note is that the document was split into two sections. The first section is a set of HTTP headers that are used to communicate various aspects about your document. HTTP headers are also sent as a matter of course with HTML page requests so there's nothing new here. Let's take a brief look at the HTTP headers to see what they indicate.

The first line indicates that you are sending information via the `HTTP-POST` method. This might seem to immediately contradict the fact that you are using `SOAP`, but we've already mentioned the fact that your `SOAP` message has to be sent as or in an HTTP request to allow it to get through to most web servers. It also mentions the endpoint of your service, `globalweather.asmx`. The next three lines of HTTP headers are pretty standard, but the final header, the SOAPAction header, must be present; otherwise the message will be invalid. It's there to help the server decide whether it can let through a message's content.

The XML document is of greater interest. The opening line is the XML document header, standard to all XML documents. Then you have the structure of the document, which in `SOAP` will always have this structure. You have a `SOAP Envelope` tag that contains a `SOAP Header` and a `SOAP Body`.

The `SOAP Header` is optional and is missing from the code, but the `SOAP Envelope` contains some vital information in the attributes to help it make up the document. It contains three attributes that all provide namespace information: `xsi`, `xsd`, and `soap`. `xmlns` is short for XML namespace. At this level of programming, you really only want to know about the latter attribute, and this is because you use it to specify a prefix to your `SOAP` tags:

```
xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/"
```

The prefix specified after the `xmlns:` attribute is `soap`, and this prefix is used in front of all the `SOAP` tags:

```
<soap:Envelope>
 <soap:Body>
 ... Web Service content here...
 <soap:Body>
<soap:Envelope>
```

All documents sent by `SOAP` will need to adhere to this structure. Inside the `SOAP:Envelope` attribute is the `SOAP:Body` tag. The `SOAP:Body` tag is always contained within the envelope and it contains the information that has been gleaned from the parameters and needs to be sent to the web service. Inside the `SOAP:Body` tags you find at last the data you want to send:

```
<GetWeather xmlns="http://www.webserviceX.NET">
  <CityName>Birmingham</CityName>
  <CountryName>United Kingdom</CountryName>
</GetWeather>
```

The `GetWeather` tag is the web service, and the `xmlns` attribute outlines the location of the web service, which in this case was `www.webservicex.net`. Inside the `GetWeather` tag are two tags, `CityName` and `CountryName`. These are the two parameters that you originally supplied to the web service when you invoked it. These parameters have been serialized into a `SOAP` document, which itself is parceled up in the HTTP data and is now transmitted to the web service.

> **Rather than use the more common terminology *call*, the term *invoke* is used with relation to web services. If you check Dictionary.com, you will find the definition of invoke is to call upon a "higher system or power for assistance, support or inspiration." The higher power in this instance is of course the web service. I suppose it is used because the word call, of course, just doesn't paint the same picture.**

So you're probably wondering why we're going into some quite esoteric detail about `SOAP` document structure. The answer is, if you want to supply data to the web service manually, it is going to have to have this structure involved. Also there is another important reason, which you will discover in the next sections.

Returning the Response

Straightaway I need to point out that a web service doesn't have to return a response. Most commonly it will return a response, but this isn't essential; it might be just enough to send some information to a database or to change an attribute on the server. Before a response of any sort can be returned, though, a few tasks must be accomplished by the web service.

Because the data has been serialized so that it can be transmitted across the Web, it has to be *deserialized* first. This is just the process of obtaining the data (in the example the words Birmingham and United Kingdom) from the XML and then executing the web service with this data. Of course the data isn't the only thing sent back as part of the response. You also get the following:

- A return address for the consumer
- The fact that this is an HTTP response and that there is no further action required
- A success or failure code
- Configuration information

So one of two scenarios is possible: either a value needs to be returned, in which case the result has to be serialized once more in an XML document and sent back to the client, or there are no values that need transmitting back, in which case there will only be a success or failure code to indicate what has happened to your web service.

In the example you might notice that the response isn't actually returned as a SOAP document, but one large XML string using the HTTP-POST protocol. This is because you sent your original call to the service as a HTTP-POST document, so the web service is just returning in like format. It is also possible to call your web service using HTTP-GET. As you might remember from Chapter 2, a call to the server using HTTP-GET involves adding a querystring to the URL and adding the parameters as querystrings. You can send the same request to the example web service as follows:

```
http://www.webservicex.net/globalweather.asmx/GetWeather?CityName=Birmingham&Coun
tryName=United%20Kingdom
```

Doing so will return exactly the same response you saw in Figure 12-4.

This leaves us finally with the SOAP message template. To send and retrieve a document using SOAP requires a little more effort, and isn't possible via the endpoint without extra code. However, the information contained with a SOAP document retains structure, rather than being sent back as a convoluted jumble bundled up in a <string> element:

```
HTTP/1.1 200 OK
Content-Type: text/xml; charset=utf-16
Content-Length: length

<?xml version="1.0" encoding="utf-16"?>
<soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
  <soap:Body>
    <GetWeatherResponse xmlns="http://www.webserviceX.NET">
      <GetWeatherResult>
        <Location>Birmingham / Airport, United Kingdom (EGBB)
         52-27N 001-44W 0M</Location>
        <Time>Jul 12, 2005 - 05:20 AM EDT / 2005.07.12 0920 UTC</Time>
        <Wind> from the E (090 degrees) at 5 MPH (4 KT) (direction
         variable):0</Wind>
        <Visibility> greater than 7 mile(s):0</Visibility>
        <SkyConditions> mostly cloudy</SkyConditions>
        <Temperature> 64 F (18 C)</Temperature>
        <DewPoint> 59 F (15 C)</DewPoint>
        <RelativeHumidity> 82%</RelativeHumidity>
        <Pressure> 30.47 in. Hg (1032 hPa)</Pressure>
        <Status>Success</Status>
      </GetWeatherResult>
 </GetWeatherResponse>
  </soap:Body>
</soap:Envelope>
```

The first three lines are the HTTP header; however, this time the weather report results (note that this was done on a different day than Figure 12-4 and hence has a different weather report) are placed within the <soap:Envelope> and <soap:body> elements. There is no <soap:header> element here; it's optional and you don't need one. If you examine the results you will also see that the <string> element is missing, which leaves your document with its intended structure.

This doesn't answer one question, though: What happens if you didn't want to include all of the information that the web service had returned, and just wanted some particular bits and pieces? The weather web service returns all kinds of extraneous information, when all you were interested in were the sky conditions and temperature. It's certainly possible to extract items from a string, but you are better served by restricting what information the web service returns at source. To do this, you need to invest in the flexibility that a command-line prompt tool like wsdl.exe (wsdl.exe is a tool that comes as part of the .NET Framework) offers. And that requires a little extra work and is beyond the scope of this book.

Using the Response

Once the client has received a response from the web service saying that either the response has succeeded or failed along with any data that was required, the cycle of your web service ends. The client in the test example received pure XML, and therefore displayed it as a normal XML document. Both `HTTP-POST` and `HTTP-GET` wrapped the response up in a single string, which to be fair isn't a lot of use to you. This is why it is preferable to use `SOAP`, because the response would be returned in the same format as the request, and it would enable you to access individual items within the XML document more easily. However, because browsers use HTTP to transfer information, it would require a separate application to create a web service using the `SOAP` message template, and to be able to decipher the response sent via the `SOAP` message template.

When you come to consume a web service in the Wrox United application, it will be problematic when you get the whole document returned as one string, rather than individual elements, from which you can pick and choose. However, it is beyond the scope of this chapter to write a separate application to be able to send a web service request in the `SOAP` message template. We will instead settle for this imperfect state of affairs and try and use the information contained within the string as best we can. In the real world we suggest that you use `SOAP`. For more details, look at `http://msdn.microsoft.com/webservices/`.

The Structure of Your Web Service

A web service has a particular structure that needs to be maintained whenever you create a new web service. This structure is pretty much unchanged between ASP.NET 1.x and ASP.NET 2.0, so if you have experience in the area it should look familiar. Every web service you create must have basically four items (detailed in the following sections).

Processing Directive

At the head of any web service file, you need a directive, which essentially just lets ASP.NET know that this is a web service. The processing directive must always be the first line and it takes the following syntax:

```
<%@ WebService Language="language" Class="classname" %>
```

The directive is used to specify particular settings such as which language the web service is written in and where to find the class that defines the particulars of your web service. The class should be a separate file.

Namespaces

As with the rest of ASP.NET, occasionally you will need to specify other namespaces so that you can appropriate other classes and functions within your own web service. These namespaces are defined after the `@WebService` attribute in the file. In ASP.NET 1.x you had to import three namespaces as a minimum; in ASP.NET 2.0 you still have three to import, but they are slightly different ones:

```
Imports System.Web
Imports System.Web.Services
Imports System.Web.Services.Protocols
```

These web services are required as an absolute minimum, because they contain classes needed for web services to handle network connection issues and other related tasks.

Public Class

The class is simply a container for the web service, and the name of the class signifies the name of the web service:

```
Public Class FixturesService
    Inherits System.Web.Services.WebService
    ...
End Class
```

The class name needs to correspond with the `Class` attribute that is specified within the processing directive. Then for all other intents and purposes, it is just a normal object, albeit one that is exposed to the Web. The trick with our web server, though, is that any calls to the object will look like they came from the same machine, and not via a foreign source.

Web Methods

To signify that a particular method (or property) is callable via the Web, you need to add a `<WebMethod>` declaration. In ASP.NET 1.x, you could only expose methods to the Web, but in ASP.NET 2.0 you can also expose properties as well.

The `<WebMethod>` declaration is really the part that does all of the legwork. You can define one or more web methods, and not only that, you can make sure some web methods are publicly accessible, whereas others can have access to them restricted via the `protected` keyword. Though the syntax does vary slightly between VB.NET and C# (VB.NET uses greater-than and less-than symbols, whereas C# uses square brackets to define the method call), they are both recognizably similar.

The syntax in VB.NET is as follows:

```
<WebMethod()> _
Public Function Hello (ByVal strName As String) As String
....
End Function
```

This defines a web method that accepts a string as a parameter and returns a string as a result, just like a normal function.

The syntax in C# is as follows:

```
[WebMethod]
public string Hello (string strName)
{
....
}
```

This also defines a web method that accepts a string as a parameter and returns a string as a result. If you don't want to expose a particular web method to the public, you simply remove the declaration.

Web methods also take parameters of their own. You can set the different attributes to modify the behavior of the web service. This allows you to customize the web service in several ways. For instance you can use the `CacheDuration` attribute to specify the number of seconds for which you want the `WebMethod` declaration to cache its results. When a consumer browses to the web service inside this allotted period, instead of the web service going back to retrieve the result, it gets a cached copy of the results instead.

In VB.NET you can specify an attribute as follows:

```
<WebMethod(CacheDuration:=60)> _
Public Function Hello (ByVal strName As String) As String
....
End Function
```

In C# you can specify an attribute as follows:

```
[WebMethod(CacheDuration=60)]
public string Hello (string strName)
{
....
}
```

You can specify multiple attributes by separating them with commas. The `Description` attribute allows you to specify a little detail about your web method, which can help potential consumers identify whether or not they want to use it.

In VB.NET you can specify multiple attributes as follows:

```
<WebMethod(Description:="A web service that says hello to you",  _
CacheDuration:=60)> _
Public Function Hello (ByVal strName As String) As String
....
End Function
```

In C# you can specify multiple attributes as follows:

```
[WebMethod(Description="A web service that says hello to you",CacheDuration=60)]
public string Hello (string strName)
{
....
}
```

You can see the effect of adding a description to a web method in Figure 12-6. The text is displayed next to the web service so that in a list of web services, you would be able to differentiate between each one.

Figure 12-6

For more information on `WebMethod` attributes, go to `http://msdn.microsoft.com/library/default.asp?url=/library/en-us/cpref/html/frlrfsystemwebserviceswebmethodattributememberstopic.asp`.

Creating a Web Service

So far you've consumed a third-party web service and seen how you can send and receive responses via a standard interface provided from the .asmx endpoint. However, it isn't the .asmx file that is the web service, it just points you in the direction of the web service. As stated earlier, we didn't have the capability to provide weather forecasting in the Wrox United application, so we borrowed someone else's service. What happens, though, if you want to create your own web service?

Creating a web service in the past hasn't always been as easy as it should've been. If you created ASP.NET 1.x pages with Notepad, you would find yourself delving around the murky world of the command prompt to compile the service, and having to create an application by hand with which to consume the service. Here you're only going to worry about the first two stages of the life cycle, creating a web service with which you can call and transmit the data.

In this Try It Out you create an example web service that is able to return the list of results and fixtures from the Wrox United web site.

Try It Out — The Fixtures Web Service

1. With the Chapter12\WroxUnited solution (C:\BegASPNET2\Chapters\Begin\Chapter12\WroxUnited) open go to Solution Explorer and select the top line, which reads C:\...\WroxUnited. Right-click it and select Add New Item.
2. A new dialog appears. In this dialog make sure that the Language is set to Visual Basic. Type in the name **FixtureService.asmx**, select the Web Service option, and click Add, as shown in Figure 12-7.

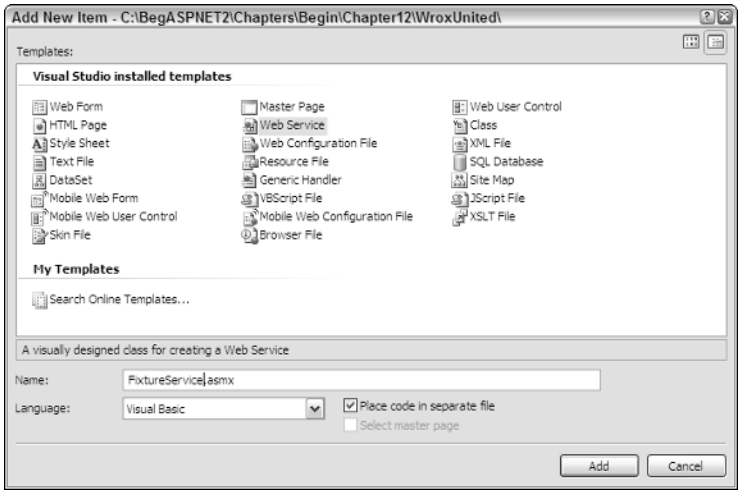


Figure 12-7

3. This creates a template web service from which to work. If it doesn't appear automatically, go to the `App_Code` folder in Solution Explorer and click `FixtureService.vb`, which will now have appeared, as shown in Figure 12-8.

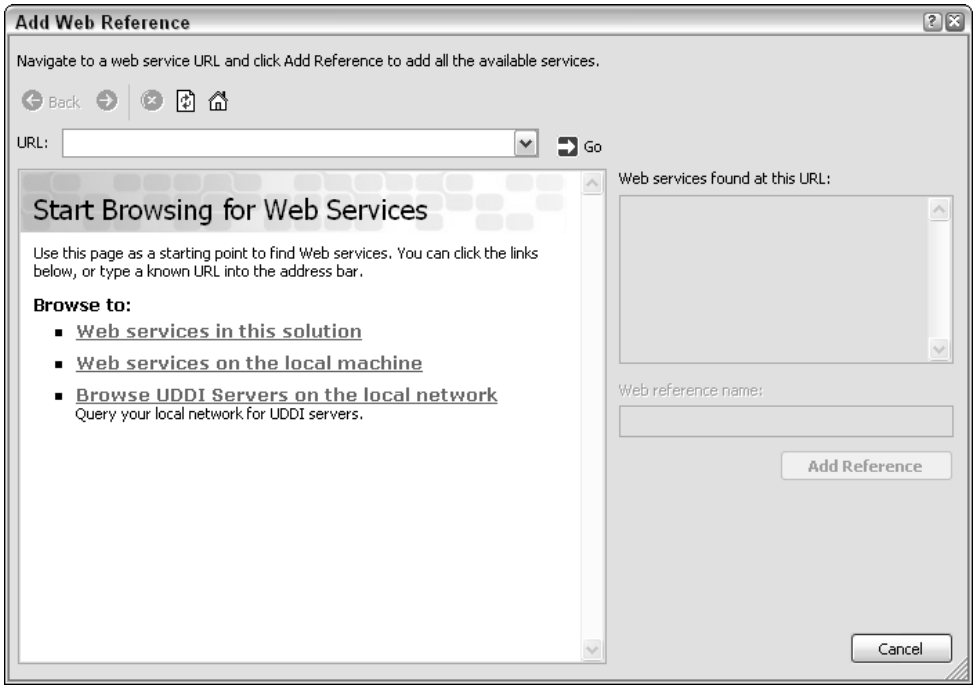


Figure 12-8

4. Add the following lines to the list of namespaces at the top of the page:

```
Imports System.Web
Imports System.Web.Services
Imports System.Web.Services.Protocols
Imports System.Data
Imports System.Data.SqlClient
```

5. Remove the lines from `<WebMethod())>` to `End Class` (because this is just a default test web service), and replace it with the following code:

```
    <WebMethod()> _
    Public Function Fixtures() As DataSet

        Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        Dim adapter As New SqlDataAdapter("SELECT FixtureDate, Opponents,
FixtureType, GoalsFor, GoalsAgainst FROM Fixtures ORDER BY FixtureDate", conn)
        Dim ds As New DataSet()

        adapter.Fill(ds, "Fixtures")

        Return ds
    End Function

End Class
```

6. Next, change the namespace attribute at the top of the page to the following:

```
<WebService(Namespace:="http://wroxunited.net/")> _
```

7. Finally, save this file.

How It Works

Inside your `WebMethod()` declaration you have a simple function, which creates a connection using the connection string, then creates a `SQLDataAdapter` and passes it the SQL to query the fixtures table:

```
Public Function Fixtures() As DataSet
Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        Dim adapter As New SqlDataAdapter("SELECT FixtureDate, Opponents,
FixtureType, GoalsFor, GoalsAgainst FROM Fixtures ORDER BY FixtureDate", conn)
        Dim ds As New DataSet()

        adapter.Fill(ds, "Fixtures")

        Return ds
   End Function
```

You create a dataset, and fill this dataset with the contents of the adapter (in other words the result of your query) and then return the dataset as a result. You also had to add in a couple of namespaces because the `SqlDataAdapter` isn't accessible by default, and so to use it you have to add `System.Data` and `System.Data.SqlClient` to enable you to create a connection and to hook up to your SQL database. You also changed the default namespace from `http://tempuri.org` (the default namespace provided by Microsoft), to `http://www.wroxunited.net`, which is the URL of the Wrox United site.

There is absolutely nothing unusual about this function; it's actually the code that surrounds this function that is important. This is what you look at in the next section.

Testing Your Web Service

So you've created your web service and taken a look at its structure, but you haven't actually done anything with it yet, not even gone as far as testing it. Fortunately you already have tools at your disposal to test the web service. Being able to browse to the endpoint of your service allows you once more to try the web service out.

Try It Out — Testing Our Fixtures Web Service

1. When you created `FixtureService.vb` and placed it in the `App_Code` folder, it automatically created an endpoint (.asmx file) for you. Go to Solution Explorer and select `FixtureService.asmx`. Right-click it and select View in Browser. You will see something similar to Figure 12-9.

Figure 12-9

2. Click Fixtures, and you will arrive at a screen similar to that displayed in Figure 12-10. From here you can test your service. Note that the service doesn't require any input.

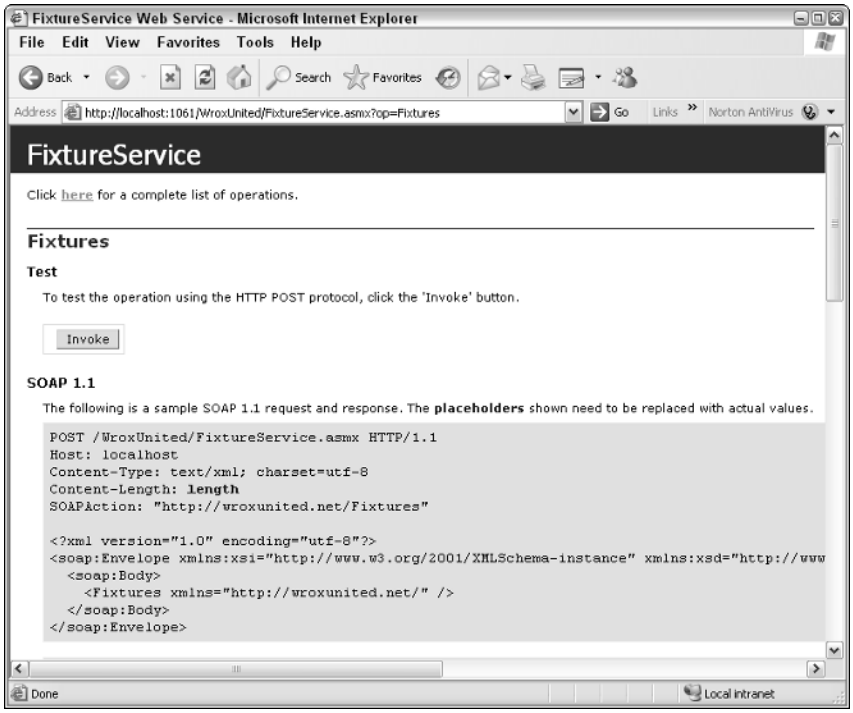


Figure 12-10

3. Click Invoke and scroll down the screen until you see the XML depicted in Figure 12-11.

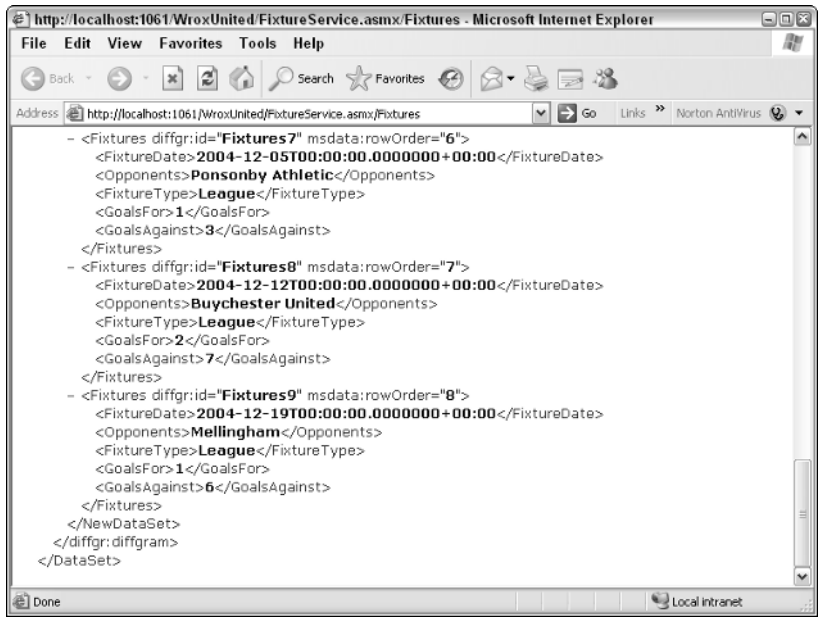


Figure 12-11

How It Works

You can see that the test has returned within the XML the fixtures and results of Wrox United's matches. The answers supplied are in pure text, so this is something that can be easily passed back and forth across the Web. You started by going to the endpoint of the service and clicking the link. From the testing page you clicked Invoke to produce the web service result in XML. This web service generated a set of fixtures from the class `FixtureService.vb` and the resulting dataset is rendered as a set of XML elements: `<FixtureDate>`, `<Opponents>`, `<FixtureType>`, `<GoalsFor>`, and `<GoalsAgainst>`.

The WSDL Contract

If you go back to the endpoint `FixtureService.asmx` and browse it again, you'll find a line with a link reading, "For a formal definition, please review the Service Description." If you click the Service Description link, you will see the page shown in Figure 12-12, containing the WSDL.

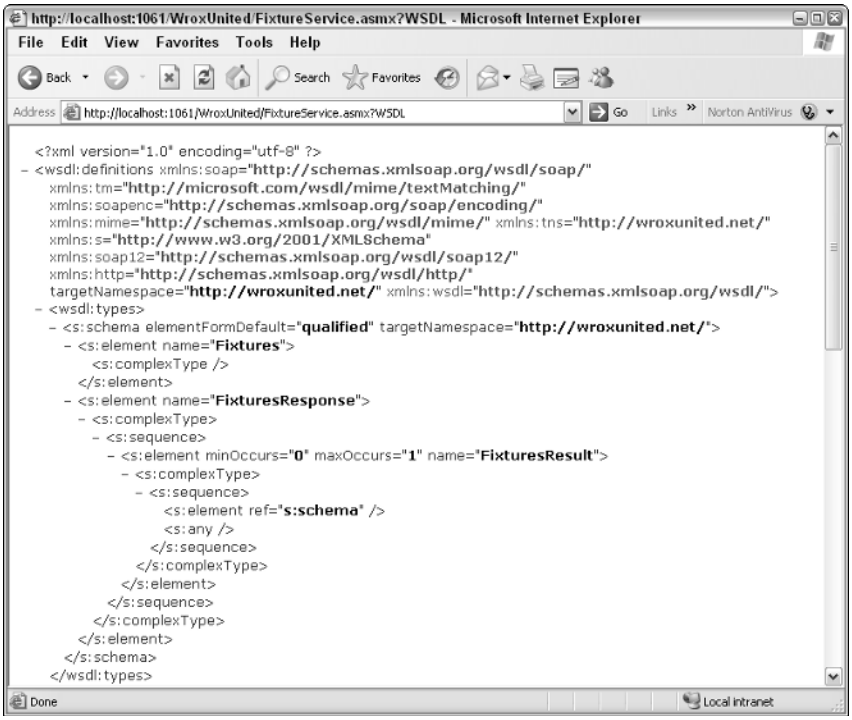


Figure 12-12

This is yet more behind-the-scenes work. WSDL is short for Web Services Description Language and it is an XML file that defines how the interaction between a web service and its consumer will occur. For example, WSDL states whether the web service uses `GET`, `POST`, or `SOAP`. The WSDL document defines whether the web service requires zero, one, or twenty parameters, and defines how many you expect back. It can also

specify that when, for example, a web service expects two specific parameters and returns a single value, what the names, order, and data types of each input and output value should be. With WSDL all of the information necessary is present to begin using the web service functionality. WSDL is yet another standard managed by W3.org and you can find the standard details at `www.w3.org/TR/wsdl`.

At the head of the WSDL document is a declaration for the `<definitions>` element, which contains various namespaces, which make references to `SOAP`. Next up is the `<types>` element, which defines each of the data types that the web service expects to receive and return after its completion. The `<types>` element is written in yet another XML language, XSD (XML Schema Definition Language).

> *If you want to see a particular definition of a data type, you need to scroll down the screen and expand each node within Internet Explorer.*

After the `<types>` element are various `<message>`, `<port type>`, and `<binding>` elements, which all refer to transmissions between the web service and consumer. The `WebMethod` message named FixtureService is contained in here, and various `SOAP` message structures are defined. In short, this file has everything needed to handle communication with your web service. And it was automatically created when you created your .asmx file.

Although you've consumed web services by browsing directly to the endpoint (the .asmx file), you haven't actually tackled how you'd go about including the web service's functionality within your own program, which is the purpose of the next section.

Web Service Discovery

Perhaps another reason why web services haven't been as successful as they might have been is that web service discovery has been a rather hit-and-miss affair. If you think back, you've created your extravagant rainfall amount cataloguing weather service, now how do you let people know about it? Stick it on your web site and hope the Google spiders will index it sooner rather than later? Stand down at your local shopping center with a placard around your neck? Web service discovery is like the process of locating any item on a search engine. You know roughly what you want to find, you just need to know the URL of where to find it. Web services are the same.

If you are the only person who needs to know about the web service, then it's a very simple affair; you just add a web reference in Visual Web Developer. When you add the web reference to the web site, it handles not only the process of compiling your web service for you, but also the process of discovering a web service as well. However, you first have to compile the web service. In prior incarnations of ASP.NET, creating a web service was a bit more fiddly than it is in ASP.NET 2.0, and it involved using the command-line prompt. You shouldn't need to drop down to command prompt, though; instead you can simply use Visual Web Developer's IntelliSense feature to compile your web services for you.

However, to make it available to a wider range of people, this is inadequate.

Two technologies are used in making web services available. The great thing is that you really don't need to know too much about either. This is because Visual Web Developer has a feature that makes the discovery of web services very straightforward, the Add Web Reference option. However, before you use it, the next sections take a very brief look at the two technologies underlying web service discovery.

DISCO

DISCO is a colorful name that belies a rather more prosaic abbreviation — discovery. DISCO is a Microsoft technology that is generally used to make web services available on your local machine. To do this you place information about the web service in a .disco document. This is an XML document that contains links to other resources that describe the web service, and can be thought of like an HTML file that contains human-readable documentation or a WSDL file.

Rather than having to worry about creating this yourself, Visual Web Developer takes care of this task for you, when you add a web reference. It creates the .disco file from the .asmx endpoint file and generates a .DISCOMAP file, both of which are placed in the `app_WebReferences` folder. These documents can then be used with Visual Web Developer automatically to find your web service.

UDDI

UDDI goes beyond DISCO; it's like a giant directory of web services, and only four big companies that use web services keep one. The two main ones are Microsoft's `http://uddi.microsoft.com` and IBM's is `www-3.ibm.com/services/uddi/`. These aren't just restricted to the companies involved; you can publish your own web service details within these directories. The UDDI directory was intended to work in the same way as a phone directory, with white pages, yellow pages, and green pages. White pages contained the business details, yellow pages contained the classification of the business, and the green pages contained technical information about the web service. Because a lot of web services are created just for the businesses involved and not for general public use, these never took off in the way they were intended to. However, if you create a web service and you do want to market it to the public, or give it away for free, then putting it in a UDDI repository is very simple. Just go to the previously mentioned URLs and follow the registration instructions.

Once again, Visual Web Developer is closely integrated with UDDI, and you can browse different registries when you come to add a web reference to your web site, and add a service to the registry in this way.

Discovering Your Web Service

DISCO and UDDI are both technologies that go on behind the scenes, and though you can make use of both of them, you don't require any specialist knowledge to do so. In the following Try It Out, you see how you can go about discovering the fixture service that you have just added to your application, by adding a web reference to it.

Try It Out — Adding a Web Reference to Your Application

1. Staying within the WroxUnited web site solution, from Visual Web Developer, select the Web Site ➪ Add Web Reference option, and you will see the screen shown in Figure 12-13.

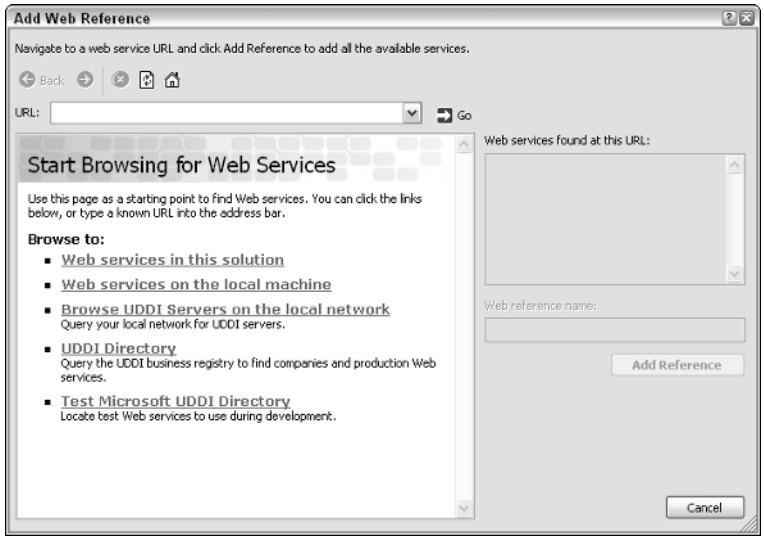


Figure 12-13

2. From here you can either browse to web services in your local application or on the local machine. You have already created a web service, so you click "Browse to web services in this solution" to arrive at the screen displayed in Figure 12-14.

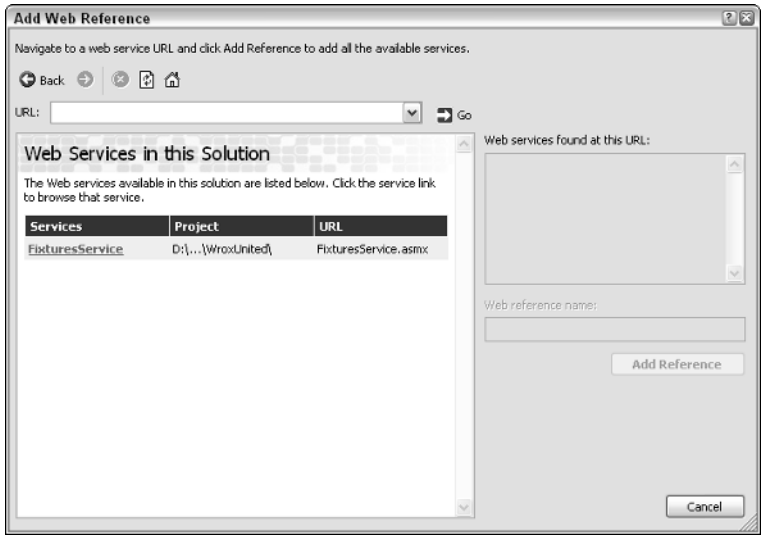


Figure 12-14

3. Only one web service should be in the solution so far, because you've only created one. Click the FixtureService link and you should be able to see a view of the web service .asmx file (see Figure 12-15).

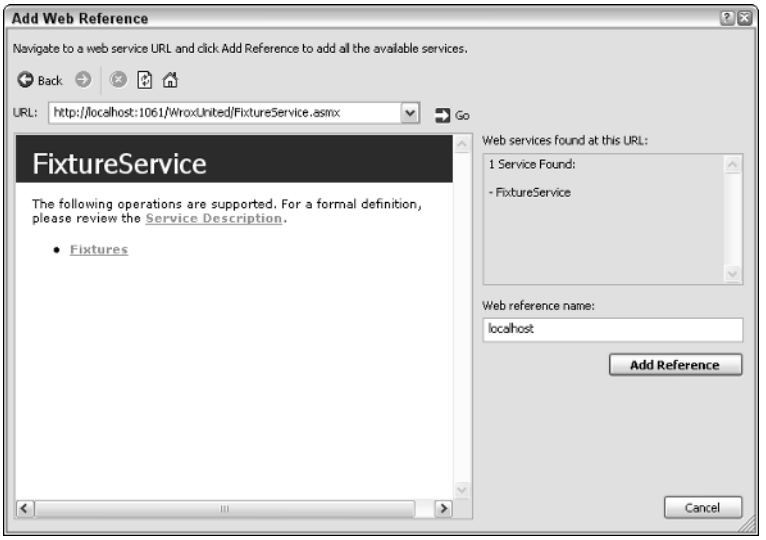


Figure 12-15

4. Click Add Reference to add this to your project. In Solution Explorer you should see a folder called `App_WebReferences`, and underneath this folder, another folder, `localhost`, which contains three files, as shown in Figure 12-16.

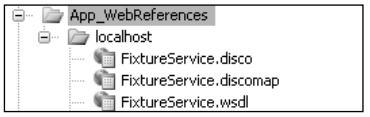


Figure 12-16

How It Works

You have created the .disco and .wsdl files in this Try It Out automatically. The process of adding a web reference involved selecting a web service (there was only one to select) and adding a reference. The reference then appears in the `App_WebReferences` folder. The .wsdl and .disco files are created at the same time. This means you are able to access the web service from within your code. This is the ultimate point of your web service and you're almost there now.

Adding the Fixture Service to Your Application

The web service now exists as an object within your code that you can access and query the methods of, just like you would with any normal object. In fact, to your application, for all intents and purposes this is a local object. Once again there is a sleight of hand going on here. What .NET Framework has done for you is to create a *proxy* object. This object acts like the web service and calls the methods on your behalf and actually passes the details to the web service.

This might sound quite complicated, but there really is absolutely no difference between creating this proxy object and creating a normal object. In the next Try It Out, you create a small page in your application that consumes your web service.

Try It Out — Adding the Service to Your Application

1. Start by creating a new Web Form in Visual Web Developer. In Solution Explorer, right-click the top line and select Add New Item. Select Web Form and call it `Consume.aspx`, as shown in Figure 12-17, and then check the Select Master Page box and select site.master as a master page

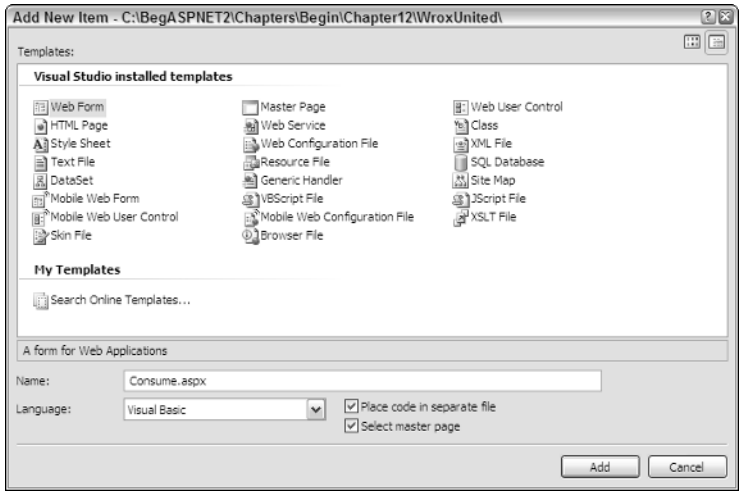


Figure 12-17

2. In Design View, add a single grid view tool to your new Web Form as in Figure 12-18.

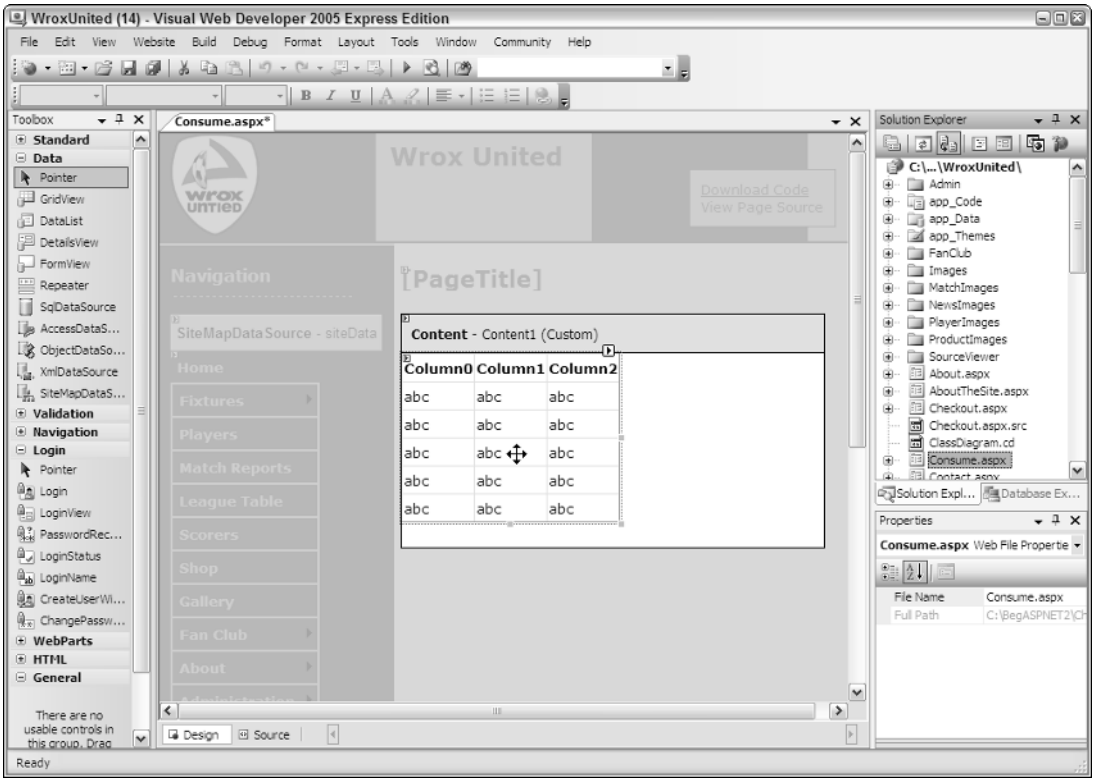


Figure 12-18

3. Click on the page alongside the new grid, in the blank part of the content are to open `Consume.aspx.vb`'s Page Load event and add the following code inside:

```
Partial Class Consume
 Inherits System.Web.UI.Page

 Protected Sub Page_Load(ByVal sender As Object, ByVal e As EventArgs)
        Dim wsConvert As New FixtureService
        GridView1.DataSource = wsConvert.Fixtures()
        GridView1.DataBind()
 End Sub
End Class
```

4. Save the page and view it in the browser. It will look like Figure 12-19.

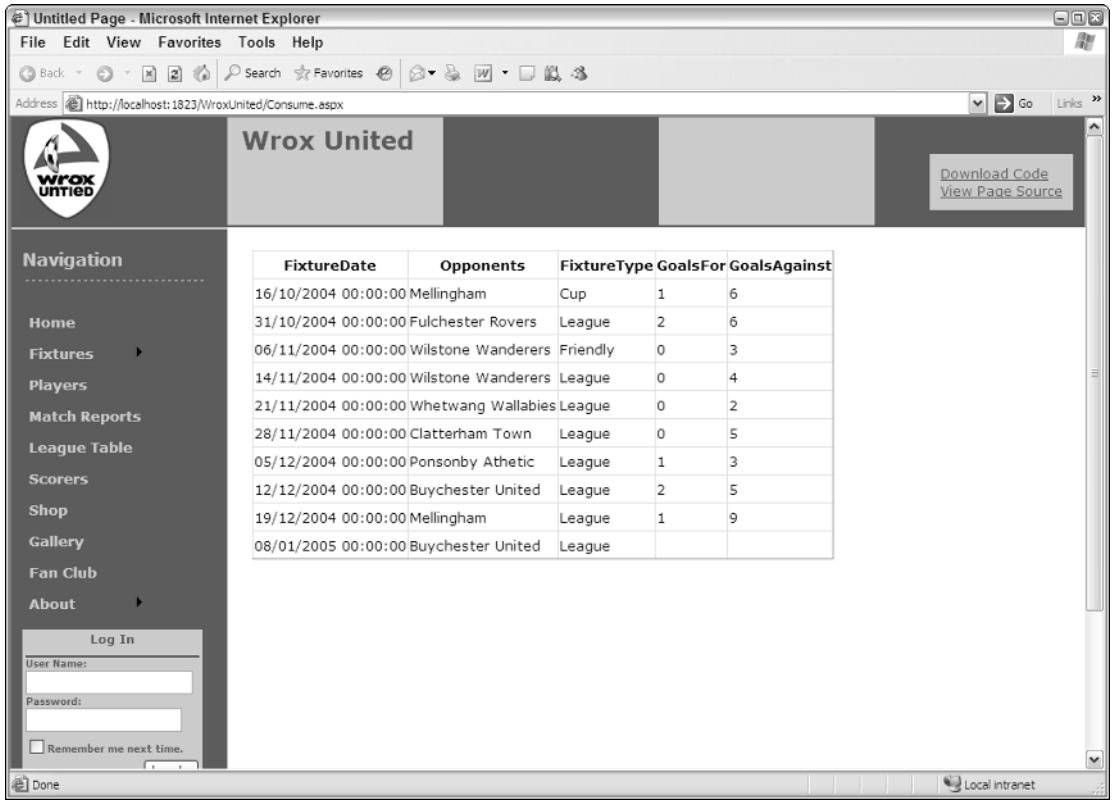


Figure 12-19

How It Works

At last, here you have it; the `GridView` control has created a table that has bound to the results and fixture provided by your fixtures web service. Only three lines of code were necessary in your final application to do this:

```
Dim wsConvert As New FixtureService

 GridView1.DataSource = wsConvert.Fixtures()
 GridView1.DataBind()
```

First you created a proxy object from `localhost.FixtureService` called `wsConvert`. In the previous example, you saw how you created a `localhost` folder under your `App_WebReferences` folder, which contained the .wsdl and .disco files.

Next, you bound to the `Fixture` method of your new `wsConvert` proxy object, and then you bound to the `GridView` control and lo and behold your web service output is rendered in Grid View. You're now free to style and alter the presentation of the web service in any way you choose.

Putting It All Together

Here's a quick recap. We've separated out each step of creating, testing, discovering, and consuming a web service so far, and we might have created the illusion that there are a lot of separate steps to perform. This isn't really the case, because we've had to abstract out each step to explain what is going on. Now you can put them all together in one large, fluid example, and create a separate user control that you can place in any application.

One common feature of many sports sites is the capability to access league tables and show a little miniaturized view of where your team is in the league, and though the Wrox United league table isn't huge (containing only eight teams), you can certainly create a web service that will show the team above and below Wrox United in the league. There are two provisos to this of course. One is that in the unlikely event that Wrox United is top of the league, you need to show the two teams underneath them. In the far more likely scenario that Wrox United is bottom, then you should show the two teams above them instead. However, we'll leap those particular chasms when we get to them.

Try It Out — Creating a League Table Mini View Web Service

1. Go to Solution Explorer, right-click the top line and select Add New Item, and then select the Web Service option. Change the name to `LeagueMiniView.asmx` and click OK.
2. Add the extra namespaces at the very top of the page underneath the existing `Imports` statements:

```
Imports System.Data
Imports System.Data.SqlClient
```

3. You need to add the following code to the `WebMethod` (note that the SQL string should all be on one line):

```
<WebMethod()> _
    Public Function ViewLeague() As DataSet

        Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        Dim sqlstring As String


Sqlstring = "SELECT [OpponentID], [Name], [TotalGoalsFor], [TotalGoalsAgainst],
[TotalGoalsFor]-[TotalGoalsAgainst] AS [GoalDifference], [Points] FROM [Opponents]
Order By [Points] DESC, [GoalDifference] DESC, [TotalGoalsFor] DESC"

       Dim adapter As New SqlDataAdapter(sqlstring, conn)
        Dim adapter2 As New SqlDataAdapter(sqlstring, conn)

        Dim ds As New DataSet
        Dim ds2 As New DataSet
        Dim position As Integer
        Dim offset As Integer
        Dim rows As DataRowCollection

        adapter.Fill(ds, "ViewLeague")
        rows = ds.Tables("ViewLeague").Rows

        For i As Integer = 0 To rows.Count - 1
```

```
            If rows(i)("Name").ToString() = "Wrox United" Then
                position = i + 1
            End If
        Next

        If position > 1 And position < rows.Count Then
            offset = position - 2
        ElseIf position = 1 Then
            offset = position - 1
        Else
            offset = position - 3
        End If
        adapter2.Fill(ds2, offset, 3, "ViewLeague")

        ds2.Tables("ViewLeague").Columns.Add("Position", GetType(Integer))
        rows = ds2.Tables("ViewLeague").Rows
        For i As Integer = 0 To rows.Count - 1
            rows(i)("Position") = offset + i + 1
        Next

        Return ds2
    End Function

End Class
```

4. Change the namespace from tempuri.org to wroxunited.net once again, to `<WebService(Namespace:="http://wroxunited.net/")>`.

5. Save this file.

6. You now need to create a page that can utilize this web service. Create a new web user control called `LeagueView.ascx` and add a `GridView` control to it. Double-click the LeagueView web user control in design view and add the following code to `LeagueView.ascx.vb`:

```
Partial Class LeagueView
 Inherits System.Web.UI.UserControl

 Protected Sub Page_Load(ByVal sender As Object, ByVal e As EventArgs)
        Dim wsConvert As New LeagueMiniView

        GridView1.DataSource = wsConvert.ViewLeague()
        GridView1.DataBind()
 End Sub
End Class
```

7. Save the page. Now you can add this control to default.aspx by tweaking that page's code as follows.

```
<%@ Register TagPrefix="uc1" TagName="News" Src="News.ascx" %>
<%@ Register TagPrefix="uc1" TagName="LeagueView" Src="~/LeagueView.ascx" %>
<asp:Content ID="Content1" ContentPlaceHolderID="mainContent" Runat="server">
    <h2>Welcome to the Wrox United Web site.</h2>
    <p>We're a great football team. No really, we are. Don't take any notice
    of our past performance. We're just unlucky.</p>
    <uc1:leagueview id="miniview" runat="server"></uc1:leagueview>
    <uc1:news id="News1" runat="server" ItemsToShow="3"></uc1:news>
</asp:Content>
```

8. Now go to `default.aspx` and view it (see Figure 12-20).

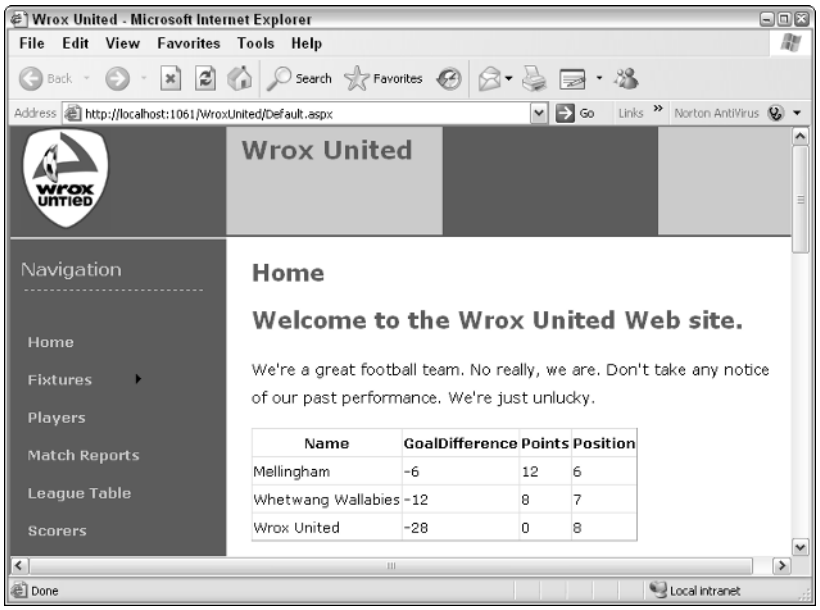


Figure 12-20

How It Works

Hopefully you will be getting a feel for this now. Although you could make the control a little more unobtrusive, the basic gist is there. Admittedly, it's a little repetitious, but should make it easier to remember. Once again your web service has returned a dataset. This time the `WebMethod` has a lot more to do. You start by creating a function that returns your dataset:

```
Public Function ViewLeague() As DataSet
```

The first task within the function is to connect to the database. You use the predefined WroxUnited connection string to do this.

```
        Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
```

You then create the SQL that is needed to return your Mini-League table. You create two `SqlDataAdapters`, one to go with each SQL string. You need two, because one is a full table and the other is your mini-view of the same league table. `adapter2` contains your new shortened view of the table with only three teams, whereas `adapter` contains the full table:

```
Sqlstring = "SELECT [OpponentID], [Name], [TotalGoalsFor], [TotalGoalsAgainst],
[TotalGoalsFor]-[TotalGoalsAgainst] AS [GoalDifference], [Points] FROM [Opponents]
Order By [Points] DESC, [GoalDifference] DESC, [TotalGoalsFor] DESC"

        Dim adapter As New SqlDataAdapter(sqlstring, conn)
        Dim adapter2 As New SqlDataAdapter(sqlstring, conn)
```

You then create two datasets, and create some variables to help you keep track of where you are in the datasets:

```
Dim ds As New DataSet
Dim ds2 As New DataSet
Dim position As Integer
Dim offset As Integer
Dim rows As DataRowCollection
```

Next you fill the first adapter with the results of the first SQL query in `sqlstring1`, which returns the whole league table in order. You then iterate through this table, position by position, until you find an entry that matches `"Wrox United"`. You save that position into the variable position:

```
For i As Integer = 0 To rows.Count - 1
    If rows(i)("Name").ToString() = "Wrox United" Then
        position = i + 1
    End If
Next
```

You have to cater for three scenarios here:

- The *golden* scenario: Wrox United is top, and you need to display the second and third place teams.
- The *doomsday* scenario: Wrox United is bottom and you need to display the two teams above them.
- The *usual* scenario: Wrox United is neither top nor bottom, but somewhere in between, in which case you display one team above them and one team below them.

Your first `if` condition deals with the case where the position isn't top or bottom of the league. You take two off the position (so if Wrox United is 5, this would be 3). Then you fill the `adapter2` with the `adapter2` starting at position `3`, and the number 3 indicates that there are three teams only. For example:

```
Adapter2.Fill(name of dataset, position to start in dataset, number of rows, name
of query).
```

So you say if the position isn't `1` and isn't last (you obtain the amount for last by counting the number of teams in the league), then you set the offset to the position minus 2 and pass that to the `adapter2.Fill` method at the end of the if then condition:

```
If position > 1 And position < rows.Count Then
    offset = position - 2
```

Of course if Wrox United has come in fifth, why are you starting with third? Surely that would display third, fourth, and fifth, when actually you intend to display fourth, fifth, and sixth? The answer is that when you filled your adapter, you started at row 0. So the team that came first is 0, the team that came second is 1, and so on. So the preceding line to fill the adapter actually does return only three teams, and will return the teams in fourth, fifth, and sixth.

Your second condition deals with what happens if Wrox United is top? You check to see if the position is 1, you set the offset to 0, (1-1), and then you fill the adapter at the end of the if then condition with the dataset starting at row 0, with the next three teams:

```
            ElseIf position = 1 Then
                offset = position - 1
```

Last, you can deduce that if our team isn't first and also didn't finish between first and last, then they must be last. You set the offset variable accordingly, and fill your data adapter:

```
            Else
                offset = position - 3
            End If
            adapter2.Fill(ds2, offset, 3, "ViewLeague")
```

You then add a new column to your second dataset called Position, and you read in the positions for each team in your mini-table:

```
            rows = ds2.Tables("ViewLeague").Rows
            For i As Integer = 0 To rows.Count - 1
                rows(i)("Position") = offset + i + 1
            Next
            Return ds2
        End Function

    End Class
```

Having created the method that fuels your web service, you then need some way of being able to reference it. Because you have a dataset, you create a user control called `leagueview.ascx` and then add a `GridView` control to the user control and bind it to your web service.

The final step is to add a reference to your new user control to the Wrox United front page, so that it is displayed in the appropriate position. It is rather large and cumbersome, so you might choose to style it some more and position it differently. This is left as an exercise for you to complete if you so desire, because any more code would distract from the already large code listings you have created.

Remote Web Services — PocketPC Application

We've stressed that what makes web services so flexible is their capability to work across platforms. However, you've had to take that for granted, because not many people will have a Mac or Linux machine in addition to their own PC. There is one platform, though, that will be familiar to quite a few readers, and that is the PocketPC platform that runs on PDAs and other mobile technologies. Because we appreciate not everyone will be able to use the following Try It Out, we will keep it relatively brief, but it demonstrates how your online reporters can supply updates to the Wrox United web site using just a web service with a PocketPC application on their PDA. Because you have already created the application that can submit data, all you need to do in this Try It Out is create a web service that will receive scores from reporters and alter the scores on the Wrox United site accordingly.

The extra bit of functionality that this Try It Out also includes is the ability to send parameters with the web service. This is just like sending parameter in a method, as you saw in Chapter 8.

To be able to run this Try It Out you will need a piece of hardware capable of running PocketPC applications. This Try It Out was tested and run on a Dell AXIM PDA that was running PocketPC 2003. While we endeavor to make sure this application will work on all PDAs running PocketPC, due to the diverse nature of the PDA we can make no such guarantees.

Try It Out Updating the Scores Web Service

1. First you need to make sure you have a copy of the PocketPC application from c:\BegASPNet2\Chapters\Begin\Chapter12\PDA.
2. Next, open the C:\BegASPNet2\Begin\Chapter12\WroxUnited web site.
3. Go to Solution Explorer. Right-click the top line, select Add New Item, and then select the Web Service option. Change the name to `UpdateScore.asmx` and click OK.
4. Add the extra namespaces at the very top of the page underneath the existing `Imports` statements:

```
Imports System.Data
Imports System.Data.SqlClient
```

5. Add the following web method.

```
    <WebMethod()> _
    Public Sub UpdateGoals(ByVal FixtureID As Integer, ByVal GoalFor As Boolean, _
      ByVal PlayerID As Integer, ByVal GoalTime As Integer)

        Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        conn.Open()
        Dim cmd As New SqlCommand("usp_UpdateScore", conn)
        cmd.CommandType = CommandType.StoredProcedure

        cmd.Parameters.Add("@FixtureID", SqlDbType.Int).Value = FixtureID
        cmd.Parameters.Add("@GoalFor", SqlDbType.Bit).Value = GoalFor

        cmd.ExecuteNonQuery()

        If GoalFor Then
            Goal(FixtureID, PlayerID, GoalTime)
        End If
    End Sub
```

6. Next add another web method underneath the previous one:

```
<WebMethod()> _
    Public Sub Goal(ByVal FixtureID As Integer, ByVal PlayerID As Integer, _
      ByVal GoalTime As Integer)

        Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        conn.Open()
```

```
        Dim cmd As New SqlCommand("usp_Goal", conn)
        cmd.CommandType = CommandType.StoredProcedure

        cmd.Parameters.Add("@FixtureID", SqlDbType.Int).Value = FixtureID
        cmd.Parameters.Add("@PlayerID", SqlDbType.Int).Value = PlayerID
        cmd.Parameters.Add("@GoalTime", SqlDbType.Int).Value = GoalTime

        cmd.ExecuteNonQuery()

    End Sub
```

7. Change the namespace from `http//:tempuri.org` to `http://wroxunited.net`, once again in the line at the beginning of the definition of the web service:

```
<WebService(Namespace:="http://wroxunited.net/")> _
```

8. Save this file.

9. Run the PDA app and add a scorer and goal details on the page, and hit the submit button (note that the PDA must have an active Internet connection for this to work). For example, in Figure 12-21, we've suggested adding Jerry Johnston at 90 minutes in the Wrox United versus Mellingham fixture.

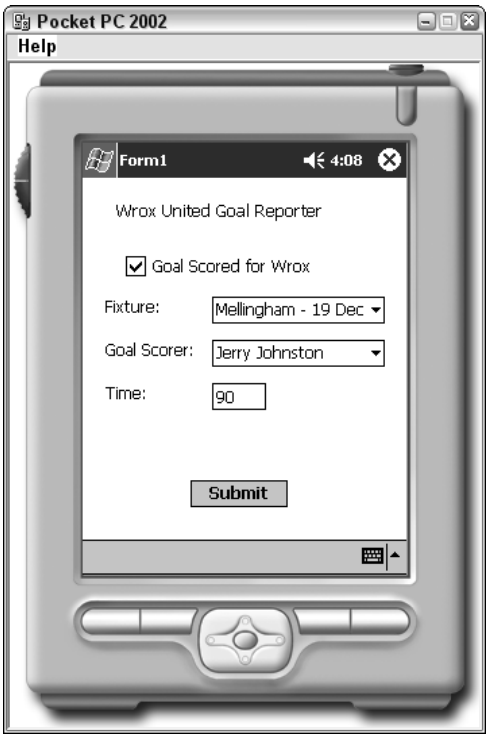


Figure 12-21

10. Run the Wrox United site and go to the scorers link, which now shows the updated details where Jerry Johnston has been added to the scorers list, as shown in Figure 12-22.

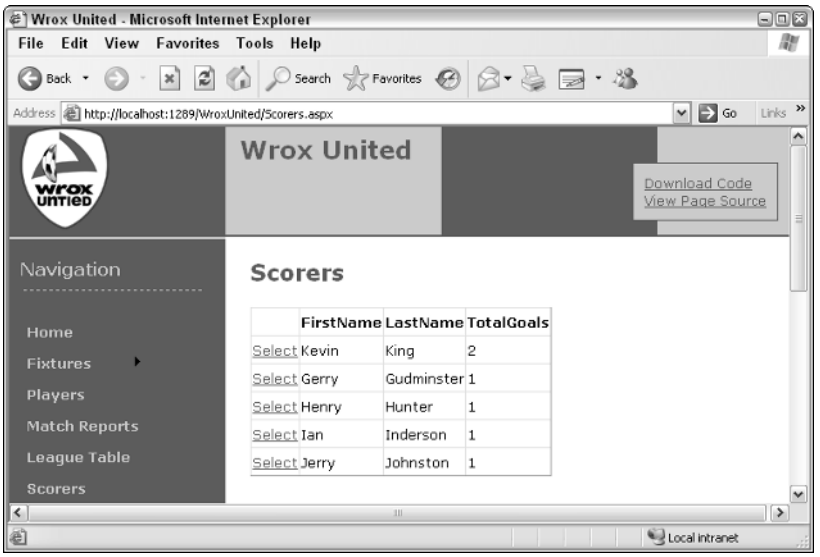


Figure 12-22

How It Works

In this Try It Out you have created two web methods as part of your web service. Which web method you use depends on whether Wrox United scored the goal or whether the goal was scored by an opponent. If Wrox United scored a goal then you need to update the goal, the player who scored it, and the time it was scored. If the opposition scored it then you only need to use two of the parameters to update the score in the database. To use the web service you start by calling the `UpdateScore` method first and then you detect whether it is a Wrox United goal, and only if it is a Wrox United goal do you update the `Goal` method as well.

The `UpdateGoals` web method updates which side scored the goal and the Score method takes four parameters, shown in bold in the following code:

```
Public Sub UpdateGoals(ByVal FixtureID As Integer, ByVal GoalFor As Boolean, _
  ByVal PlayerID As Integer, ByVal GoalTime As Integer)
```

The web method creates a connection and a command, and sets the command type as stored procedure (stored procedures are discussed in Chapter 14):

```
Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        conn.Open()
        Dim cmd As New SqlCommand("usp_UpdateScore", conn)
        cmd.CommandType = CommandType.StoredProcedure
```

You pass the parameters of the `FixtureID` and the whether the goal was for or against us and execute the query.

```
        cmd.Parameters.Add("@FixtureID", SqlDbType.Int).Value = FixtureID
        cmd.Parameters.Add("@GoalFor", SqlDbType.Bit).Value = GoalFor

        cmd.ExecuteNonQuery()
```

If the goal was for us, then you call the `Goal` web method with the `FixtureID`, the `PlayerID`, and the `GoalTime`:

```
        If GoalFor Then
            Goal(FixtureID, PlayerID, GoalTime)
        End If
```

The `Goal` web method updates the Wrox United goals and the Score method only takes three parameters, shown in bold here:

```
    Public Sub Goal(ByVal FixtureID As Integer, ByVal PlayerID As Integer, _
      ByVal GoalTime As Integer)
```

These three parameters are the fixture number, the number of the player, and the timing of the goal. In the PDA application, you selected the `FixtureID` from a selection of possible fixtures (for example, Wrox United versus Ponsonby Athletic) rather than selecting `FixtureID` `27` from a `DropDownList` control, and you selected the name of the player from a `DropDownList` control along with checkbox indicating if it was a goal for or against Wrox United. In the text box you typed the time of the goal. These are passed to your web method.

The web method is very similar to the previous one in that it you create a connection and call a stored procedure, which will update the Wrox United database. It passes the three parameters and executes the query:

```
Dim conn As New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        conn.Open()
        Dim cmd As New SqlCommand("usp_Goal", conn)
        cmd.CommandType = CommandType.StoredProcedure

        cmd.Parameters.Add("@FixtureID", SqlDbType.Int).Value = FixtureID
        cmd.Parameters.Add("@PlayerID", SqlDbType.Int).Value = PlayerID
        cmd.Parameters.Add("@GoalTime", SqlDbType.Int).Value = GoalTime

        cmd.ExecuteNonQuery()
```

Much of the work is done behind the scenes with the PocketPC application; however, as long as the Wrox United application makes the information available in a standard way (as we have done here), then any application — whether a Windows application, a web application, or a PDA application — can use it via an Internet connection.

Web Service Security

This chapter's introduction mentioned that one of the reasons that web services' lack of adoption in some quarters may be due to the ease, or rather lack of ease, with which they can be secured. If you create a web service, and you do want to market it, then you need to be able to control and regulate access to the web service.

While certainly possible in ASP.NET 1.x, it wasn't the easiest of tasks and this is one area that has definitely been improved in ASP.NET 2.0. Also, as you've seen, the web service request and response is sent as XML documents (in other words pure text), so if you're not sending via SSL, then anyone is able to intercept and steal the code. A couple of new facilities in ASP.NET 2.0 help you deal with this.

Encryption and Message-Based Security

Encryption is the process of scrambling the text containing your web service so that only the intended reader is able to decrypt it with the aid of a key. *Message-based* security has been introduced in web services.

Message-based security allows you to hand your encrypted messages to anyone, and they won't be able to decrypt the encrypted data. If your message is modified you will be able to detect that straightaway because the signature attached to the message will be invalid and you can throw those messages away. It works by encrypting the message at both request and response level and is defined in the web services WS-Security specification (a relatively new W3 specification detailing how to handle web services security).

Authentication and Access Controls for Services

Authentication is the process of checking to see if a particular user is who they claim to be. This is done usually by the common user ID/password entry. One way to secure a web service is to force anyone who attempts to use a service to have to supply credentials first. They have to supply a user ID and password, and if they don't they are refused access to the web service.

You can find more details at `http://msdn.microsoft.com/library/default.asp?url=/library/en-us/rsprog/htm/rsp_prog_soapapi_dev_6ne8.asp`.

Using both of these facilities is beyond the scope of this book; they are mentioned here because previously people would have disregarded web services for transferring sensitive and confidential information, but that no longer needs to be the case.

Summary

Web services are a massive subject that could command a whole book quite easily in their own right. We have been necessarily curt in our treatment of them to give you an idea of how they might be accessed and used within your own applications. As you saw at the beginning of this chapter a web service is simply a functionality that can be remotely called over the web. However, the distinct advantage they enjoyed over other similar methods is that all information was sent and returned in the form of XML documents (and therefore text). Specifically, this chapter covered the following topics:

- The process of using a web service, which can be broken down into creating a web service, making the web service available for discovery, and ultimately consuming the web service.
- A lot of new technologies introduced in this chapter (fortunately Visual Web Developer handles them smoothly for us), including `SOAP`, which is a framework for exchanging messages and is used in the transmission of web services. A `SOAP` document is transmitted as part of the HTTP data. DISCO and UDDI are used to make the web service available so that people can see and use it.
- Last, you've seen the idea of a proxy object within your code, which takes the place of the web service and allows you to access the different methods of the web service as though it were on the same PC.

Although all of these technologies each has a role to play, they have been very much hidden from us. The files and objects are created automatically for us, and the bottom line is that if you create a method or object, basically all you need to do is start a `<WebMethod>` with a few extra configuration details, and the rest is done for you.

The next chapter deals with e-commerce by showing you how to set up a shopping cart and how to shop for merchandise on Wrox United's web site.

Exercises

1. What is the role of `SOAP` in web services?
2. Create a web service that retrieves a Wrox United score wherever they've scored more than one goal.
3. Create a page that consumes the third-party weather forecast for Birmingham, United Kingdom. (Hint: You will also need to discover this service first.)

13

E-Commerce

This is the first version of this book that's ever dared to talk about e-commerce. This isn't because we've forgotten to, or because we think it's unimportant, but mainly because this is the first version of ASP.NET where it hasn't been too complicated to even think about. I must admit it's the one area as a developer that even I (or any developer) will tread carefully. The reason is simple — money. When you're handling other people's money, you really must make every effort to ensure that nothing can go wrong. If not, you, or the company you work for, could be held responsible and personally liable for every penny lost or stolen.

If you're not frightened off by that rather stern introduction, then I must hasten to add that there has never been a better time for building e-commerce functionality into your applications. By *e-commerce* I'm using an all-embracing term, because e-commerce covers a multitude of features; in fact, it extends over the entire process of buying and selling an item on the Web. If you consider what happens when you visit a site such as Amazon, with an intention to purchase something, there are several stages. First is the product catalog that displays the list of items from which you want to make a purchase. Once you've chosen an item, it is moved into your shopping cart. You can choose to continue shopping and add more items, and once you've finished, you check out. After you check out, your order has to be processed. These kinds of questions have to be answered when order processing: Is your item in stock? How long will it take to order if it isn't? Where should it be delivered? Next comes the bit we all hate, getting the credit card out and supplying details, checking that the number is valid, and the dates. The whole transaction should be secure. Then at last a summary and maybe an e-mail summarizing the details of the sale. ASP.NET 2.0 introduces a terrific range of features to help you build a workable e-commerce solution for any web site.

Of course it isn't possible to fully model every step of this process in just one chapter, and as with web services entire books are devoted to this subject. Also, it just isn't practical to set up a credit card–handling facility for the sake of testing one chapter. However, with the new features that ASP.NET 2.0 brings you can create a product catalog, a shopping cart, and a checkout system, you can update the stock details and product catalog, get users to enter their details, and see how you would handle real credit card details. This should give you a strong overview of how you can add the capability to buy and sell items from your web site, and although it is something to be wary of

and treated very seriously, it isn't something to be scared of adding, because ASP.NET 2.0 makes it simpler than ever before.

This chapter looks at the following:

- The typical process involved in an e-commerce transaction
- Creating a product catalog
- Creating a shopping cart and remembering which items you have in it
- Completing an e-commerce transaction and checkout
- What you'd need to do to process the order
- The considerations involved in credit card–handling
- Conducting secure transactions

The E-Commerce Pipeline

The once-common term *pipeline* is used to describe the whole e-commerce process, from browsing for particular products all the way through to having the product or products in your hand. Although the term has fallen out of the common vernacular slightly, it's one that we use here because it accurately reflects what is going on. Although different businesses may have different variations on the pipeline, it remains fundamentally similar for most web sites. A typical e-commerce pipeline might look like Figure 13-1.

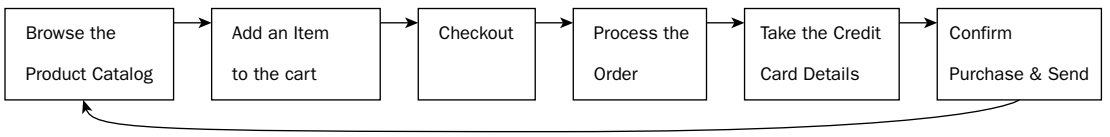


Figure 13-1

It's referred to as a pipeline because the next stage is dependent on the last and you have to pass the details through each stage. So like water flowing from a reservoir, through the pipes, to your faucet, here it's the same with the product. You select a product, you add that product to the shopping cart, you check out with that selected product, you get a total price for the product you want to purchase, you pay for the product, you get confirmation of that purchase, and then hopefully, all being well, the product is sent to you. At any stage of the pipeline, you must be able to halt the transaction, with the minimum of hassle. The only moment the transaction becomes irrevocable is when you hit "Confirm Purchase." Even then, you should be able to return the product to the shop if you ordered the wrong one, or you just plain don't like it. However, we're not going to go to quite to that extreme level of detail; you should get the idea.

The Wrox United web site already has a fully formed pipeline, and what you're going to do in this chapter is rebuild the pipeline from the ground up, step by step, right from the initial design, and learn about the decisions that need to be made as it is built. You should see that e-commerce isn't just about

programming a solution, but it's about design, layout, and taking into account the customer's needs and requirements. This chapter spends a lot of time away from the programming "factory floor" talking about these needs, too.

The Product Catalog

This chapter starts at the beginning with the Product catalog. *Catalog* is the commonly accepted term for an online version of a store's brochure. It is the one rare occasion where jargon hasn't gotten involved to complicate matters, because the word describes perfectly what it does. Every e-commerce site depends upon its catalog; it's the place from which customers will pick and choose which items to buy, and place them in the shopping cart. Wrox United is no different in this respect.

The Structure of the Catalog

The first question should be, "What are we going to sell?" The Wrox United team, like most franchises, has its own range of branded items, and you want to make all of them available on the web site for the public to buy. The current Wrox United product range looks like this:

- Scarf (plain edition or stripey edition)
- Car Sticker
- Lucky Mascot
- Large Flag (for at the match)
- Fan Club Membership
- Replica Kit (Home and Away)
- Small Flag (for the car)
- Mouse pad
- Hat
- Bug

Already you can see that there might be different categories of items that you might need to differentiate between in your catalog, such as a Home Replica Kit and an Away Replica Kit. However, the product range is small, boasting just ten different items, so you can make the decision not to subdivide the catalog into different categories, because you should be able to display the details on just one page, and treat them all as individual items.

The Design of the Catalog

Having sorted out what you're going to sell, the next question is, "What should our customers want to see when they come to purchase an item?" Because there are only ten items on display, you'll do your best to make sure that all of the items are displayed together on one page. That means cramming in a lot on just one page, so you can use a grid to lay them out and try to get away with not adding too much to the page.

For the Wrox United products, perhaps the absolute minimum you could offer is as follows:

- Product image
- Product title
- Price

Behind the scenes you'll also need to make sure that you can uniquely identify each product you offer, so you'll need a Product ID as well. When customers come to examine a product, they'll probably want to know a little more about it, such as Product Description, but you can deal with this on a separate page dedicated to the item.

In addition to this, you could also consider a wider set of attributes that you might want listed for each product, such as how many products are currently in stock, how long they will take to deliver, the release date of the product, customer reviews/testimonials to how wonderful/appalling the product is, and even a cross-linking reference that mentions which other items customers had purchased when they purchased this item.

For Wrox United, this is all complete overkill; there are only so many things you can say about a flag. However, you should be able to see that what you will require in the database will be specific to your particular business. For Wrox United, it's easy to settle on the aforementioned five fields (Image, Title, Price, Description, and for behind the scenes, the unique Product ID). Normally, the first stage would be to build or alter the database to add these categories, but all of them are already contained within the Products table of the database, so you don't need to add anything else to it. You've got a structure of the catalog and you've got a design, and a database that supports it, so you can proceed straight to the next stage and implement it.

Implementation of the Catalog

The product catalog actually breaks down into two pages: one is like an index of all the products in your catalog and the second is the page that shows particular details about the item. In this Try It Out you start by building the product catalog.

Try It Out — Building an Index Page for the Catalog

1. Open Visual Web Developer and open the `C:\BegASPNET\Chapters\Begin\Chapter13` web site. Open the blank `wroxshop.aspx` page.
2. First you'll add some controls. Drag a `SqlDataSource` control from the Data menu of the Toolbox into Design View of the page, and click the Common Tasks Menu that appears (see Figure 13-2).
3. Click Configure Data Source from the Tasks panel that appears, and then click New Connection in the dialog that appears. Select `WroxUnitedConnectionString` (which is already automatically configured, as indeed connection strings are for all databases found within the `App_Data` folder), as shown in Figure 13-3.

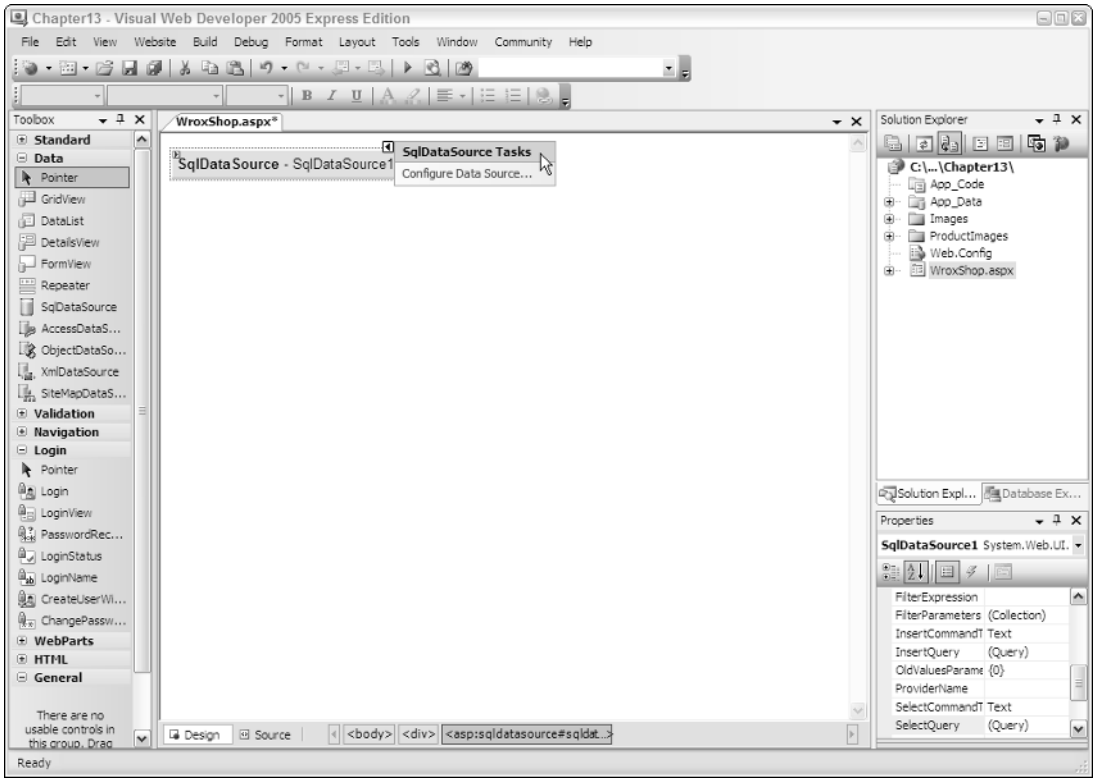


Figure 13-2

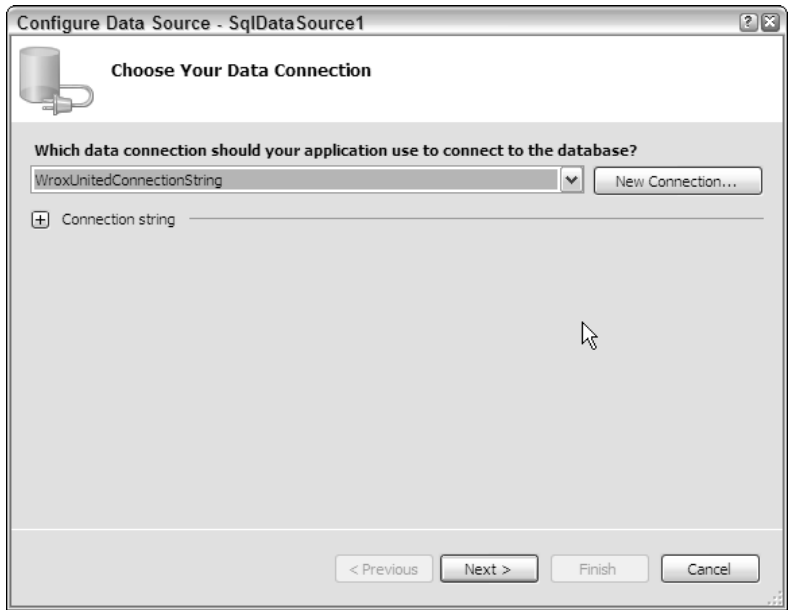


Figure 13-3

4. Click Next and then click Next again on the page that asks you whether you want to save the ConnectionString to `app.config` (it doesn't matter either way). From the Configure the Select Statement dialog that appears, you need to select the Products table and all of the fields contained within it, as shown in Figure 13-4.

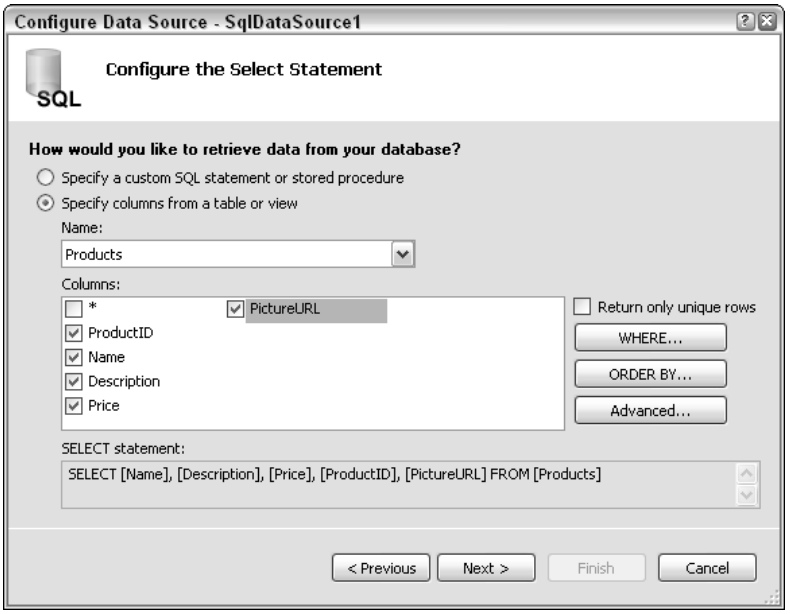


Figure 13-4

5. Click Next. Test the query to make sure it retrieves the data and then, click Finish, which takes you back to Design View.

6. Now you need to add a second control to your page. From the Data menu of the Toolbox, select the `DataList` control. Click the smart tag dialog box that appears. From the Choose Data Source drop-down list option, select `SqlDataSource1`, as shown in Figure 13-5.

7. Click the smart tag dialog box above the `DataList` control and select Edit Templates. Chapter 7 looked at the process of editing an ItemTemplate if you need a quick reminder. Figure 13-6 shows your default layout.

8. This ensuing layout needs a bit of rejigging to be suitable for displaying a catalog. First delete all of the explanatory text, such as Name: and Description:, using the Backspace key. Also, you don't need to display all of the items from the Products table; in fact, you only need a picture of the item, its price, and its name on the catalog page, as agreed upon in the design. Delete the Product ID and Description and move the Picture URL to the top. You can drag and drop the `Label` controls to order them correctly, as shown in Figure 13-7.

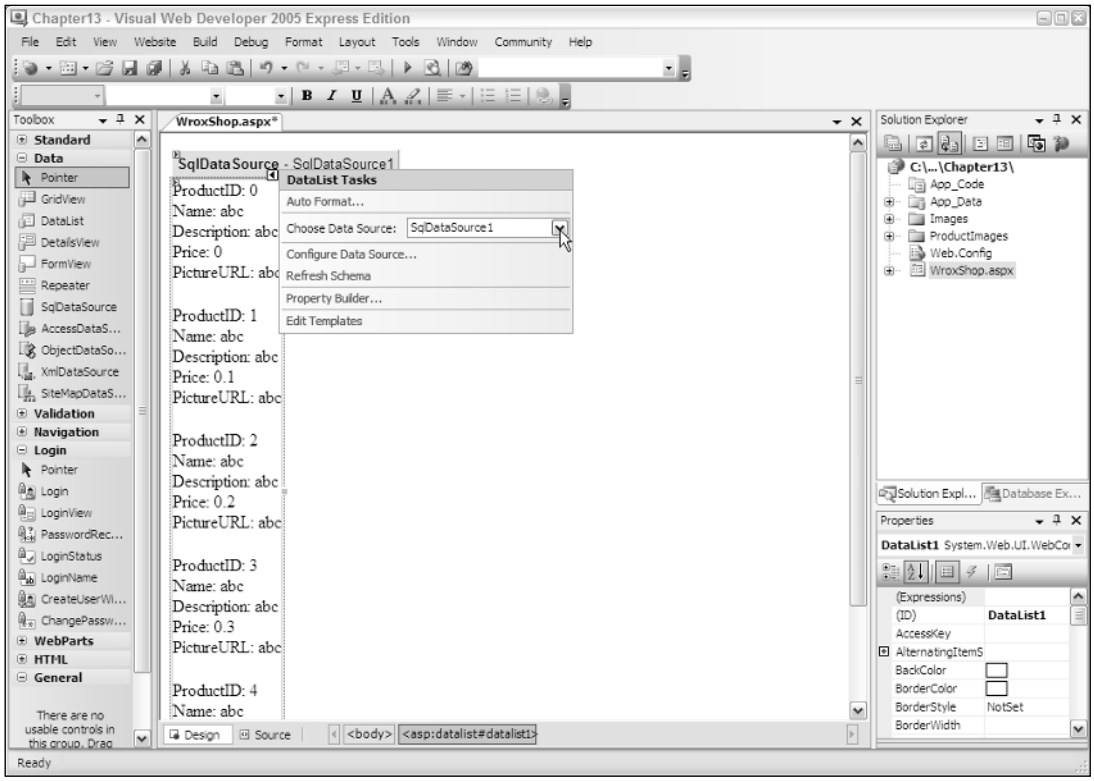


Figure 13-5

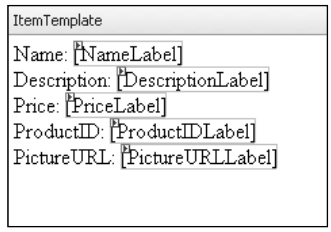


Figure 13-6

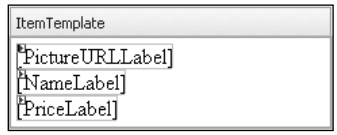


Figure 13-7

9. Next, delete the `PictureURL` label, because you want to display an image here rather than a label. Select `ImageButton` from the menu and drag it across to where the `PictureURLLabel` was. A red cross and the smart tag dialog box with the legend Edit Data Bindings should appear (see Figure 13-8). (You saw in Chapter 7 how to do this, but it delved directly into the code, whereas here you're using the wizard.)

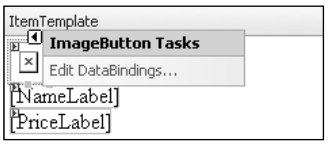


Figure 13-8

10. Select Edit Data bindings and then select the Custom binding radio button, and you need to amend the Code expression box so that it reads:

```
Eval ("PictureURL","ProductImages\thumb_{0}")
```

Figure 13-9 shows how everything should look.

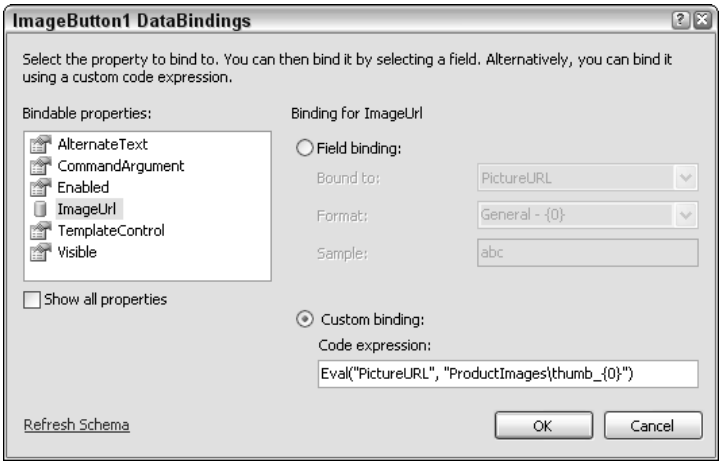


Figure 13-9

11. Click OK. Next, select the smart tag dialog box that appears next to `PriceLabel` and select Edit DataBindings (see Figure 13-10). This time select the `Text` property under Bindable properties, and select the Currency option from the Format drop-down list.

12. Click OK. You have a couple of final tasks to perform. Go to the common tasks dialog and select 'End Template Editing'. Next click the smart tag dialog box by the `DataList` control and select Property builder. Set the Columns to 4 and change the Direction from Vertical to Horizontal, as shown in Figure 13-11.

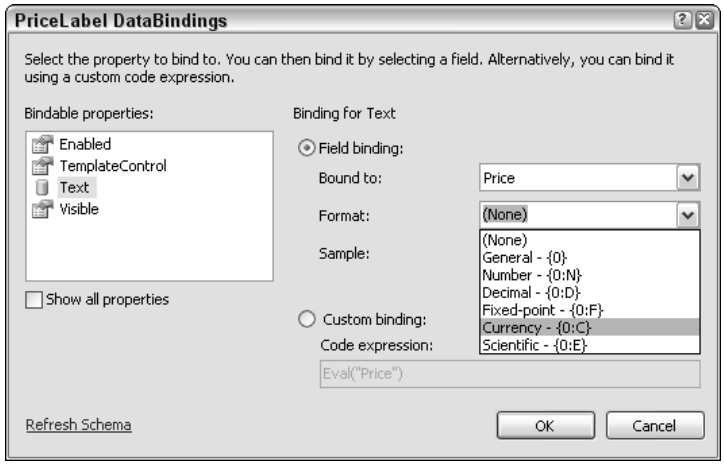


Figure 13-10

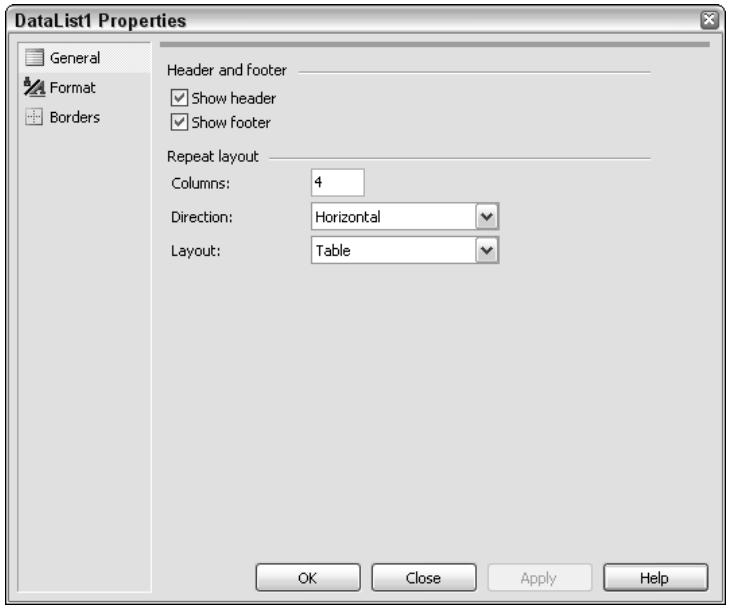


Figure 13-11

13. You've now finished the layout of the catalog. Run the project and view the catalog. It should look like Figure 13-12.

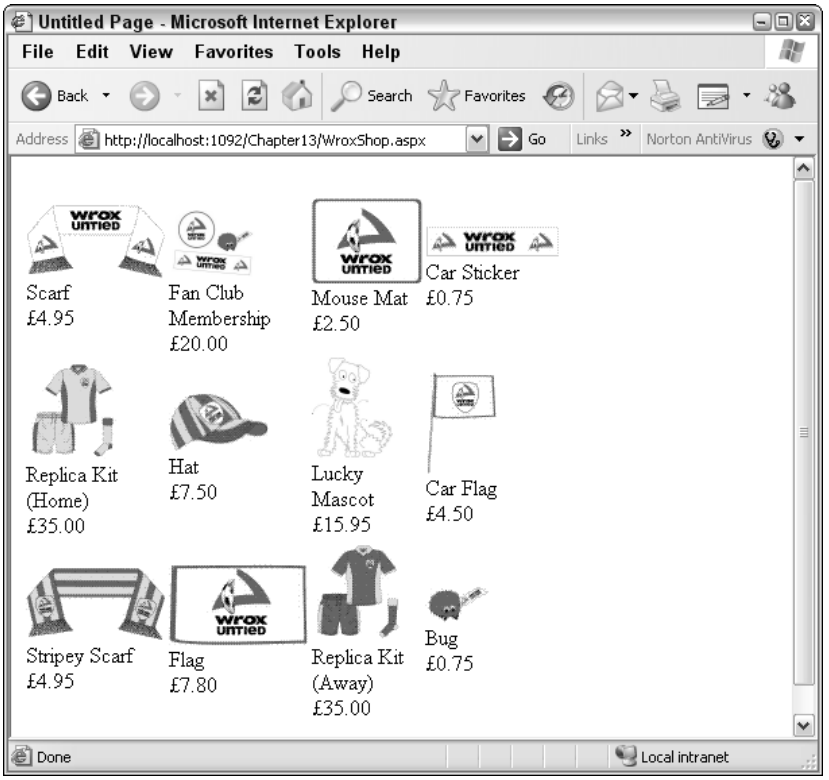


Figure 13-12

How It Works

You've created a catalog that pretty much resembles the one on the Wrox United web site. You've created your images as image buttons, which will eventually act as links to the individual product item page. If you click an image, it doesn't take you anywhere (yet), but in all other respects it is the same as the example site. In this Try It Out two controls do the work. If you go back to Visual Web Developer and view the source for this page you will see the following code:

```
<asp:SqlDataSource ID="SqlDataSource1" runat="server" ConnectionString="<%$
ConnectionStrings:WroxUnitedConnectionString %>" SelectCommand="SELECT [Name],
[Description], [Price], [ProductID], [PictureURL] FROM [Products]">
</asp:SqlDataSource>

<asp:DataList ID="DataList1" runat="server" DataKeyField="ProductID"
 DataSourceID="SqlDataSource1" RepeatColumns="4" RepeatDirection="Horizontal"
 Width="48px">
     <ItemTemplate>
          <asp:ImageButton ID="ImageButton1" runat="server" ImageUrl='<%#
           Eval("PictureURL", "ProductImages\thumb_{0}") %>' /><br />
          <asp:Label ID="NameLabel" runat="server" Text='<%# Eval("Name")%>'>
          </asp:Label><br />
```

```
            <asp:Label ID="PriceLabel" runat="server" Text='<%# Eval("Price",
             "{0:C}") %>'></asp:Label>
        </ItemTemplate>
    </asp:DataList>
```

The first control, `SqlDataSource1`, is the one that sources your catalog. The details of what is for sale in the Wrox United web site are stored in the Products table. It contains the connection string enabling you to connect to the database, and also a `SelectCommand` attribute that specifies the SQL that will pluck the Name, Description, Price, ProductID, and the URL of the image from the Products table. The `SqlDataSource` on its own doesn't display anything, though; it needs the `DataList` to do this for it.

The `DataList` contains three controls as well as the formatting needed to display your catalog correctly. You started by replacing the `Label` control contained for `PictureURL` with an Image button. You did this because a label would just have displayed the text URL of the image, such as `ProductImages\Item1.gif`, if you hadn't. Secondly, you chose an `ImageButton` in place of an image because you needed a link to the product item page. Rather than having to move or re-create this folder of product images, we have placed it in the web site folder already, and all you've had to do is reference it as follows:

```
Eval("PictureURL", "ProductImages\thumb_{0}")
```

The data-binding expression has two parameters: the first is the name of the field from the Products table you want to bind to your image button and the second is the contents of the field itself (indicated by `{0}`). You altered the second parameter so that it pointed to the ProductImages folder. Then you placed `"thumb_"`, which indicates that you don't want to use a full-sized image, but instead a thumbnail of the image for the catalog.

You used labels for the other two items in the catalog, because you only needed to display text, but for your price you changed the format so that it displayed it in currency format as $0.00, rather than just 0.0000. Last, you altered the layout so that it displayed the items in a horizontal grid format, four across in each row.

The Product Item Page

In our design discussion we talked about all the possible features you might want to add to a specific product page, but settled on only really needing an enhanced description of the product. Of course your item page shouldn't contain any less information about the product than the catalog, so you will need to display the name, image, and price in addition to the description. You add that to your web site in the following Try It Out.

Try It Out — Building a Product Page for the Catalog

1. Go to Solution Explorer, right-click the top item in it, and select Add New Item. Add a new Web Form and call it `WroxShopItem.aspx`.
2. Once again you need the `SqlDataSource` and `DataList` controls. In Design View, drag a `SqlDataSource` control from the Data section of the Toolbox.
3. Click the Configure Data Source flyout and select the `WroxUnitedConnectionString` from the drop-down list in the Choose your Data Connection dialog that appears.
4. Click Next and, as with the previous Try It Out, select the Products table and select each of the items within it, as shown in Figure 13-13.

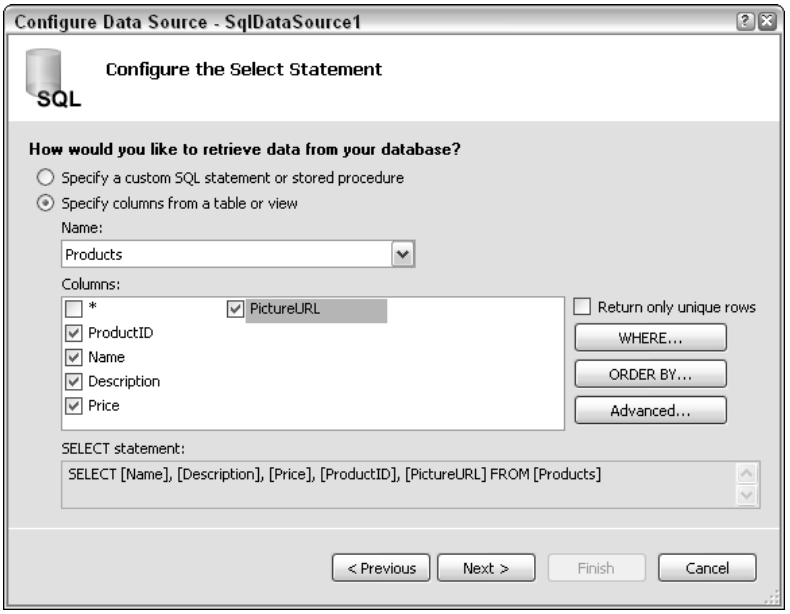


Figure 13-13

5. This time click WHERE. You will be presented with the screen depicted in Figure 13-14. Select ProductID from the Column drop-down list; select QueryString from the Source drop-down list; and type in **ProductID** to the QueryString field, leaving the Default value blank. This step allows you to hone in on your single selected product. You use the filter clause to match the product ID of the selected product and therefore only show details about that particular product. Click Add.
6. Click OK, and then Next and Finish to return to Design View.
7. Add a `DataList` control and click Configure DataSource and select `SqlDataSource1` from the Choose Data Source drop-down list.
8. Next, click Edit Templates from the list, and once again delete all the text alongside the labels. Move the `PictureURL` label to the top. This time only remove the product ID label, so that it now looks like Figure 13-15.
9. Right-click `PictureURLLabel` and select Properties. Change the Visible property to false. You're going to need the URL, but you don't want it displayed on the screen. The `PictureURLLabel` is used to provide the URL of where to find the image of your product, however you don't want the actual URL text displayed, but rather the image itself.
10. Next, in Design View add an `Image` control from the Standard section of the Toolbox.
11. Click the smart tag dialog box next to the `Image` control and select Edit Data Bindings.
12. In the dialog that appears, click Custom bindings and amend the text so that it reads (slightly differently from the last Try It Out, because you want a full-sized version of the image, not a thumbnail) as follows:

```
Eval("PictureURL", "ProductImages\{0}")
```

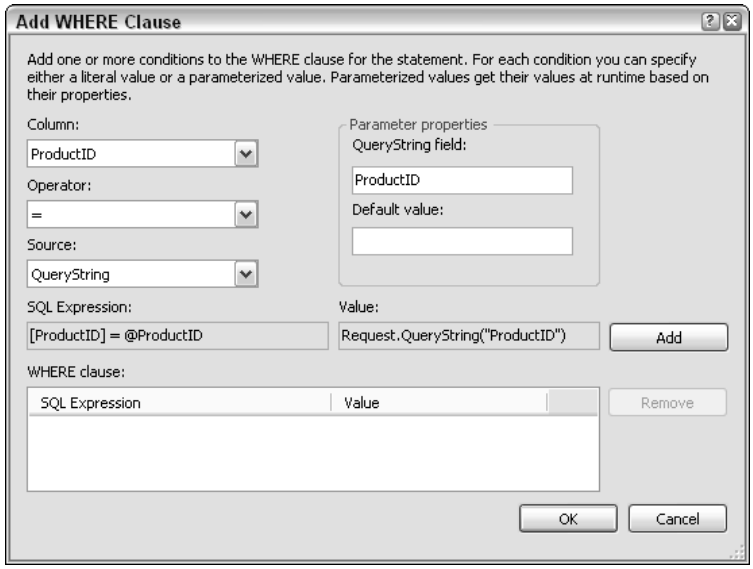


Figure 13-14

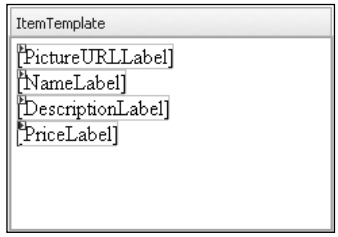


Figure 13-15

13. Click OK, and then go to Price Label and select the Edit Data Bindings option from the menu that appears when you click the black arrow. Enter the following code in the Custom bindings drop-down list box:

```
Eval("Price", "{0:##0.00}")
```

> **This is slightly different from before, because you want to use the currency format, but currency format adds a $ symbol, and you want to use this value in your code later, so you don't want to include the $ symbol in the label.**

14. Click OK. In Design View, select Hyperlink from the Standard section of the Toolbox menu and place it below the `DataList` control, as shown in Figure 13-16.

15. Right-click `HyperLink` and select the Properties option. Change the `Text` property so it reads `Return to Shop`, and change the `NavigateURL` property so that it reads `~/WroxShop.aspx`, as shown in Figure 13-17. Alternately, the reader can click the ellipsis button in the NavigateURL property box and choose wroxshop from there.

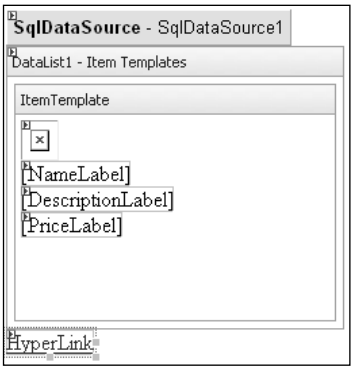


Figure 13-16

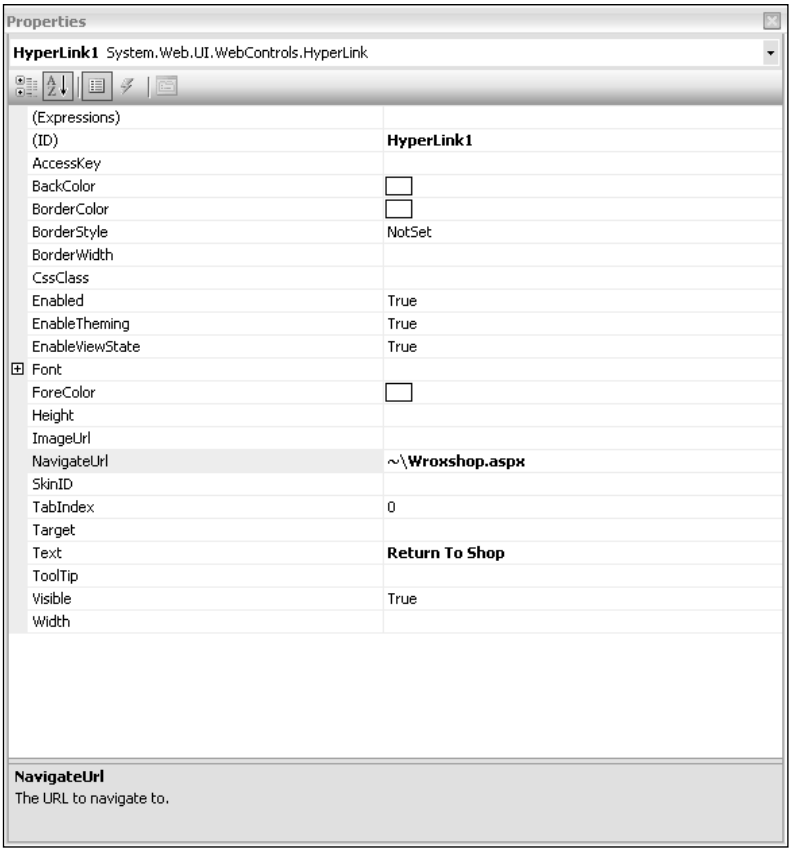


Figure 13-17

16. Close the Properties window, and go to Design View in the first page you created (`WroxShop.aspx`).

17. Select the `DataList` control underneath `SqlDataSource1`. From the smart tag dialog box that appears select Edit Templates ➪ Item Template.

18. Go to the Image Button (the graphic with the red cross), click the smart tag dialog box, and select Edit Data Bindings in the dialog that appears.

19. Click Show All Properties and select PostbackURL. Check the Custom bindings and change it so that it reads as follows:

```
Eval"ProductID","WroxShopItem.aspx?ProductID={0}"
```

20. Run the application from `WroxShop.aspx` and click the Scarf image. You should see what appears in Figure 13-18.

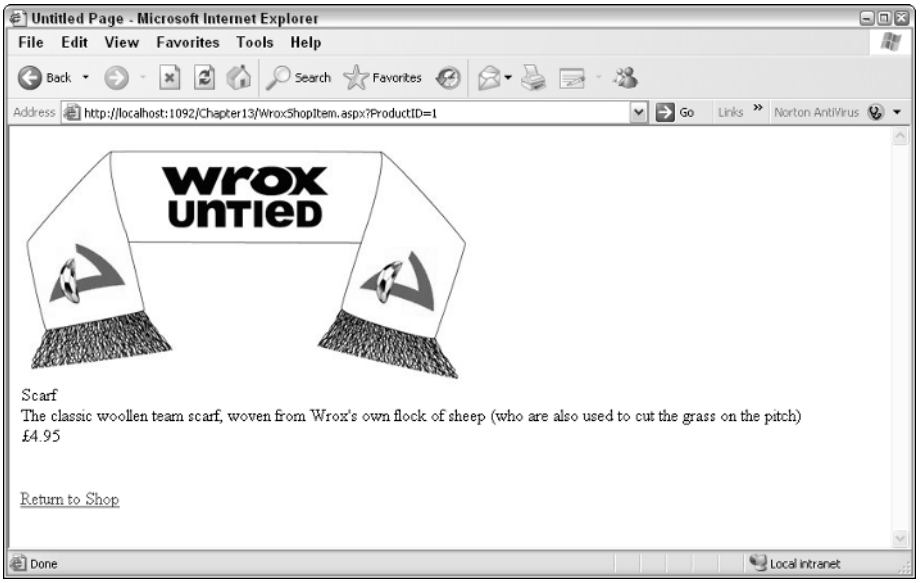


Figure 13-18

If you click Return to Shop and go back and select another image, you will get details about that product, too.

How It Works

The Product Item page is put together in much the same way as the Product Catalog, the main difference being that instead of all of the items being viewed, you only want to look at the details of a single item. If you view the source, you will once again see that it is comprised of the `SqlDataSource` and `DataList` controls:

```
<form id="form1" runat="server">
<div>
        <asp:SqlDataSource ID="SqlDataSource1" runat="server" ConnectionString="<%$
        ConnectionStrings:WroxUnitedConnectionString %>"
```

```
          SelectCommand="SELECT DISTINCT [ProductID], [Name], [Description],
          [Price], [PictureURL] FROM [Products] WHERE ([ProductID] = @ProductID)">
             <SelectParameters>
                 <asp:QueryStringParameter Name="ProductID"
                  QueryStringField="ProductID" Type="Int32" />
             </SelectParameters>
         </asp:SqlDataSource>
</div>
         <asp:DataList ID="DataList1" runat="server" DataKeyField="ProductID"
          DataSourceID="SqlDataSource1">
             <ItemTemplate>
                 <asp:Label visible="false" ID="PictureURL"
                            Text='<%#Eval("PictureURL")%>' />
                <asp:Image ID="Image1" runat="server" ImageUrl='<%#
                  Eval("PictureURL", "ProductImages\{0}") %>' /><br />
                 <asp:Label ID="NameLabel" runat="server" Text='<%# Eval("Name")
                  %>'></asp:Label><br />
                 <asp:Label ID="DescriptionLabel" runat="server" Text='<%#
                  Eval("Description") %>'>
                 </asp:Label><br />
                 <asp:Label ID="PriceLabel" runat="server" Text='<%# Eval("Price",
                 "{0:##0.00}") %>'></asp:Label><br />
                 <br />
                 <br />
             </ItemTemplate>
         </asp:DataList>
         <asp:HyperLink ID="HyperLink1" runat="server"
          NavigateUrl="~/WroxShop.aspx">Return to Shop</asp:HyperLink>
</form>
```

The difference is that this time the `SqlDataSource`'s `SelectCommand` attribute has an extra `WHERE` clause:

```
          SelectCommand="SELECT DISTINCT [ProductID], [Name], [Description],
          [Price], [PictureURL] FROM [Products] WHERE ([ProductID] = @ProductID)"
```

This references a `ProductID` parameter. Underneath this element the `SqlDataSource1` also contains a `SelectParameters` element, which specifies where you are going to get the parameter from:

```
             <SelectParameters>
                 <asp:QueryStringParameter Name="ProductID"
                  QueryStringField="ProductID" Type="Int32" />
             </SelectParameters>
```

These parameters are used to transfer the details across about which item you have clicked on. This is where the hidden ProductID comes into play. You haven't used it so far, but now you most definitely need it. Each item in your catalog has a unique identifier, this being ProductID. You collect ProductID when the image is collected and send it as a `QueryString` as follows:

```
http://localhost/Chapter13/WroxShopItem.aspx?ProductID=1
```

Then your second page (`WroxShopItem.aspx`) is able to pick that up and use that in the `WHERE` clause of the `SELECT` command of the `SqlDataSource` control to return the details of that single item. The

`DataList` control of `WroxShopItem` is incredibly similar to the `WroxShop` `DataList` control. The only two changes are that instead of referencing the thumbnail version of the image, you just use the whole version of the image. Space is no longer such an essential here, because you don't have to worry about nine other items. The second change is that you have added the Description from the Products table as an extra label. You've also used the `PictureURL` from `PictureURLLabel` as a URL for your `<asp:Image>` control that you use to display the merchandise. Apart from that, it is business as usual.

You're actually quite a distance into this chapter and so far you haven't created anything totally specific to e-commerce. I'm not deliberately playing a waiting game here; the problem is that without a catalog and a set of items, you have nothing to put into your cart. The order in which you create things is quite essential. Now that you have a catalog and the ability to browse specific items in the catalog, it's at last time to wheel out your shopping cart.

The Shopping Cart

The shopping cart is a simple enough control in principle, but until ASP.NET 2.0, it has been an awkward feature to create. The simple reason is this — how do you go about remembering which items are stored in the cart? The quick answer is state. State management, though, has never been quite as straightforward as it perhaps should be. Chapter 14 looks at sessions and state in greater detail, but we need to talk about it briefly here.

It's not new feature and to be fair it's been going on behind the scenes throughout this book, because every page contains a `ViewState` control that holds an encrypted version of each page's control contents. However, this is squared against the fact that the Internet is stateless, and so every time you move from page to page, the web server acts like a goldfish — asking the same question, "Who are you?" So you must do the remembering for the web server.

Previously in ASP.NET 1.1 you could go about remembering the items in the cart in one of two common ways. Either you could create a cart and stick the whole contents of the cart in a `Session` object, and lose the list of items every time someone logged out and back in again, or alternatively you could create a shopping cart item in the database, and then be tied to updating the database each time you added something to the cart. The advantage of the second approach is of course that if you lost your Internet connection suddenly when you came to log back in, you would still have the contents of the cart. This is particularly useful if you've just spent an hour assembling the weekly shop, only to have to endure your ISP's 0.01% downtime at that crucial point. Of course, the first approach could make use of cookies so that it could link back to your shopping cart if you logged on again, but then this would rely on a whole membership system, so you can see how suddenly your nice small shopping cart becomes a rather larger and more complex shopping cart and membership system.

ASP.NET 2.0 is able to take some of the advantages from both approaches (remembering the state between connections) while leaving at home some of the awkwardness (constant database access, needing to log on as a member before you can use the shopping cart). It does this by making use of the new profiles features that you looked at in Chapter 11. You'll see how you can use this as you come to build your shopping cart control. First, though, you need to build the object that is going to form the foundations of your shopping cart's memory.

The Shopping Object

You're going to create an object that can store your items. You need to start once again at the drawing board by creating a design. The first thing to mention is that your shopping object needs to look after two things: the items in the cart and the cart itself. Therefore, you're going to need two objects:

- `CartItem`
- `ShoppingCart`

Both merit some more in-depth discussion as to what is required.

The CartItem Object

The `CartItem` object is easiest. Design is often just a case of sitting down with pen and paper and trying to imagine what you as a user would require from a site. A second option is to look at what everyone else is doing. However, it's probably best to just stick to the pen and paper option when brainstorming, because what you might require from a site might be unduly influenced by you looking at other vendors' sites. So you're going to have a quick think now. It doesn't matter if you don't get it absolutely right the first time, because you can amend it as you go along.

With your shopping cart a good first stab would be the following list of attributes:

- A representation of the item
- The quantity of the item
- The price of the item
- The total price

For the representation of the item, you could quite easily use the title or the description of the item, but given that you have some thumbnail pictures at hand, it would be nice to use them as well. In your cart you can start with the name and a link to the image of the item purchased. The quantity and the price are both self-explanatory enough. However, the total price needs a little expanding. You could have a total price as follows:

Item	Quantity	Price
Scarf	2	$4.95
Bug	2	$0.75
Total Price		$11.40

It looks a little strange. That's because you're immediately totalling the $4.95 and the 75 cents, and they don't add up to make $11.40. So as well as the total price, it might be better to do it spreadsheet style and total the price and the quantity first and create a total for each line, as shown in the following table:

Item	Quantity	Price	Item Total
Scarf	2	$4.95	$9.90
Bug	2	$0.75	$1.50
Total Price			$11.40

So you can now add line total to the list of attributes you want to store. I think that's as much as you need for each `CartItem`, so let's move onto the `ShoppingCart`.

The WroxShoppingCart Object

The `CartItem` object was the easiest, because it's fairly static in its conception. Either you have a `CartItem` object or you don't, unless you prescribe to some sort of parallel universe theory where you can have both at the same time. However, computing is quite complicated enough already without parallel universes to think about, too! The reason the `WroxShoppingCart` object is more complex is because it will comprise one or several items in the cart. So you immediately need somewhere to store a stack of cart items in your object. Rather than a warehouse or a shopping trolley, you can use the collections talked about in Chapter 9 to do this.

This also raises other questions, namely how do you differentiate between different items in the cart, and how do you maintain some sort of order with them? The answer is to add an index, so that, for example, if you add a scarf and that is item 1 in the cart, and then you add a bug, that becomes item 2 in the cart.

Your cart will also need to deal with the set of possible actions that you can perform on the contents of the cart. Briefly the most common actions you might perform on a shopping cart are as follows:

- Adding an item to the cart
- Updating the information about an item in the cart
- Updating the total price of all of the items in the cart
- Deleting an item from the cart

You will need to handle these four actions. Last, because you are keeping a record of all of the items within the cart, it might be easier to move the total purchase price across to this object instead. This is just the kind of amendment we talked about earlier when creating a design. Better to discover it now, than when you've actually created it. So the cart item collection; an index; the add, update, and delete actions; and a final total are all the things you are going to have build into your `ShoppingCart` object.

Now that you've got an outline of what you need to store, in this Try It Out you build the object to store it.

Try It Out — Building the WroxShoppingCart Object

1. Go to Solution Explorer, right-click the top item, and select Add New Item. Choose Class and call it `Shopping.vb`.
2. Click OK. Visual Web Developer will inform you with a dialog that you are attempting to add a class to an ASP.NET application and that it should be moved to the `App_Code` folder to be generally consumable. Click Yes to accept this proposition.

3. Add the following code to create a shopping cart item object, called `CartItem`:

```
Imports Microsoft.VisualBasic
Imports System.Data
Imports System.Data.SqlClient
Imports System.Collections.Generic

Namespace Wrox.Commerce

  <Serializable()> _
  Public Class CartItem
    Private _productID As Integer
    Private _productName As String
    Private _productImageUrl As String
    Private _quantity As Integer
    Private _price As Double
    Private _lineTotal As Double

    Public Sub New()
    End Sub

    Public Sub New(ByVal ProductID As Integer, ByVal ProductName As String, _
      ByVal ProductImageUrl As String, ByVal Quantity As Integer, _
      ByVal Price As Double)

      _productID = ProductID
      _productName = ProductName
      _productImageUrl = ProductImageUrl
      _quantity = Quantity
      _price = Price
      _lineTotal = Quantity * Price

    End Sub

    Public Property ProductID() As Integer
      Get
        Return _productID
      End Get
      Set(ByVal value As Integer)
        _productID = value
      End Set
    End Property

    Public Property ProductName() As String
      Get
        Return _productName
      End Get
      Set(ByVal value As String)
        _productName = value
      End Set
    End Property

    Public Property ProductImageUrl() As String
      Get
        Return _productImageUrl
```

```
        End Get
        Set(ByVal value As String)
          _productImageUrl = value
        End Set
      End Property

      Public Property Quantity() As Integer
        Get
          Return _quantity
        End Get
        Set(ByVal value As Integer)
          _quantity = value
        End Set
      End Property

      Public Property Price() As Double
        Get
          Return _price
        End Get
        Set(ByVal value As Double)
          _price = value
        End Set
      End Property

      Public ReadOnly Property LineTotal() As Double
        Get
          Return _quantity * _price
        End Get
      End Property

    End Class
```

4. Underneath the `CartItem` class add the following code to create the `WroxShoppingCart` object:

```
    <Serializable()> _
    Public Class WroxShoppingCart

      Private _dateCreated As DateTime
      Private _lastUpdate As DateTime
      Private _items As List(Of CartItem)

      Public Sub New()
        _items = New List(Of CartItem)
        _dateCreated = DateTime.Now
      End Sub

      Public Property Items() As List(Of CartItem)
        Get
          Return _items
        End Get
        Set(ByVal value As List(Of CartItem))
          _items = value
        End Set
```

```
    End Property


    Public Sub Insert(ByVal ProductID As Integer, ByVal Price As Double, _
                      ByVal Quantity As Integer, ByVal ProductName As String, _
                      ByVal ProductImageUrl As String)
      Dim ItemIndex As Integer = ItemIndexOfID(ProductID)
      If ItemIndex = -1 Then
        Dim NewItem As New CartItem()
        NewItem.ProductID = ProductID
        NewItem.Quantity = Quantity
        NewItem.Price = Price
        NewItem.ProductName = ProductName
        NewItem.ProductImageUrl = ProductImageUrl
        _items.Add(NewItem)
      Else
        _items(ItemIndex).Quantity += 1
      End If
      _lastUpdate = DateTime.Now()
    End Sub

    Public Sub Update(ByVal RowID As Integer, ByVal ProductID As Integer, _
                      ByVal Quantity As Integer, ByVal Price As Double)
      Dim Item As CartItem = _items(RowID)
      Item.ProductID = ProductID
      Item.Quantity = Quantity
      Item.Price = Price
      _lastUpdate = DateTime.Now()
    End Sub

    Public Sub DeleteItem(ByVal rowID As Integer)
      _items.RemoveAt(rowID)
      _lastUpdate = DateTime.Now()
    End Sub

    Private Function ItemIndexOfID(ByVal ProductID As Integer) As Integer
      Dim index As Integer
      For Each item As CartItem In _items
        If item.ProductID = ProductID Then
          Return index
        End If
        index += 1
      Next
      Return -1
    End Function

     Public ReadOnly Property Total() As Double
      Get
        Dim t As Double

        If _items Is Nothing Then
          Return 0
        End If

        For Each Item As CartItem In _items
          t += Item.LineTotal
```

```
        Next

        Return t
      End Get
    End Property
  End Class
End Namespace
```

5. Save this page. Unfortunately there's nothing you can do with the class until you come to instantiate an instance of the object, so there's nothing to see just yet.

How It Works

The `WroxShoppingCart` class provides you with an object that you can just insert into your code. You start by defining both objects as being in the `Namespace` `Wrox.Commerce`. This means that you can insert them into any page by using the following reference at the top of a page:

```
<%@ Imports Namespace = "Wrox.Commerce" %>
```

This reference enables you to make use of all of the properties and methods within the `ShoppingCart` object. There is a lot of code here within the object, so let's briefly skip through what is happening with each object inside the `ShoppingCart` object.

The `CartItem` is just a series of properties to store each of the cart attributes in. You define a set of private variables that represent each of the items in your `CartItem` object. On top of the five previously mentioned, the `productID` is also there so you can uniquely identify the type of item:

```
Private _productID As Integer
Private _productName As String
Private _productImageUrl As String
Private _quantity As Integer
Private _price As Double
Private _lineTotal As Double
```

The `productID` attribute is an integer, because it stores your unique identifier. The `productName` attribute is text, so you store that as a `String`. Next comes the `productImageUrl` attribute, and rather than store a physical image, you store a URL of the location where you can find that image (thus saving you having to physically store the images in the database), and so that is also stored as `Text`. The `quantity` attribute is also stored as an `Integer`, because it is impossible to have a fraction of an item (Wrox United doesn't sell half a scarf, or a bug with two legs). The `price` attribute, however, is a representation of currency, so that requires a `Double` data type because you will be dealing with fractions, and because the `lineTotal` attribute is made from quantity multiplied by price, that must also be a `Double` data type.

Each of these attributes must be both readable and writable, so you create a set of properties for each in this format, using the `ProductID()` property as an example:

```
Public Property ProductID() As Integer
  Get
    Return _productID
  End Get
  Set(ByVal value As Integer)
    _productID = value
  End Set
End Property
```

Each one of the properties takes this format with both `Get` and `Set` constructors, referencing the variables you defined at the top of the `ShoppingCart` definition. The only one that is any different is the `LineTotal()` property, which is a multiplication of the `quantity` and `price` properties. You don't want anyone to be able to alter this because you change it yourself, so it only has a `Get` part:

```
Public ReadOnly Property LineTotal() As Double
  Get
    Return _quantity * _price
  End Get
End Property
```

That sums up the entire `CartItem` object. The `WroxShoppingCart` object is a little trickier. Because you are constantly updating your shopping cart, you need to keep a track of when it was created and when it was last updated. You start by defining a couple of variables that do this for you:

```
Private _dateCreated As DateTime
Private _lastUpdate As DateTime
```

These two variables store the time at which the `WroxShoppingCart` object was created and the time at which it was last updated. Next you create the collection. The collection is a `List` object and it contains a list of `CartItem` objects. You create a `New()` method that you can call in your code, to create a new instance of a shopping cart:

```
Public Sub New()
  _items = New List(Of CartItem)
  _dateCreated = DateTime.Now
End Sub
```

You create a property called `Items` in which to store your `List` of `CartItems`:

```
 Public Property Items() As List(Of CartItem)
   Get
     Return _items
   End Get
   Set(ByVal value As List(Of CartItem))
     _items = value
   End Set
End Property
```

Then you come to your three actions, which you code as methods. The first method insert requires all the information that your cart requires, namely `ProductID`, `Quantity`, `Price`, `ProductName`, and the `ProductImageUrl`:

```
Public Sub Insert(ByVal ProductID As Integer, ByVal Price As Double, _
                  ByVal Quantity As Integer, ByVal ProductName As String, _
                  ByVal ProductImageUrl As String)
  Dim ItemIndex As Integer = ItemIndexOfID(ProductID)
  If ItemIndex = -1 Then
    Dim NewItem As New CartItem()
    NewItem.ProductID = ProductID
    NewItem.Quantity = Quantity
    NewItem.Price = Price
    NewItem.ProductName = ProductName
```

```
    NewItem.ProductImageUrl = ProductImageUrl
    _items.Add(NewItem)
  Else
    _items(ItemIndex).Quantity += 1
  End If
  _lastUpdate = DateTime.Now()
 End Sub
```

When you add a new item into the cart (the `Insert` method), you need to create an index to track this. If the index is –1, you know that item is not already present in the cart, and you need to create a new cart item with the accompanying `ProductID`, `Quantity`, `Price`, `ProductName`, and `ProductImageUrl` details. If it is present, you just need to add one to the quantity. Because you have just made the last update to the cart, you also need to record this in the `lastUpdate` variable and use the `DateTime.Now()` function to record the current date and time.

The `Update` action is in fact just a recalculation of `Price`; as mentioned earlier, `Quantity` is the only item you can actually change when you update the cart details. (If you think about it this makes total sense, because you can't have the customers updating the price, or the product name or description anyway.) The quantity affects the price.

```
Public Sub Update(ByVal RowID As Integer, ByVal ProductID As Integer, _
                  ByVal Quantity As Integer, ByVal Price As Double)
  Dim Item As CartItem = _items(RowID)
  Item.ProductID = ProductID
  Item.Quantity = Quantity
  Item.Price = Price
  _lastUpdate = DateTime.Now()
End Sub
```

You identify the item once again using the index, and you read the `ProductID`, the `Quantity`, and the `Price` from the `CartItem` collection, and set it to the new `Quantity` for your chosen product. You update the time the cart was updated as well.

You've looked at the `Update` and `Insert` methods, so that just leaves the question of how customers can remove items from the cart. This is done via the `Delete` method. The `Delete` method is the simplest of the three; all you need to do is use the index to identify which item has been selected for deletion and remove it with the `RemoveAt` method. You also set the `_lastUpdate` variable to contain the current time, because you have just updated the cart by deleting an item from it:

```
Public Sub DeleteItem(ByVal rowID As Integer)
  _items.RemoveAt(rowID)
  _lastUpdate = DateTime.Now()
End Sub
```

Under the `Insert`, `Update`, and `DeleteItem` methods is the `index` property. The `index` property is as follows:

```
Private Function ItemIndexOfID(ByVal ProductID As Integer) As Integer
  Dim index As Integer
  For Each item As CartItem In _items
    If item.ProductID = ProductID Then
      Return index
```

```
      End If
      index += 1
    Next
    Return -1
  End Function
```

The index, which is used to identify each item in the cart, stores each product's `Product` ID. If the first item in the cart was a scarf, then the first item in the index will contain the scarf's `ProductID`. If you haven't got a `ProductID`, you return `-1` instead to indicate that this product is not currently in the cart, and that you need to create a `CartItem` object for it.

The `Total` comes last:

```
  Public ReadOnly Property Total() As Double
    Get
      Dim t As Double

      If _items Is Nothing Then
        Return 0
      End If

      For Each Item As CartItem In _items
        t += Item.LineTotal
      Next

      Return t
    End Get
  End Property
```

It's a fairly simple property too. If there are no items in your collection (you check this by seeing if it `Is Nothing`) then you don't have any arithmetic to do. Otherwise, you iterate through each `Item` in the `CartItem` collection, adding the `LineTotal` property on for that item and you return the total amount as the variable `t`.

The Profile

You have your `WroxShoppingCart` object, which will act as the memory of the shopping cart, but this still doesn't answer a key question — how are you going to keep this shopping cart if your user gets his Internet connection violently terminated? In fact you've already looked at the solution to this in a previous chapter.

In Chapter 11 you looked at how you can create a user profile and how it can be used to create a particular personalized view of the site for any user who logs on to the site. In particular, you stored the member's name, address (including city, county, and country), e-mail, whether he wanted to receive mailings or not, and his particular theme of the site. It is via this capability that you can also store the `ShoppingCart` object. Rather than getting you to create the whole profile, we've already provided it in the ready-to-go app that is available for download from `www.wrox.com` for this chapter.

I can hear the wiseguys at the back now — so I see how to save the cart, but surely you still have to log in to get associated with your cart? That's where the wiseguys are wrong. Another great new feature of ASP.NET is the capability to track seemingly anonymous users via the personalization and profiling system. If the wiseguys had been paying attention in Chapter 11, they would have known that!

In Chapter 11 you saw how you could set up a template to handle anonymous users, and how you could also migrate the details from the anonymous person's shopping cart to the bona fide logged-in user's shopping cart. Now it's time to fill in the other jigsaw pieces. How does this fit into the overall shopping cart picture?

Well, you can set an attribute to track anonymous users so that even if they haven't logged in, and have their connection to the application terminated, then when they come back they will still have their shopping cart contents intact. This is all contained within the `Web.config` file, which you have already partially predefined for the application in this chapter, so that your e-commerce application makes use of changes introduced to the Wrox United site in Chapter 11, and therefore requires a minimal amount of extra code. You add that capability in the next Try It Out.

Try It Out — Amending the Profile to Use the ShoppingCart Object

1. In the Chapter13 application, go to Solution Explorer and open up the `Web.config` file. Scroll down to find the `<profile>` element and add the highlighted code:

```
<anonymousIdentification enabled="True">
<profile enabled="true">
   <properties>
         <add name="MemberName"/>
         <add name="Name"/>
         <add name="Address"/>
         <add name="City"/>
         <add name="County"/>
         <add name="PostCode"/>
         <add name="Country"/>
         <add name="Mailings" type="System.Boolean"/>
         <add name="Email"/>
         <add name="Theme"/>
         <add name="Cart" serializeAs="Binary"
              type="Wrox.Commerce.WroxShoppingCart"
              allowAnonymous="true"/>
   </properties>
 </profile>
```

2. Save Web.config.

How It Works

Because `Web.config` is used by your application, the simple act of saving any changes ensures that the update is immediately applied. You've only added two items. The first just switches on anonymous identification, which is switched off by default:

```
<anonymousIdentification enabled="True">
```

The second is the cart definition:

```
<add name="Cart" serializeAs="Binary"
     type="Wrox.Commerce.WroxShoppingCart"
     allowAnonymous="true"/>
```

You use the `Type` attribute to refer to the `ShoppingCart` object. You set the `allowAnonymous` attribute to `true` so that this particular property is tracked even when the user hasn't logged in. Last, there is a bit of technical detail in the `serializeAs` property, which needn't concern you. It simply enables you to make use of your `ShoppingCart` object. You can find more details about it at `http://msdn2.microsoft.com/library/46xzk8kd(en-us,vs.80).aspx`.

The Shopping Cart Control

Unfortunately, among the multitude of new controls, there is no predefined shopping cart control that you can use, so you are going to have to create one. However, what you can do is make use of some of the existing ASP.NET 2.0 controls and you can construct a shopping cart control that you can not just use in this application, but in any application you come to build. In ASP.NET 2.0, the data handling features have taken a giant leap forward, and you can use the `GridView` control and some clever data-binding to create your shopping cart for you.

Before you rush into building the cart, though, it's worth thinking a little bit more about design. How are you going to access your cart? How are you going to display the items in it? The first question is easy enough to answer: You add a button to your product item page, which when clicked simply adds the item to the cart. However, where should you go then? Rather than going to your shopping cart, you probably want to return to your catalog. Shopping carts by nature should be unobtrusive; you don't want to be confronted with the contents of your cart every time you stick an item in; this is probably not conducive to impulse buying (and by inference profitable selling)! It's much easier only to be confronted with the contents once you get to checkout. So your system develops a structure like Figure 13-19.

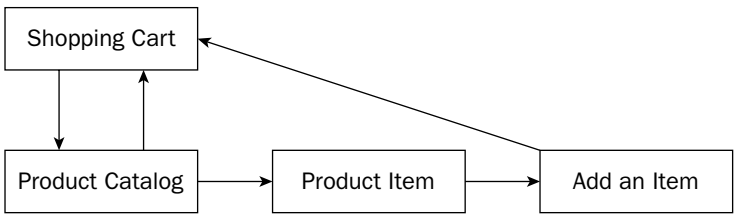


Figure 13-19

This diagram shows how you can navigate between the different parts of your application. You can move from the Product Catalog page, either to the Shopping Cart itself or to the Product Item page. From the Product Item page you can Add an Item, which in turn will appear in the Shopping Cart.

The second question, then, is about how you should display your shopping cart. If you were feeling extremely confident about the layout, you could probably have a little control pop up at the side that appeared in every page of the site, but because you don't want to have to spend a lot of time with the jigsaw puzzle of fitting things into your web site design, you'll just make the shopping cart a separate page that can be easily accessed via a separate link. You've already earmarked the `GridView` control to display the contents of your cart, so continue and build the next stage of your pipeline.

In this Try It Out, you create a user control, the Shopping Cart control, and then add it to a page. The user control is a lot more portable; you learned about them in Chapter 10 and how they help you to reuse code effectively.

Try It Out Adding a Shopping Cart Control

1. Open Solution Explorer in Visual Web Developer. Right-click the top item and select Add New Item. Add a Web User Control and call it `WroxShoppingCart.ascx`.
2. In Design View, select the `GridView` control from the Data section of the Toolbox. Click the smart tag dialog box and select the Edit Columns option.
3. From the dialog that appears, select one `TemplateField`, four `BoundFields`, and one `CommandField`, as shown in Figure 13-20.

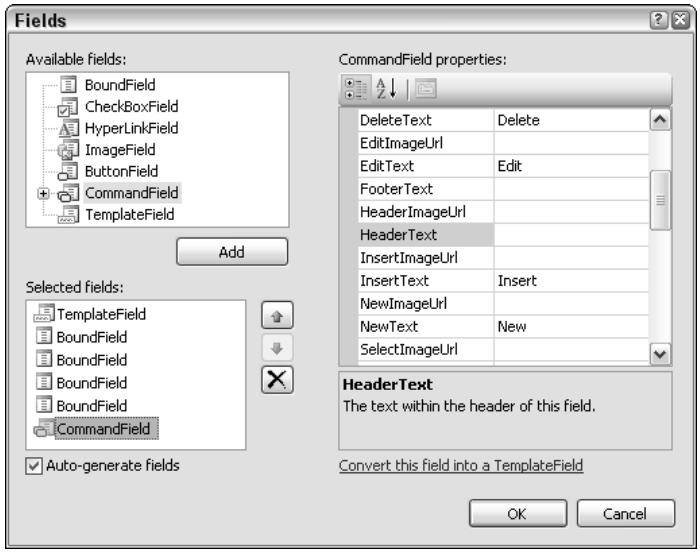


Figure 13-20

These will be used to represent the `ProductImage`, `ProductName`, `Quantity`, `Price`, and `LineTotal` (that is, quantity multiplied by price) of that particular item and a button to edit that item or to delete it from your shopping cart, respectively.

4. Select the `BoundFields` field and change the properties one by one in the Properties window as follows:

	DataField	HeaderText	ReadOnly	DataFormatString
Bound Field 1	`ProductName`	Product	True	
Bound Field 2	`Quantity`	Quantity	False	
Bound Field 3	`Price`	Price	True	{0:c}
Bound Field 4	`LineTotal`	Total	True	{0:c}

Don't click OK in between adding each item, which will take you back to Design View.

5. Go to the `CommandField` and set the `ShowEditButton` and `ShowDeleteButton` properties to `True`.
6. Click OK to go back to Design View. Click the smart tag dialog box, and select Edit Templates from the flyout that appears.
7. Now drop an `Image` control into the `ItemTemplate` and click the smart tag dialog box, as displayed in Figure 13-21.

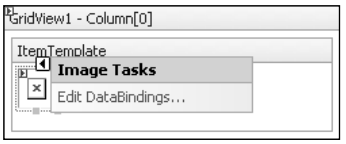


Figure 13-21

8. Select Edit Data Bindings and select `ImageUrl` from the Bindable properties. Add the following code to the Code Expression box:

```
Eval("ProductImageUrl", "~/ProductImages/thumb_{0}")
```

9. Return to Design View and select the smart tag dialog box on the `GridView` control. Select Edit Templates ➪ EmptyDataTemplate from the menu that appears. Type the following text directly into the `EmptyDataTemplate` (see Figure 13-22): **There is nothing in your shopping cart. You can buy items from the Shop.**

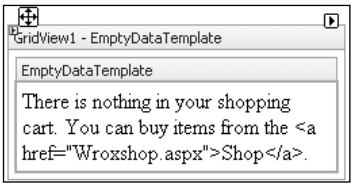


Figure 13-22

Drop back to Source view and add an anchor <a> tag around the Shop section as follows:

```
<a href="Wroxshop.aspx">Shop</a>.
```

This is the text that will be displayed when the user views a shopping cart with no items in it. You supply a link back to the main shopping page as well.

10. Choose to End Template Editing from the Common Tasks panel
11. In Design View right-click the `GridView` control and select Properties. Enter the following values:

Property	Value
(ID)	CartGrid
AutoGenerateColumns	False
DataKeyNames	ProductID

12. Right-click Solution Explorer and select Add a New Item. Select a Web Form and call the new item `WroxShoppingCartPage.aspx`. Note that this is an .aspx file now unlike the user control you have just created. This is the page that will host your user control.

13. In Design View, drag `WroxShoppingCart.ascx` onto the page, as shown in Figure 13-23.

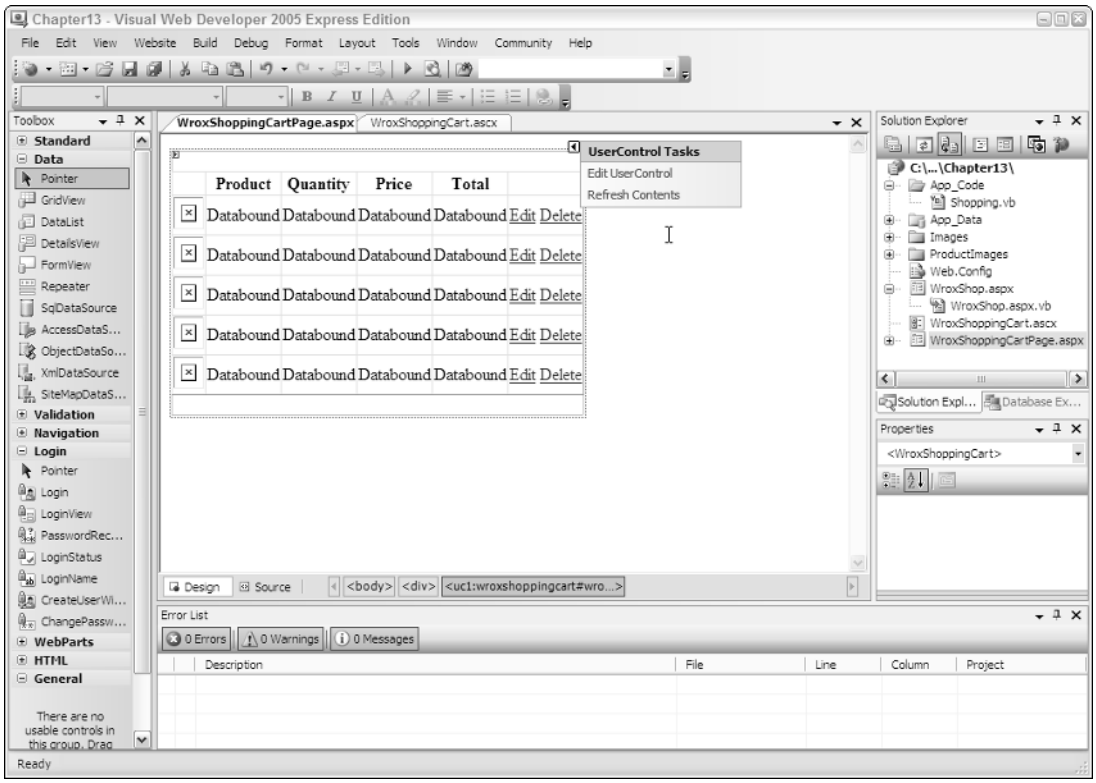


Figure 13-23

How It Works

This finishes the first stage of your shopping cart control. You've created your control and you've added a thumbnail image and fields to store the `Quantity`, `Price`, and `LineTotal` of the product, as well as a button enabling you to edit or delete your choices in the cart.

If you go to Source View it will currently look as follows:

```
<asp:GridView ID="CartGrid" Runat="server" AutoGenerateColumns="False"
DataKeyNames="ProductID" >
      <Columns>
          <asp:TemplateField>
              <ItemTemplate>
                  <asp:Image id="ProductImage" Runat="server" ImageUrl='<%#
                   Eval("ProductImageURL", "~/ProductImages/thumb_{0}")%>' />
              </ItemTemplate>
          </asp:TemplateField>
          <asp:BoundField DataField="ProductName" HeaderText="Product"
           ReadOnly="True" />
          <asp:BoundField DataField="Quantity" HeaderText="Quantity" />
          <asp:BoundField DataField="Price" HeaderText="Price"
           DataFormatString="{0:c}" ReadOnly="True" />
          <asp:BoundField DataField="LineTotal" HeaderText="Total"
           DataFormatString="{0:c}" ReadOnly="True" />
          <asp:CommandField ShowEditButton="True"
           ShowDeleteButton="true"></asp:CommandField>
      </Columns>
      <EmptyDataTemplate>
         There is nothing in your shopping cart. You can buy items from the
         <a href="wroxshop.aspx">Shop</a>.
      </EmptyDataTemplate>
</asp:GridView>
```

This is all very familiar and close to what you supplied to the `DataList` controls in your Catalog and Item pages. You bind the `ProductImageURL` to an image in the `ItemTemplate`. You have several bound fields that will display text. The price fields have settings for the `DataFormatString` so that they display their values correctly as prices. However, there is one setting to note. In your bound fields, you made three of the four rows read-only. The `Quantity` row was left editable so that you can edit the contents of your cart.

You've also added an `EmptyDataTemplate` to display a message in the event that there is nothing in the cart. However, at the moment, you have no data source. In the Catalog and Item pages, you first created a `SqlDataSource` control and bound it to the `DataList` control; you haven't bound the `ShoppingCart` control to anything yet.

Automating the Shopping Cart

So far, so good, you have your `ShoppingCart` control fully designed. However, it doesn't do much at the moment. In fact, it doesn't do anything! If you want the cart to be responsive, you will need to add some code telling ASP.NET 2.0 what to do when something occurs. When you created your bound fields in the shopping cart, three of the four bound fields were read-only; the last-one, Quantity, was the only bound field left editable because it means that you only need to anticipate what happens if someone changes the quantity of items within a particular row in the cart.

You will want to cater to four possible events, because there are four possible scenarios:

- **Editing the cart:** When you enter a new quantity.
- **Canceling an edit in the cart:** When you decide you don't want go with the quantity value you've changed.
- **Updating the cart:** When you want that new quantity to take effect.
- **Deleting items from the cart:** When you want to completely remove an item from the cart.

This will require some code-behind. You looked at code-behind in Chapters 9 and 10. Here your code-behind will be run directly in response to one of these four events occurring. A second question is once you've updated the shopping cart, how do you associate that with a particular user? You've already created a profile, so now all you need to do is to reference that profile within your code, via the `Profile` object.

Go ahead and add this code to your shopping cart in the next Try It Out.

Try It Out — Automating the Shopping Cart

1. Go to your `ShoppingCart` control (right-click `GridView` and select Properties. From the Properties window, select the Lightning Bolt button the fourth one along, as shown in Figure 13-24).

Figure 13-24

2. This displays a list of events. Double-click the `RowEditing` event. In Source View, a gap will have appeared for the events. Add the following highlighted code to the events:

```
Sub CartGrid_RowEditing(ByVal sender As Object, ByVal e As
    System.Web.UI.WebControls.GridViewEditEventArgs)
  CartGrid.EditIndex = e.NewEditIndex
  BindGrid()
End Sub
```

3. Go back to Design View, right-click `GridView`, and select Properties. It should take you straight to `Events` this time. Double-click the `RowUpdating` event. Add the following highlighted code:

```
Sub CartGrid_RowUpdating(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.GridViewUpdateEventArgs)
  Dim QuantityTextBox As TextBox = _
    CType(CartGrid.Rows(e.RowIndex).Cells(2).Controls(0), TextBox)
  Dim Quantity As Integer = Convert.ToInt32(QuantityTextBox.Text)
  If Quantity = 0 Then
    Profile.Cart.Items.RemoveAt(e.RowIndex)
  Else
    Profile.Cart.Items(e.RowIndex).Quantity = Quantity
  End If
  CartGrid.EditIndex = -1
  BindGrid()
End Sub
```

4. Go back to Design View. Right-click `GridView` and select Properties. Double-click the `RowCancelingEdit` event. Add the highlighted code:

```
Sub CartGrid_RowCancelingEdit(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.GridViewCancelEditEventArgs)
  CartGrid.EditIndex = -1
  BindGrid()
End Sub
```

5. In Design View, right-click `GridView` and select Properties. Double-click the `RowDeleting` event. Add the highlighted code:

```
    Sub CartGrid_RowDeleting(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.GridViewDeleteEventArgs)
  Profile.Cart.Items.RemoveAt(e.RowIndex)
  BindGrid()
End Sub
```

6. From Design View, double-click the blank page surrounding the `WroxShoppingCart` control, and add the highlighted code to the `Page_Load` event:

```
Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) Handles Me.Load
  If Profile.Cart Is Nothing Then
    Return
  End If
  If Not Page.IsPostBack Then
    BindGrid()
  End If
  If Profile.Cart.Items.Count = 0 Then
    TotalLabel.Visible = False
  End If
End Sub
```

7. You may have noticed that you've also referenced a function called `BindGrid()` within all of these events. This function does the binding so that your shopping cart can display something. You need to add this code for `BindGrid()` underneath the functions within the code-behind as well:

```
Private Sub BindGrid()
  CartGrid.DataSource = Profile.Cart.Items
  DataBind()

  TotalLabel.Text = String.Format("Total:{0,19:C}", Profile.Cart.Total)
End Sub
```

8. At the top of the page add a reference to your `WroxShoppingCart` object:

```
<%@ Import Namespace="Wrox.Commerce" %>
```

9. Switch to Design View and drag a `Label` control onto the screen and place it under the `GridView` control. Right-click the `Label` control and select Properties. Delete the `Text` property and change the `ID` property to `TotalLabel`, as shown in Figure 13-25.

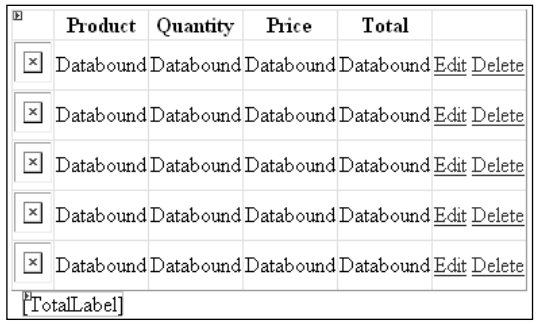


Figure 13-25

10. If you view the page `WroxShoppingCartPage.aspx` now, you will see what appears in Figure 13-26.

Figure 13-26

How It Works

For the first time you're able to browse your shopping cart, although you only get to view the `EmptyDataTemplate` at the moment. Your code, though, provides all of the necessary functionality to be able to use the cart properly. The `RowEditing` method allows you to store the ID of the Product you are editing to the index:

```
CartGrid.EditIndex = e.NewEditIndex
BindGrid()
```

After this you bind to the grid. The `RowCancelEdit` sets it back to the default of -1:

```
CartGrid.EditIndex = -1
BindGrid()
```

This means that no row in the grid is currently selected. Once again you bind to the grid afterwards. Your `delete` method removes the index number from the cart stored in the profile and binds to the grid:

```
Profile.Cart.Items.RemoveAt(e.RowIndex)
BindGrid()
```

The update first has to obtain the quantity figure from the text box, and then it converts it to an integer. If you've set the quantity to 0, then this acts the same as a delete, so you perform a `RemoveAt` to remove the `CartItem` object. Otherwise you simply re-adjust the quantity and reset the index to -1 and bind to the grid:

```
Dim QuantityTextBox As TextBox = _
  CType(CartGrid.Rows(e.RowIndex).Cells(2).Controls(0), TextBox)
Dim Quantity As Integer = Convert.ToInt32(QuantityTextBox.Text)
If Quantity = 0 Then
  Profile.Cart.Items.RemoveAt(e.RowIndex)
Else
  Profile.Cart.Items(e.RowIndex).Quantity = Quantity
End If
CartGrid.EditIndex = -1
BindGrid()
```

You need to consider two final sections of code. The first is the `BindGrid` function, which performs your data binding for you and is called by each of the events:

```
CartGrid.DataSource = Profile.Cart.Items
DataBind()
TotalLabel.Text = String.Format("Total:{0,19:C}", Profile.Cart.Total)
```

It simply sets the `GridView` control's `DataSource` property to point to the Items collection of your particular profile and then sets the total for your cart. The second one is the contents of the `Page_Load` event handler, which is fired whenever a page is started up:

```
If Profile.Cart Is Nothing Then
  Return
End If
If Not Page.IsPostBack Then
  BindGrid()
End If
If Profile.Cart.Items.Count = 0 Then
  TotalLabel.Visible = False
End If
```

This basically says if the cart is empty, then do nothing. It then says if the page hasn't been posted back, and is therefore the first time the user has seen the page, then you must bind the grid, and it goes on to make the total label invisible if there is nothing in the cart and sets the format correctly for displaying the total as a currency. There is a distinction to be made here, between the first `IF` and third `IF` statement. The first `IF` statement will be triggered if the cart hasn't been created. The third `IF` will be triggered if the cart has been created but is empty (in other words, someone has removed all the items from it). You have to be able to handle both scenarios when updating the cart in your profile.

The Add to Cart Facility

Your shopping cart is now fully functional in all but one respect. You can edit it and delete items from it, but you still can't add any items to it. This is because the adding of items needs to be done from a different page entirely.

The next part of your odyssey is to place an "add to cart" button, back on the previous Product Item page. In the following Try It Out, this will add the corresponding item to your cart every time a button is clicked. If you click it twice on two separate occasions, it will update the quantity for you.

Try It Out — Adding the Add to Cart Button

1. Open up `WroxShopItem.aspx` in Visual Web Developer, go to Design View, and add an ImageButton, above the Return to Shop link. Via the Properties window change its name to `btnAddToCart`, and change the `ImageUrl` property to `"~/Images/AddToCart.gif"`, as shown in Figure 13-27.

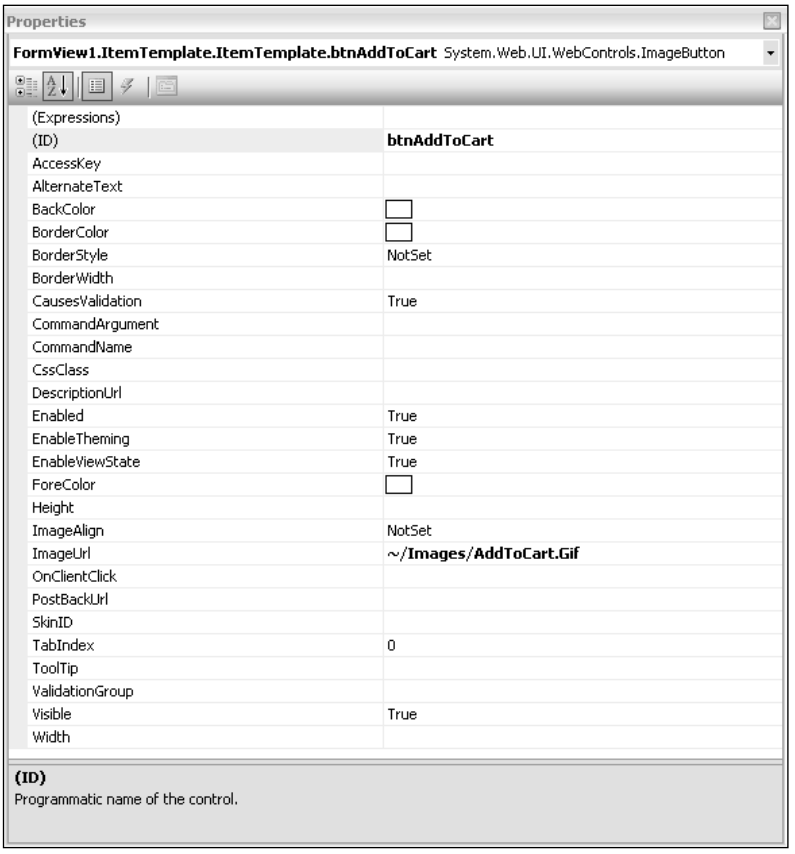


Figure 13-27

2. Double-click the button and add the following code:

```
Sub btnAddToCart_Click(ByVal sender As Object, ByVal e As _
                       System.Web.UI.ImageClickEventArgs)
  Dim Price As Double =  _
    Double.Parse(CType(DataList1.Controls(0).FindControl("PriceLabel"),Label).Text)
```

```
    Dim ProductName As String =  _
      CType(DataList1.Controls(0).FindControl("NameLabel"),Label).Text
    Dim PictureURL As String = _
      CType(DataList1.Controls(0).FindControl("PictureUrlLabel"),Label).Text
    Dim ProductID As Integer = CInt(Request.QueryString("ProductID"))


    If Profile.Cart Is Nothing Then
      Profile.Cart = New Wrox.Commerce.WroxShoppingCart()
    End If
      Profile.Cart.Insert(ProductID, Price, 1, ProductName, PictureURL)
      Server.Transfer("WroxShop.aspx")
  End Sub
```

3. Go back to `WroxShopItem.aspx` in Design View. Add a hyperlink button from the General section of the Toolbox. Right-click the link, select Properties, and change the following properties:

Property	Value
`ID`	`ShoppingCartLink`
`NavigateURL`	`~/WroxShoppingCartPage.aspx`
`Text`	`View Shopping Cart`

It will now look like Figure 13-28.

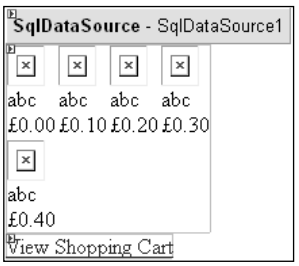


Figure 13-28

4. You're now ready to give the shopping cart a test drive. Go to the `WroxShop.aspx` and select the scarf, as shown in Figure 13-29.

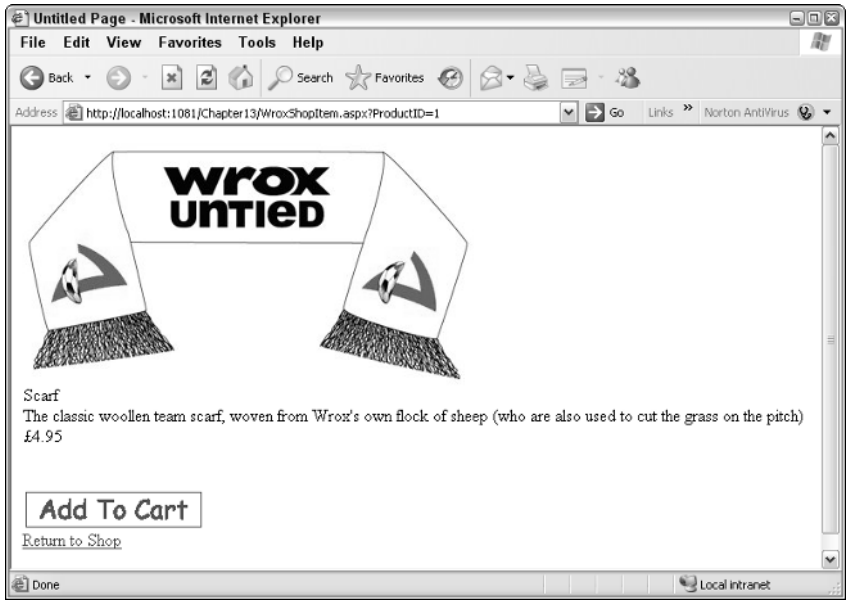


Figure 13-29

5. Click Add to Cart. This takes you back to the main shopping screen. Now click View Shopping Cart, and as you can see in Figure 13-30, your item has been added to the cart.

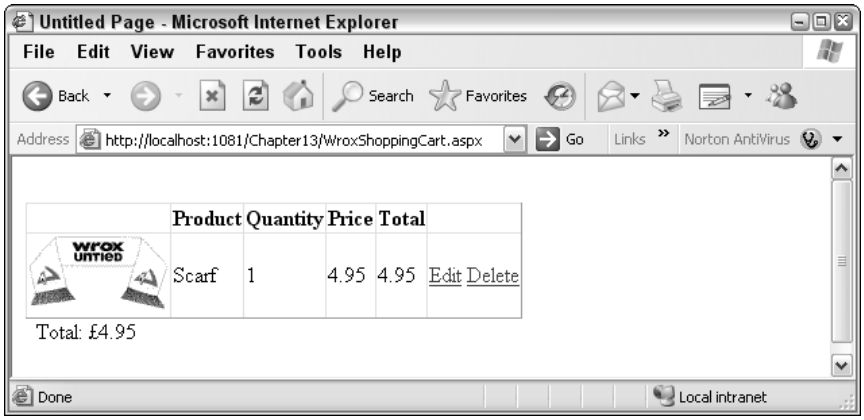


Figure 13-30

6. Clicking Edit changes the Quantity box into a text box that you can edit (see Figure 13-31).

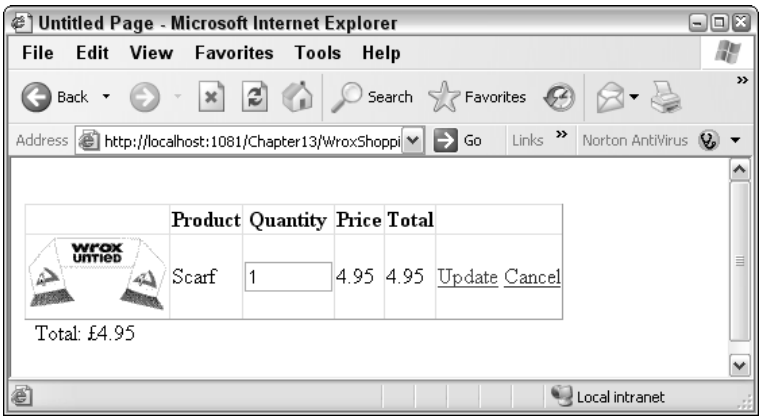


Figure 13-31

7. Type in **2** and click Update, and the totals are updated, as shown in Figure 13-32.

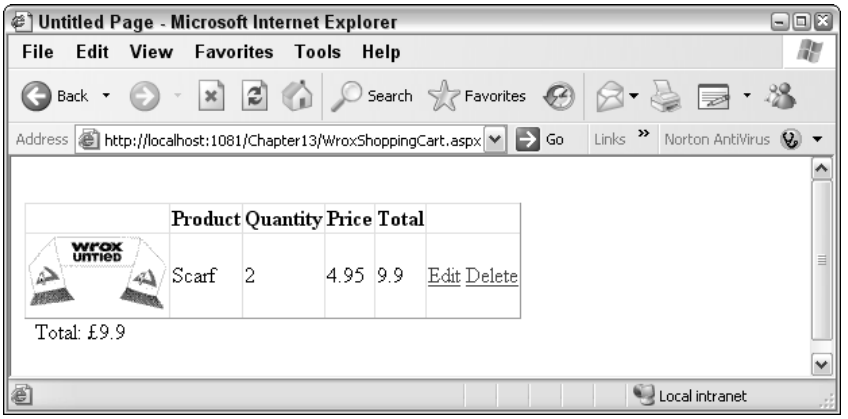


Figure 13-32

8. Last, you can click Delete and the item is removed from your cart.

How It Works

By adding two bits to the application in this Try It Out, you enabled the whole functionality of the shopping cart. You started by adding a button to the Product Item page and creating some code that ran when the button was clicked. The code handles the business of adding an item to your shopping cart. You start by getting the `Price`, `ProductName`, `PictureUrl` and `ProductID`:

```
Dim Price As Double =  _
  Double.Parse(CType(DataList1.Controls(0).FindControl("PriceLabel"),Label).Text)
Dim ProductName As String =  _
```

```
    CType(DataList1.Controls(0)FindControl("NameLabel"),Label).Text
  Dim PictureURL As String = _
    CType(DataList1.Controls(0).FindControl("PictureUrlLabel"),Label).Text
```

This information has already been cunningly stored in the page. You use the `FindControl` method of a control to locate a control. The `DataList` control contains an item template, so you have to move into the controls collection of the `DataList` control to get at the `Label` controls. The `CType` function allows you to cast the contents of the control to text. So each of the three lines works like this. You declare a variable in which to store your item. You search the `DataList` control for your `Label` control using `FindControl`, and supply it with the name of the control you want to find. You pass this to the `CType` function, along with the type to which you want to convert the type. So for the `Price`, you search for the `PriceLabel` control's contents and you convert it to text. There is actually another level of conversion required here. You want the price as a `Double` data type so you convert the text item you receive into a double and store it in the `Double` data type. The PictureUrlLabel is the one you didn't delete in the second Try It Out of this chapter because I said you'd need it later. This is where you need it. Having stored the `Price`, `ProductName`, and `PictureURL`, you still need the `ProductID`. This can be located in the query string passed to the page:

```
Dim ProductID As Integer = CInt(Request.QueryString("ProductID"))
```

You check to see if a cart exists for this profile:

```
If Profile.Cart Is Nothing Then
  Profile.Cart = New Wrox.Commerce.WroxShoppingCart()
End If
```

If it doesn't you create a new one. Then you need to insert a new item into your shopping cart along with the `ProductID`, `Price`, `ProductName`, `PictureURL`, and the quantity of 1:

```
Profile.Cart.Insert(ProductID, Price, 1, ProductName, PictureURL)
```

Last, you simply transfer the user back to the initial Product Catalog page:

```
Server.Transfer("WroxShop.aspx")
```

This stage can continue cyclically until the user either leaves the application or needs to check out.

Checkout

Checking out is perhaps the lengthiest stage of the whole process. The checkout process involves a number of considerations, not just the totalling up of the items and how much they cost, but also things like stock availability, getting the user's address and delivery details, obtaining and verifying payment for the items, and some sort of rounding up of the whole process.

Checkout is, in itself, a mini set of stages. If you're serious about implementing your own e-commerce process it's worth checking some of the major e-commerce vendors (such as Amazon) and seeing what they do in their checkout process, and asking is it quick and intuitive to use? A lot of time and effort has gone into producing checkout processes that can be completed in the minimum number of steps, with the minimum number of clicks.

In your design, consider checkout as being comprised of the following:

- Order processing
- Login
- Enter or get the address and delivery details
- Get the credit card details
- Finish

This is one part of the process that is impossible to model completely, without actually building a real, live, working e-commerce site. However, some considerations about each step are worth talking about.

Order Processing

The first step of the checkout process is to check whether or not the item is in stock. With a large retailer such as Amazon, not all of the items they carry will be sourced by them. They have a range of suppliers and they often need to check with them first to see if a particular item is in stock. Hence you will find that some products will ship from Amazon within 24 hours, whereas others may take between four and six weeks. In reality there is often another pipeline (similar to Figure 13-33) going on here that has to be negotiated.

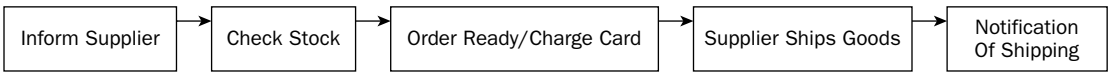


Figure 13-33

With WroxUnited, once again you're not going to delve into this level of detail. You are going to assume that all goods are stored in the Wrox United warehouse, and once you've checked the stock level and they are in stock, they are good to be released for shipping.

Login

We've already mentioned that the Wrox United application uses one of ASP.NET 2.0's best features to keep track of the shopping cart, in that you don't have to physically log in to keep track of your shopping cart. However, when you come to checkout, you must log in, because you need to supply your address details and credit card information. You need to supply a login box and password to be able to authenticate your user's details. You will use the standard ASP.NET 2.0 login control to do this.

Address/Delivery Details

The address details are fairly easy to sort as well. One of two scenarios could occur. Either you have already captured the user's details and you can access the details that are stored with the profile, or if you don't have them on record, you must request that the user enter them into a series of text boxes. You can either use the Profile that was created in Chapter 11 and that stores these details, or you can store the details supplied in the text boxes by the user.

Credit Card Handling

Here you're going to cop out and not handle credit cards at all, and just add a small dummy section. This gives the impression that it isn't a major part of the e-commerce pipeline, but don't be fooled for a moment; it is of course critical to the success of the pipeline. For obvious reasons you can't set up an actual credit card handling facility; for starters you don't have a physical product to sell. Fetching as the Wrox United kits undoubtedly would be, they only exist in cyberspace. So here we can't provide any code, but instead can quickly consider what you need to take into account when setting up a credit card handling facility on your web site.

Credit card retailers first starting out needed a merchant ID, usually supplied via their bank, which gave some sort of guarantee that the business was genuine. Most Internet businesses require the same thing. In the U.S., there are two ways to do this. The first is to provide all the processing and handling of credit cards yourself, and the second is to get someone else to do it on your behalf.

In-House Credit Card Transactions

Setting up credit card processing in-house is the ideal way to keep an eye on all your transactions, but it can be quite a slow and unwieldy process. You require an e-commerce ID (also known as a merchant number or in the UK as an Internet Merchant Account [IMA]) from a third party who can actually process the credit card details for you, meaning the third party can decide whether or not a particular credit card number is genuine. You will have to apply for an account with the third party and provide a lot of details that help establish your authenticity.

Obtaining an E-Commerce ID, Merchant Number, or IMA

In the U.S. you can go to one of the following web sites:

- **Verisign/CyberCash:** `www.icverify.com`
- **First Data/Card Service:** `www.cardservice.com`

In the UK you can go to one of these web sites:

- **WorldPay:** `www.worldpay.co.uk`
- **DataCash:** `www.datacash.com`

For worldwide transaction processing you can try PayPal, which accepts credit cards once you have set up a business account with them:

- **PayPal:** `www.paypal.com`

Payment Gateways

Once you have your e-commerce ID, merchant number, or IMA, you still actually need another link in the chain, a way of communicating from a payment gateway to a bank. You should be able to use the same company you obtained an e-commerce ID from to do this. You supply the e-commerce ID to the bank; they use it to track the money's movements to the gateway service and back again. These services usually come at a hefty price. If all this sounds too complex, you might want to consider the alternative.

Bureau Services

Because this is a beginner's book, it's probably safe to assume that the first site you start development on won't be a major store; more likely you'll be working on a small store (maybe your own), that perhaps won't really want to cover the risks and costs associated with having a system handling credit cards themselves. In the early days of e-commerce on the Web, there were a series of high profile hacks, one notorious one where all customers of a then high-profile music store had their credit card details stolen, when the database containing them was compromised. Rather than having to worry about all the risks from encrypting card details to storing them in a way to ensure their complete safety, it's easier to get someone else to do this for you. These are termed *bureau services*. When you get to the part of a site where you check out, instead of handling the details you link to the bureau service's site, and they handle the whole process for you from then on.

Until relatively recently bureau services were expensive propositions that still required quite a large financial commitment on the part of the seller. Several years ago, I costed a small record label's ability to do this, and the cheapest I could find to provide an online store would have meant they would have to have sold several hundred CDs a month to cover the gateway fees alone. The rise of eBay, though, has led to a massive rise in demand of people who want to handle their own sales instantly, so rather than having to wait for checks (which carry risk of both fraud and bouncing if the funds aren't present), or doing money transfers via banks or a third party such as Western Union, they want to be able to handle credit card transactions. In addition to that, they might only ever want to handle as little as 10 or 20 sales.

Two popular solutions are as follows. You will find they even go one further than supplying this service, and can actually supply common components such as a shopping cart for you.

- **PayPal:** `www.paypal.com`
- **BTClick&Buy:** `www.btclickandbuy.com`

Obviously, other sites exist too. There are digital credit card services that specialize in micropayments when paying for small items such as single mp3s. It all depends on what you want to sell and how much you want to sell it for. If these two sites don't provide a solution that suits you, then look around for something better! If you want further details about how to handle credit card transactions, we suggest you read the details given on the sites mentioned in these sections.

Summarizing the Transaction

Typically once you've completed your transaction, it would be good to receive a notification or receipt of what you've ordered. This is actually a relatively simple step of the process, but to e-mail somebody requires a working SMTP server, so for that reason alone, you aren't going to implement this step.

How You Intend to Checkout

Once again you are governed by keeping things simple. What is the minimum you can boil down your checkout process to?

The five-stage process will be as follows:

- Login
- Delivery address
- Payment

- Confirmation of the order
- Finish

You will also need a breadcrumb next to you to help you keep an eye on where you are in the whole checkout process. As mentioned at the beginning of the chapter, one priority is being able to abort the transaction at any point prior to confirming the purchase.

What you're not going to do is the stock handling (reducing items and keep a track on stock levels) and also sending a confirmation of order e-mail. The chapter is already big enough as it is and these things are arguably stretched over different disciplines to e-commerce. Having added that caveat, in the next Try It Out, you create the final stages of the e-commerce pipeline.

Try It Out Checking Out

1. In Solution Explorer in Visual Web Developer, right-click the `C:\...\Chapter13` heading at the top and select Add New Item. Add a Web Form called `Checkout.aspx` and check the Place Code in separate file box to ensure a separate code behind file is created
2. In Design View, from the Toolbox grab a `Wizard` control and drop it onto the page, as shown in Figure 13-34.

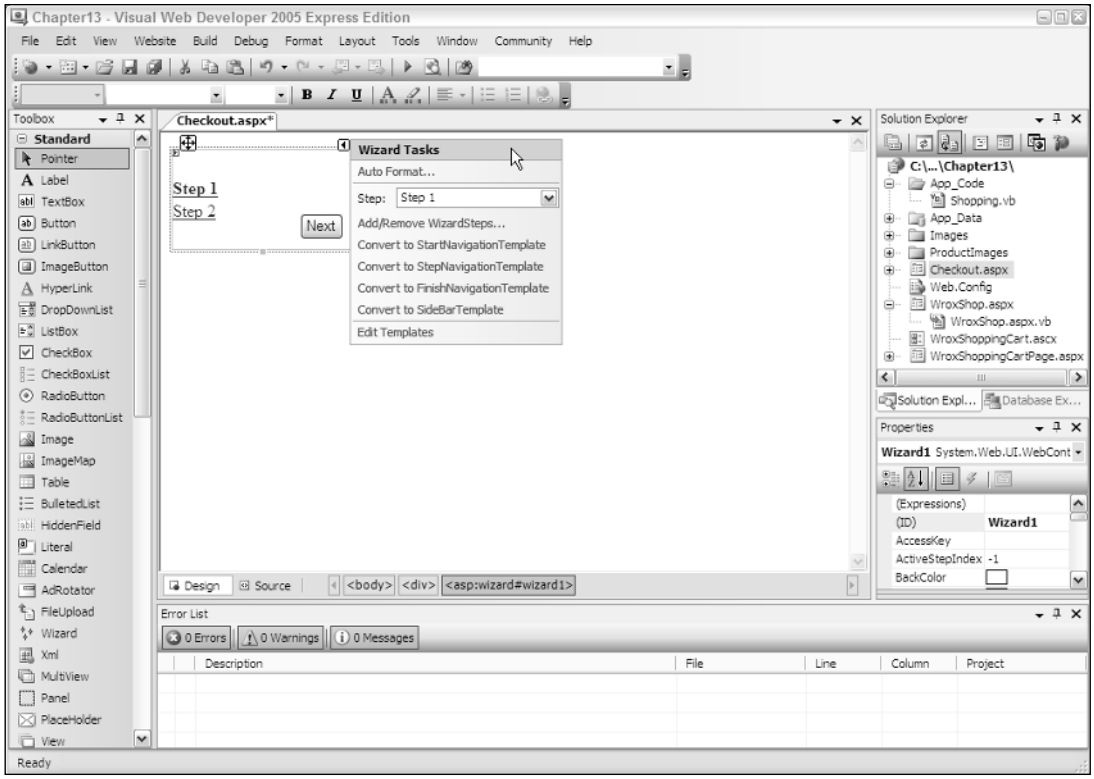


Figure 13-34

3. From the smart tag dialog box select the Add/Remove wizard steps option.

4. In the dialog that appears you are going to add three extra steps. This is so you have five steps, one for login, one for address, one for credit card details, one to confirm the order, and one to finish the transaction. Start by clicking Add (see Figure 13-35) and entering Step 3 next to Title, and then clicking Add and entering Step 4 and lastly clicking Add and entering Step 5.

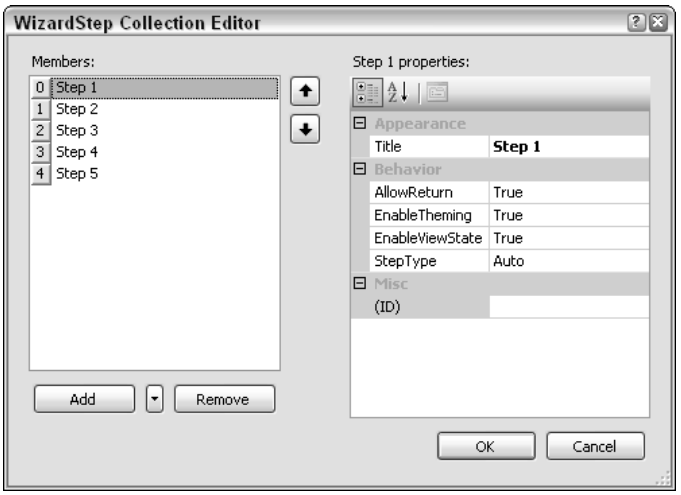


Figure 13-35

5. Go back and change the Title property in each so that it reads as shown in Figure 13-36.

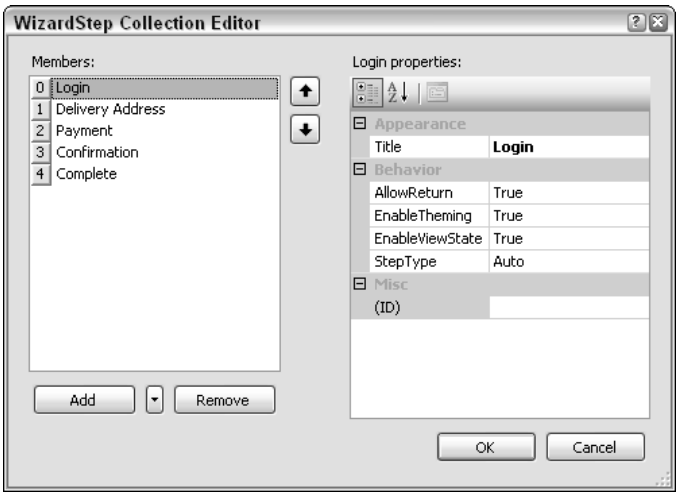


Figure 13-36

6. Click OK.

7. From the Login section of the Toolbox, drag a Login box into the `<asp:Wizard>` control, as shown in Figure 13-37.

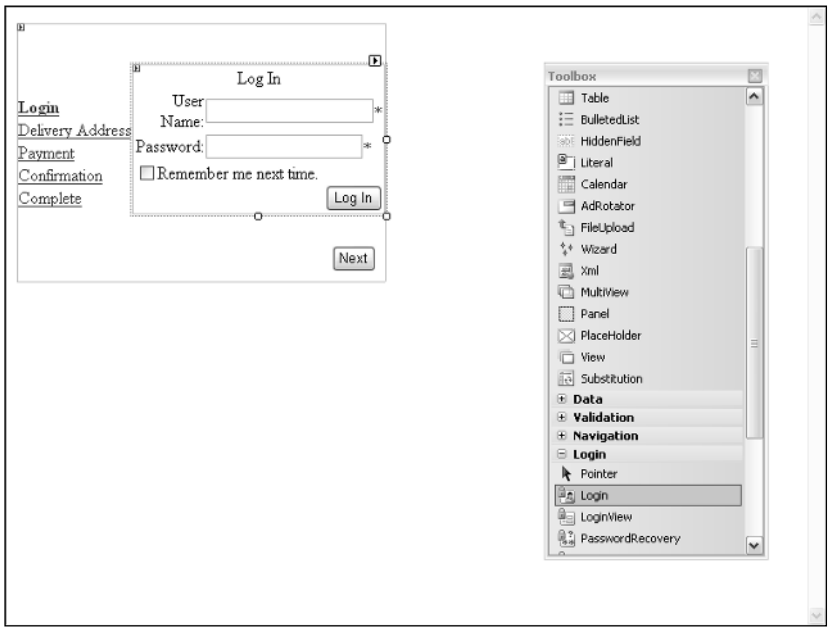


Figure 13-37

8. Click Design View. Add the following code to the Wizard step for Step 2 (Delivery Address):

```
<asp:checkbox id="chkUseProfileAddress" runat="server" autopostback="True"
  text="Use membership address"
  OnCheckedChanged="chkUseProfileAddress_CheckedChanged"></asp:checkbox><br />

<table border="0">
  <tr><td>Name</td><td><asp:textbox id="txtName" runat="server" /></td></tr>
  <tr><td>Address</td><td><asp:textbox id="txtAddress" runat="server" /></td></tr>
  <tr><td>City</td><td><asp:textbox id="txtCity" runat="server" /></td></tr>
  <tr><td>County</td><td><asp:textbox id="txtCounty" runat="server" /></td></tr>
  <tr><td>Postcode</td><td><asp:textbox id="txtPostCode" runat="server" />
    </td></tr>
  <tr><td>Country</td><td><asp:textbox id="txtCountry" runat="server" /></td></tr>
</table>
```

9. Add the following code to the Wizard step for Step 3 (Payment):

```
<asp:DropDownList id="lstCardType" runat="server">
  <asp:ListItem>MasterCard</asp:ListItem>
  <asp:ListItem>Visa</asp:ListItem>
</asp:DropDownList>
<br />
Card Number: <asp:Textbox id="txtNumber" runat="server"
```

```
  Text="0123456789" ReadOnly="True"/>
<br />
Expires:
<asp:textbox id="txtExpiresMonth" runat="server" columns="2" />
/
<asp:textbox id="txtExpiresYear" runat="server"  columns="4" />
```

10. Go back to Design View for Step 4 (Confirmation). Type in the following:

```
Please confirm the amount you wish to have
deducted from your credit card.
```

11. Select `WroxShoppingCart.ascx` and drag it into the `Wizard` control above the text you have created, as shown in Figure 13-38.

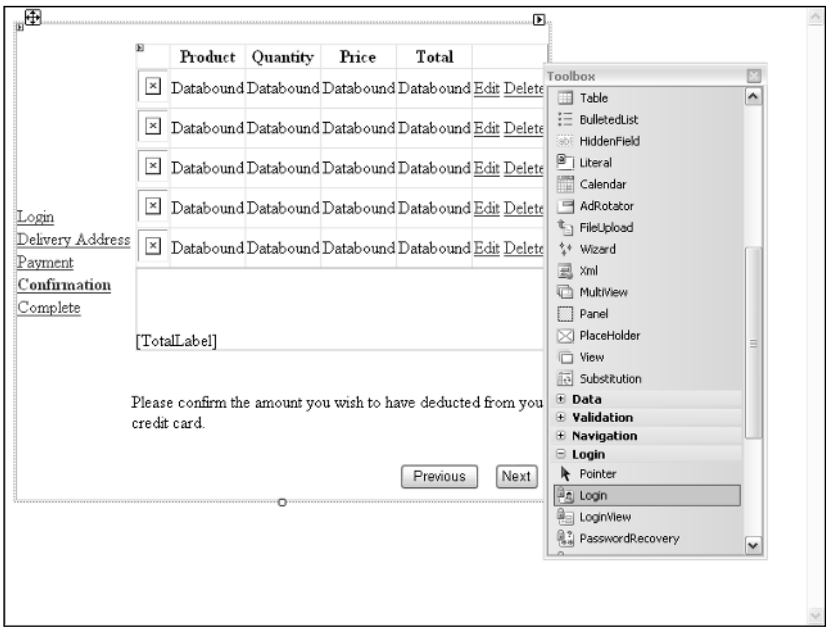


Figure 13-38

12. Click Complete and in Design View for Step 5 (Complete) just type in **Thank you for your order.**

13. Go to Source View and above the `<asp:Wizard>` control add the following:

```
<asp:Label id="NoCartlabel" runat="server" visible="false">
There are no items in your cart. Visit the shop to buy items.
</asp:Label>

<div style="float:right">
  <asp:LoginView ID="LoginView1" Runat="server">
    <AnonymousTemplate>
      <asp:passwordrecovery id="PasswordRecovery1" runat="server" />
```

```
      </AnonymousTemplate>
    </asp:LoginView>
  </div>
```

14. Above this code add the following:

```
<%@ Import Namespace ="System.Data.SqlClient"%>
<%@ Import Namespace ="Wrox.Commerce"%>
```

15. Save the design.

16. Go to Solution Explorer, select `checkout.aspx.vb`.

17. Add the following code-behind in place of whatever is already in there.:

```
Imports System
Imports System.Data.SqlClient
Imports Wrox.Commerce


Partial Class Checkout
    Inherits System.Web.UI.Page

  Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) _
    Handles Me.Load

    If Not Page.IsPostBack Then
      If Profile.Cart Is Nothing Then
        NoCartlabel.Visible = True
        Wizard1.Visible = False
      End If

      If User.Identity.IsAuthenticated Then
        Wizard1.ActiveStepIndex = 1
      Else
        Wizard1.ActiveStepIndex = 0
      End If
    End If

  End Sub

  Sub chkUseProfileAddress_CheckedChanged(ByVal sender As Object, _
    ByVal e As System.EventArgs)

    ' fill the delivery address from the profile, but only if it's empty
    ' we don't want to overwrite the values
    If chkUseProfileAddress.Checked AndAlso txtName.Text.Trim() = "" Then
      txtName.Text = Profile.Name
      txtAddress.Text = Profile.Address
      txtCity.Text = Profile.City
      txtCounty.Text = Profile.County
      txtPostCode.Text = Profile.PostCode
      txtCountry.Text = Profile.Country
```

```
      End If

    End Sub

    Sub Wizard1_FinishButtonClick(ByVal sender As Object, _
      ByVal e As System.Web.UI.WebControls.WizardNavigationEventArgs)

      ' Insert the order and order lines into the database
      Dim conn As SqlConnection = Nothing
      Dim trans As SqlTransaction = Nothing
      Dim cmd As SqlCommand


      Try
        conn = New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        conn.Open()

        trans = conn.BeginTransaction

        cmd = New SqlCommand()
        cmd.Connection = conn
        cmd.Transaction = trans

        ' set the order details
        cmd.CommandText = "INSERT INTO Orders(MemberName, OrderDate, Name, " & _
          "Address, County, PostCode, Country, Total) " & _
          "VALUES (@MemberName, @OrderDate, @Name, " & _
          "@Address, @County, @PostCode, @Country, @Total)"
        cmd.Parameters.Add("@MemberName", Data.SqlDbType.VarChar, 50)
        cmd.Parameters.Add("@OrderDate", Data.SqlDbType.DateTime)
        cmd.Parameters.Add("@Name", Data.SqlDbType.VarChar, 50)
        cmd.Parameters.Add("@Address", Data.SqlDbType.VarChar, 255)
        cmd.Parameters.Add("@County", Data.SqlDbType.VarChar, 50)
        cmd.Parameters.Add("@PostCode", Data.SqlDbType.VarChar, 15)
        cmd.Parameters.Add("@Country", Data.SqlDbType.VarChar, 50)
        cmd.Parameters.Add("@Total", Data.SqlDbType.Money)

        cmd.Parameters("@MemberName").Value = User.Identity.Name
        cmd.Parameters("@OrderDate").Value = DateTime.Now()
        cmd.Parameters("@Name").Value = _
          CType(Wizard1.FindControl("txtName"), TextBox).Text
        cmd.Parameters("@Address").Value = _
          CType(Wizard1.FindControl("txtAddress"), TextBox).Text
        cmd.Parameters("@County").Value = _
          CType(Wizard1.FindControl("txtCounty"), TextBox).Text
        cmd.Parameters("@PostCode").Value = _
          CType(Wizard1.FindControl("txtPostCode"), TextBox).Text
        cmd.Parameters("@Country").Value = _
          CType(Wizard1.FindControl("txtCountry"), TextBox).Text
        cmd.Parameters("@Total").Value = Profile.Cart.Total
        Dim OrderID As Integer
```

```
        OrderID = Convert.ToInt32(cmd.ExecuteScalar())


        ' change the query and parameters for the order lines
        cmd.CommandText = "INSERT INTO OrderLines(OrderID, ProductID, " & _
                          "Quantity, Price) " & _
                          "VALUES (@OrderID, @ProductID, @Quantity, @Price)"
        cmd.Parameters.Clear()
        cmd.Parameters.Add("@OrderID", Data.SqlDbType.Int)
        cmd.Parameters.Add("@ProductID", Data.SqlDbType.Int)
        cmd.Parameters.Add("@Quantity", Data.SqlDbType.Int)
        cmd.Parameters.Add("@Price", Data.SqlDbType.Money)

        cmd.Parameters("@OrderID").Value = OrderID
        For Each item As CartItem In Profile.Cart.Items
          cmd.Parameters("@ProductID").Value = item.ProductID
          cmd.Parameters("@Quantity").Value = item.Quantity
          cmd.Parameters("@Price").Value = item.Price

          cmd.ExecuteNonQuery()
        Next

        ' commit the transaction
        trans.Commit()

      Catch SqlEx As SqlException
        ' some form of error - rollback the transaction
        ' and rethrow the exception
        If trans IsNot Nothing Then
          trans.Rollback()
        End If

        ' Log the exception
        Tools.log("An error occurred while creating the order", SqlEx)
        Throw New Exception("An error occurred while creating the order", _
          SqlEx)



        Return
      Finally
        If conn IsNot Nothing Then
          conn.Close()
        End If

      End Try

      ' we will only reach here if the order has been created successfully
      ' so clear the cart
      Profile.Cart.Items.Clear()

    End Sub

    Sub Wizard1_NextButtonClick(ByVal sender As Object, _
```

```
          ByVal e As System.Web.UI.WebControls.WizardNavigationEventArgs)

      If e.CurrentStepIndex = 0 Then

        Dim l As System.Web.UI.WebControls.Login = _
                  CType(Wizard1.FindControl("Login1"), Login)

        If Membership.ValidateUser(l.UserName, l.Password) Then
          FormsAuthentication.SetAuthCookie(l.UserName, l.RememberMeSet)
          e.Cancel = False
        Else
          l.InstructionText = "Your login attempt was not successful. " & _
            "Please try again."
          l.InstructionTextStyle.ForeColor = System.Drawing.Color.Red

          e.Cancel = True
        End If
      Else
        If Not User.Identity.IsAuthenticated Then
          e.Cancel = True
          Wizard1.ActiveStepIndex = 0
        End If
      End If

    End Sub

    Protected Sub Wizard1_ActiveStepChanged(ByVal sender As Object, _
      ByVal e As System.EventArgs) Handles Wizard1.ActiveStepChanged

      If Not User.Identity.IsAuthenticated Then
        Wizard1.ActiveStepIndex = 0
      End If

    End Sub

  End Class
```

18. Open `WroxShoppingCartPage.aspx` and in Design View, and add a hyperlink to the page. Right-click the link and change the properties as follows:

Property	Value
ID	Checkout
Text	Checkout
NavigateURL	~/Checkout.aspx

19. Add two scarves to your shopping cart and click Checkout. First you supply login details in the fields shown in Figure 13-39.

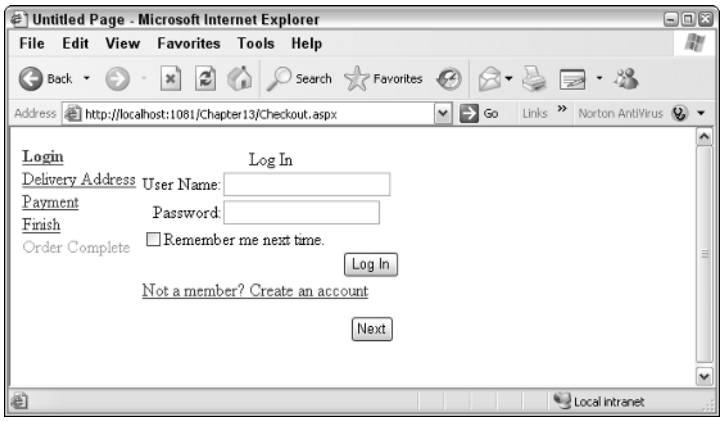


Figure 13-39

20. Click Next once you're logged in, and then you either click on your membership address or supply your address details (see Figure 13-40).

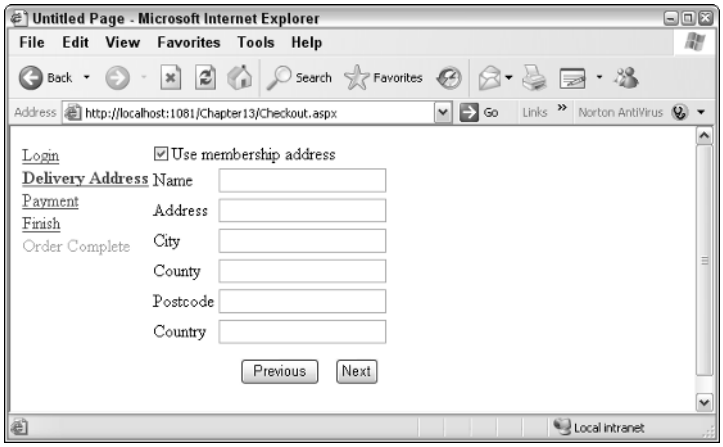


Figure 13-40

21. Click Next, and you'll arrive at the screen shown in Figure 13-41. This is your credit card handler; it doesn't require any user details.

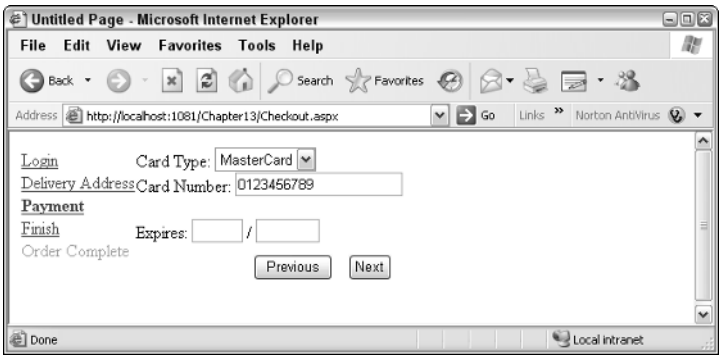


Figure 13-41

22. Click Next, and on the last page (see Figure 13-42) you see a summary of the details.

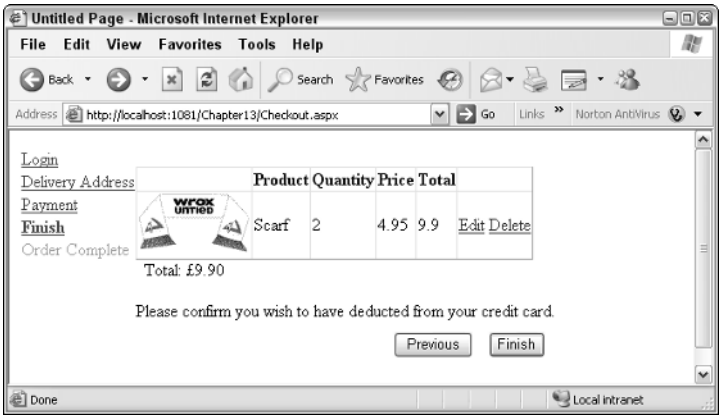


Figure 13-42

23. Click Finish to end the checkout.

How It Works

This completes your e-commerce pipeline. You started by creating the five stages of our agreed checkout process using the `<asp:wizard>` control. The login stage used a `Login` control, and the delivery address used a checkbox and a series of text boxes to record the details. The payment stage took the credit card details via a drop-down list, which contained the type of credit card, and you had text boxes for the card number and expiration date. You didn't validate these details in any way. In the confirmation stage you just stuck a copy of the shopping cart control, and the last step simply displayed a short thank you message.

You added a control `LoginView`, which contained your anonymous template:

```
<asp:LoginView ID="LoginView1" Runat="server">
    <AnonymousTemplate>
        <asp:passwordrecovery id="PasswordRecovery1" runat="server" />
    </AnonymousTemplate>
</asp:LoginView>
```

This displayed the password recovery control, which is displayed to aid any user who might have forgotten their password.

Once again it was left to the code-behind to provide the meat of the example. When the page first loads, you check to see if there is anything in the cart. If there isn't, then you make the wizard invisible and show the no cart label, which informs the user that there is nothing in the cart. The second check is to see if the user identity has been authenticated. This is a test of whether or not they have logged in. If they have logged in already then you jump them past the login stage, or else you have to get them logged in first:

```
Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) _
  Handles Me.Load

  If Not Page.IsPostBack Then
    If Profile.Cart Is Nothing Then
      NoCartlabel.Visible = True
      Wizard1.Visible = False
    End If

    If User.Identity.IsAuthenticated Then
      Wizard1.ActiveStepIndex = 1
    Else
      Wizard1.ActiveStepIndex = 0
    End If
  End If

End Sub
```

The next procedure in the code is the code that responds to the checkbox being altered in Step 2, the delivery address. If this box is checked, you fill the text boxes with the details stored in the user's profile. Otherwise you leave them empty:

```
  Sub chkUseProfileAddress_CheckedChanged(ByVal sender As Object, ByVal e As
System.EventArgs)

    ' fill the delivery address from the profile, but only if it's empty
    ' we don't want to overwrite the values
    If chkUseProfileAddress.Checked AndAlso txtName.Text.Trim() = "" Then
      txtName.Text = Profile.Name
      txtAddress.Text = Profile.Address
      txtCity.Text = Profile.City
      txtCounty.Text = Profile.County
      txtPostCode.Text = Profile.PostCode
      txtCountry.Text = Profile.Country
    End If

  End Sub
```

The `NextButtonClick` is used to check whether the user has logged in successfully and can therefore progress to the next step of the wizard. This step only comes into play if you are actually on the login stage at the time. You check to see if the user has been validated and, if not, you display an appropriate error message informing the user that they haven't been able to log in this time. Otherwise you validate the user:

```
  Sub Wizard1_NextButtonClick(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.WizardNavigationEventArgs)

    If e.CurrentStepIndex = 0 Then

        Dim l As System.Web.UI.WebControls.Login = _
                 CType(Wizard1.FindControl("Login1"), Login)

      If Membership.ValidateUser(l.UserName, l.Password) Then
        FormsAuthentication.SetAuthCookie(l.UserName, l.RememberMeSet)

        e.Cancel = False
      Else
        l.InstructionText = "Your login attempt was not successful. " & _
          "Please try again."
        l.InstructionTextStyle.ForeColor = System.Drawing.Color.Red

        e.Cancel = True
      End If
    Else
      If Not User.Identity.IsAuthenticated Then
        e.Cancel = True
        Wizard1.ActiveStepIndex = 0
      End If
    End If

  End Sub
```

The `FinishButtonClick` contains perhaps the longest set of code, but it isn't as daunting as it looks. This is where you write the user's order to the database. You have to be able to roll this back if a mistake has occurred. You start by creating a connection string, and you create a transaction. Then you read in all of the details supplied in the checkout process into parameters. There are a lot of them! You have the member name, the delivery address, the credit card details, the whole shopping cart total:

```
  Sub Wizard1_FinishButtonClick(ByVal sender As Object, ByVal e As
System.Web.UI.WebControls.WizardNavigationEventArgs)

    ' Insert the order and order lines into the database
    Dim conn As SqlConnection = Nothing
    Dim trans As SqlTransaction = Nothing
    Dim cmd As SqlCommand


    Try
      conn = New
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
```

```
conn.Open()

trans = conn.BeginTransaction

cmd = New SqlCommand()
cmd.Connection = conn
cmd.Transaction = trans
' set the order details
cmd.CommandText = "INSERT INTO Orders(MemberName, OrderDate, Name, " & _
  "Address, County, PostCode, Country, SubTotal, Discount, Total) " & _
  "VALUES (@MemberName, @OrderDate, @Name, " & _
  "@Address, @County, @PostCode, @Country, @Total)"
cmd.Parameters.Add("@MemberName", Data.SqlDbType.VarChar, 50)
cmd.Parameters.Add("@OrderDate", Data.SqlDbType.DateTime)
cmd.Parameters.Add("@Name", Data.SqlDbType.VarChar, 50)
cmd.Parameters.Add("@Address", Data.SqlDbType.VarChar, 255)
cmd.Parameters.Add("@County", Data.SqlDbType.VarChar, 50)
cmd.Parameters.Add("@PostCode", Data.SqlDbType.VarChar, 15)
cmd.Parameters.Add("@Country", Data.SqlDbType.VarChar, 50)
            cmd.Parameters.Add("@Total", Data.SqlDbType.Money)

cmd.Parameters("@MemberName").Value = User.Identity.Name
cmd.Parameters("@OrderDate").Value = DateTime.Now()
cmd.Parameters("@Name").Value = _
  CType(Wizard1.FindControl("txtName"), TextBox).Text
cmd.Parameters("@Address").Value = _
  CType(Wizard1.FindControl("txtAddress"), TextBox).Text
cmd.Parameters("@County").Value = _
  CType(Wizard1.FindControl("txtCounty"), TextBox).Text
cmd.Parameters("@PostCode").Value = _
  CType(Wizard1.FindControl("txtPostCode"), TextBox).Text
cmd.Parameters("@Country").Value = _
  CType(Wizard1.FindControl("txtCountry"), TextBox).Text

cmd.Parameters("@Total").Value = Profile.Cart.Total

Dim OrderID As Integer
OrderID = Convert.ToInt32(cmd.ExecuteScalar())
```

Once you've written the data into the Orders table, you need to create an order in which you write into the OrderLines table. This contains an order ID, the product ID, the quantity, and price. After this you commit the transaction:

```
' change the query and parameters for the order lines
cmd.CommandText = "INSERT INTO OrderLines(OrderID, ProductID, " & _
  "Quantity, Price) " & _
  "VALUES (@OrderID, @ProductID, @Quantity, @Price)"
cmd.Parameters.Clear()
cmd.Parameters.Add("@OrderID", Data.SqlDbType.Int)
cmd.Parameters.Add("@ProductID", Data.SqlDbType.Int)
cmd.Parameters.Add("@Quantity", Data.SqlDbType.Int)
cmd.Parameters.Add("@Price", Data.SqlDbType.Money)

cmd.Parameters("@OrderID").Value = OrderID
```

```
        For Each item As CartItem In Profile.Cart.Items
          cmd.Parameters("@ProductID").Value = item.ProductID
          cmd.Parameters("@Quantity").Value = item.Quantity
          cmd.Parameters("@Price").Value = item.Price

          cmd.ExecuteNonQuery()
        Next

        ' commit the transaction
        trans.Commit()
```

The next part is the exception handler. If there is any kind of database error you have to roll back the exception and write it to the error log. Exception handling is explained in more detail in Chapter 15. This code is specifically tailored to handle SQL errors and will cause an error in the application

```
      Catch SqlEx As SqlException
        ' some form of error - rollback the transaction
        ' and rethrow the exception
        If trans IsNot Nothing Then
          trans.Rollback()
        End If

        ' Log the exception
        Tools.log("An error occurred while creating the order", SqlEx)
        Throw New Exception("An error occurred while creating the order", SqlEx)


        Return
```

Last, you close the connection and you clear the cart profile of the items if the transaction has been successful:

```
      Finally
        If conn IsNot Nothing Then
          conn.Close()
        End If

      End Try

      ' we will only reach here if the order has been created successfully
      ' so clear the cart
      Profile.Cart.Items.Clear()

    End Sub
```

There is also a failsafe step that checks to see if you have jumped in the wizard. Normally this will be under the direction of the program; in other words, you check to see if the user has logged in and jump them forward one step. However, it's possible an unscrupulous user might have jumped into this procedure halfway through, or that the procedure has accidentally "forgotten" the login details (normally caused by the session variable being lost — this might happen if ASP.NET restarts halfway

through the wizard). In which case you check to see if the user has logged in or not, and if you have no record of them (in other words, they aren't authenticated), then you jump them back to the login dialog.

```
  Protected Sub Wizard1_ActiveStepChanged(ByVal sender As Object, ByVal e As
System.EventArgs) Handles Wizard1.ActiveStepChanged

    If Not User.Identity.IsAuthenticated Then
       Wizard1.ActiveStepIndex = 0
    End If

  End Sub

End Class
```

The checkout process is a lengthy one, but it is the most essential part. If you get this wrong, you will never get any orders!

Secure Transactions

You might be forgiven for thinking that you're missing one vital part of the process. How do you ensure that your transaction isn't compromised and that credit card details aren't left wide open to the ether? Of course the nature of the HTTP protocol is exactly that, you send text across to the web server and you receive text back again. There's nothing to stop anybody out there from listening and recording your details.

Fortunately, there is a two-pronged attack with which you can ensure transactions are secure and that the credit card details and other confidential information are not compromised:

- **Encryption:** You must *encode*, or scramble, the information that is sent to the web server and received back from the web server. The web server has a public key, and users will have a private key that enables them to decode the information. Only having the public key and the private key together will allow you to encrypt the message. The web server will have a public key and its own private key at the other end. To encrypt messages, you use a secure communications protocol; either Secure Sockets Layer (SSL) or Secure HTTP (S-HTTP) would provide this functionality. You can specify encryption methods and whether to use SSL on a connection in the `Web.config` file.
- **Certificates:** To guarantee that the site you are dealing with at the other end is reputable, it can be certified by a Certificate Authority. Verisign (`www.verisign.com`) is perhaps the most common Certificate Authority. The authority is paid a yearly fee by the e-commerce vendor and in return the authority performs checks on the business to prove that it is legitimate. These checks are then recorded in the form of a certificate. You can browse particular sites' certificates during the checkout process. To make your site trustworthy, you should go about obtaining a certificate from a Certificate Authority.

You're not going to implement any of these features on the Wrox United site for reasons of practicality, but if you want to implement an e-commerce solution, you must make use of encryption and certificates.

What Else Can You Do?

Having reached this far in the chapter you probably deserve a cup of tea and a sit down. However, while you're enjoying your well-earned brew, this would be a good time to get your thinking cap on and have a think about what else you could add to the shop. An e-commerce site is like a community and can continually evolve as your site evolves; you shouldn't think that you've done everything possible with it. The following list outlines some things to consider as your e-commerce site evolves:

- **Improving the Product Catalog:** To improve the product catalog, you can show how many products are currently in stock, show how long they will take to deliver, show the release date of a product, add customer reviews or testimonies to how wonderful or appalling the product is, and add a cross-linking reference that mentions which other items a customer purchased when they purchased a particular item.
- **Improving Membership Tracking and Personalization:** Add a member discount, record credit card details, mail out special offers related to past purchases (so if a customer bought a replica kit in 2004, when the 2005 version comes out, it might be good to e-mail them).
- **Improving the Shopping Cart:** Make the shopping cart visible at all times.
- **Improving the Checkout Process:** Make the checkout process simpler so that it can be achieved in as few clicks as possible.

Summary

Hopefully this rather lengthy chapter hasn't scared you away. E-commerce is a lengthy and complex process; however, the new features of ASP.NET 2.0 make it approachable and possible to program for the first time without weeks of heartache and stress. While e-commerce isn't something to be taken lightly, it is something that can be added to an application with a little bit of thought and careful work.

This chapter started by describing the e-commerce pipeline, which is outlined as follows:

- Select an item from the catalog
- Put the item in the shopping cart
- Checkout with the item or items
- Supply address details
- Pay for the item
- Confirm the transaction

You started by creating a design for your product catalog and then you built a Catalog page. From the catalog you allowed the user to hone in on particular items, and you did this via a Product Item page. Neither of these items specifically required the use of the shopping cart so you held off creating one. They just queried the database and displayed the relevant details. However, without these pages, you would not be able to shop effectively.

With a catalog working, you could add the cart. The cart consisted of two objects, the `CartItem` object (one for each item selected by the user from the catalog) and the `WroxShoppingCart` object, which contained a bundle of `CartItem` objects. To enable the shopping cart you added `Insert`, `Update`, and `Delete` methods, which allowed you to put things in, change the amount of, and remove items from your shopping cart. Last, you connected the shopping cart to your catalog by creating an Add an Item button to your Product Item page.

Next you created a checkout process that handled the login, the confirmation of the delivery address, the credit card details, and finished the procedure. Although you couldn't handle the card details with the application, you learned about the various options offered. Finally you learned how to make the transactions secure and some ways to extend and improve the e-commerce procedure in Wrox United.

Exercises

An e-commerce site could potentially choose to offer many extra features. In these exercises you're going to focus on just one. Some fan sites offer the capability for their members to purchase items at a reduced price, a membership discount. How would you go about implementing it? Each question is about a stage of the implementation and together they will give you this functionality.

1. The member discount is something that is applied to the shopping cart as you add items to the cart. What do you need to add to the `ShoppingCart` object to make sure it can store a discount of 10% for fan club members? You can assume that you can detect a fan club member with the property `HttpContext.Current.User.IsInRole ("FanClubMember")`.

   Hint: You will need to create a subtotal as well.

2. How can you display the member discount details on the Shopping Cart page so that only a fan club member will see them?

14

Performance

Throughout the book you've learned a range of techniques to help you build web sites, and really concentrated on the possibilities; what controls and code you can use to produce great functionality for your site. One thing you haven't looked at, though, is how to make your site perform as well as it possibly can. After all, it doesn't matter how great your site looks; if it performs badly it fails. Internet users are an impatient lot and expect sites to be fast.

Although performance should be addressed throughout the design and building of a site, this isn't always practical, especially for the beginner. So this chapter revisits some of the earlier pages to see how they can be improved, and discusses the techniques that can be used to create the best performing sites.

In particular, this chapter looks at the following:

- How to design and test for performance
- The techniques to use in ASP.NET pages and data handling to ensure the fastest possible pages
- What caching is and how it can be used

Let's start with the things you can do to either existing code or new code that you write.

Simple Techniques

Several simple things are easy to do and provide good performance, as well as being good design techniques and aiding future development work and maintenance. After all, writing applications isn't just about getting the best from them now, but also getting the best from them in the future. Being able to fix and update web applications easily is just as much a part of development as producing the application in the first place. This section on simple techniques looks at the following:

- How to dispose of resources once they are no longer required.
- How to ensure connecting to a database is done in the best possible way.
- How using stored procedures can improve data access performance.

- How to use generics to improve performance of collections.
- How session state can be minimized to allow less processing to be done by ASP.NET.
- How view state can be tuned to reduce the amount of data sent to and from the web server.

This section starts with object disposal.

Object Disposal

In performance terms certain things are expensive; that is, they can lead to performance problems. The reason for this is that objects need resources to manage them, resources such as CPU and memory, so the fewer of these resources used, the less work the server is doing, which in turn leads to more pages for more users. If the use of these resources can be minimized, the site will perform better, and part of that minimization is to make sure you only use the resource for as little time as possible.

In general, objects that use expensive resources like the file system, graphics, or databases should be disposed of as soon as they are no longer needed. The only exception is database connections in ASP.NET applications, as discussed in the "Database Connections" section later in the chapter. Disposal of objects frees up resources, such as files and memory, allowing the web server to perform more efficiently. By default, resources are disposed of automatically by the Garbage Collector, but it is possible to improve performance by taking control of object disposal yourself, and you can do this in two ways. You can either use a standard pattern for creating the resource, using it, and then disposing of it, or you can use the `Using` statement. This section looks at both, because you'll see both in documentation.

In the Wrox United site, one area where this is used is for images. Certain users have permission to upload images: Administrators can upload new images for the shop, the owner and coach can upload player pictures, and reporters and fan club members can upload match pictures. Part of this upload process involves creating a thumbnail image, which uses the `Image` object, something that should be disposed of as soon as it's no longer required. Disposal is necessary for two reasons. The first is because the image is a file-based resource, and the file may be required by other pages, so making sure you don't have any connection to it means it's available for others — the sooner you remove your need for it, the sooner someone else can access it. The second reason for disposal is because images take memory, so disposing of the image means the memory is freed and available for other processes.

The routine for creating thumbnails is in the `ImageHandling.vb` file, in the `App_Code` directory, and is a simple class with a single shared method (well two methods, but one is only required as part of the image handling and isn't actually used).

The general structure of this code is to create a new `Image` object from an existing image stored on disc. Then a new `Image` object is created using the `GetThumbnailImage` method, which specifies the new width and height. It's pretty simple, but does involve two `Image` objects, so it requires two lots of disposal. The next section looks at how this routine works using the two ways of resource disposal.

Disposal with Try/Catch

To dispose using the `Try/Catch` methods you follow this simple pattern:

```
Try
  ' create resource
Catch
  ' handle exception
```

```
Finally
  ' dispose of resource
End Try
```

Your image code using this pattern is as follows:

```
Public Shared Sub GenerateThumbnail(ByVal SourceImagePath As String, _
                                    ByVal TargetImagePath As String)

  Dim newHeight As Short
  Dim newWidth As Short
  Dim sourceImage As Image = Nothing
  Dim targetImage As Image = Nothing

  Try
    sourceImage = Image.FromFile(SourceImagePath)

    newHeight = CShort(sourceImage.Height * 0.25)
    newWidth = CShort(sourceImage.Width * 0.25)

    Dim cb As New Image.GetThumbnailImageAbort(AddressOf ThumbnailCallback)

    Try
      targetImage = sourceImage.GetThumbnailImage(newWidth, newHeight, _
                                                  cb, IntPtr.Zero)
      targetImage.Save(TargetImagePath, Imaging.ImageFormat.Gif)
    Catch ex As Exception
      ' log exception
    Finally
      If targetImage IsNot Nothing Then
        targetImage.dispose()
      End If
    End Try
  Catch ex As Exception
    ' log exception
  Finally
    If sourceImage IsNot Nothing Then
      sourceImage.Dispose()
    End If
  End Try

End Sub
```

You can immediately see this is a little hard to read. There are two `Try/Catch` blocks, one within the other. The outer one is for `sourceImage`—the original image. This is loaded from a file using `Image.FromFile`, and then the new width and height are calculated using the `Height` and `Width` properties of the source image; the new height and width are 25% of the original. After the new size is defined, a callback variable (`cb`) is created in case there is an error during the creation of the thumbnail—the `GetThumbnailImage` method will call the callback if an error occurs. We're not actually handling any errors because we decided that it isn't critical if thumbnails aren't generated. If you have an application where it is critical to know about these errors, you could log the error in the callback routine.

The inner `Try/Catch` block then surrounds `targetImage`, which is generated from `sourceImage` using `GetThumbnailImage` using the new width and height. This creates a new image based on the new size. Once generated, `targetImage` is then saved to a file as a GIF image.

The `Finally` blocks of each `Try/Catch` check that the `Image` object exists before disposing of the object, by calling the `Dispose` method.

Disposal with Using

The `Using` statement makes the preceding code much simpler, as shown here:

```
Public Shared Sub GenerateThumbnail(ByVal SourceImagePath As String, _
                                    ByVal TargetImagePath As String)

  Dim newHeight As Short
  Dim newWidth As Short

  Using sourceImage As Image = Image.FromFile(SourceImagePath)

    newHeight = CShort(sourceImage.Height * 0.25)
    newWidth = CShort(sourceImage.Width * 0.25)

    Dim cb As New Image.GetThumbnailImageAbort(AddressOf ThumbnailCallback)
    Using targetImage As Image = _
          sourceImage.GetThumbnailImage(newWidth, newHeight, cb, IntPtr.Zero)
      targetImage.Save(TargetImagePath, Imaging.ImageFormat.Gif)
    End Using
  End Using

End Sub
```

You can immediately see how much easier this is to read, as well as how much more sense it makes. The `Using` statement created the resource, which is then automatically disposed of when `End Using` is reached. The syntax for the `Using` statement is as follows:

```
Using resource
  ' code that uses the resource
End Using
```

What happens is that when the `End Using` is reached the resource is disposed of immediately; there's no waiting for the Garbage Collector to dispose of it. In the code you have:

```
Using sourceImage As Image = Image.FromFile(SourceImagePath)
```

This is similar to the `Dim` statement in that it declares a variable, `sourceImage`, and assigns it a value. Unlike the `Dim` statement, though, the variable is disposed of as soon as the `End Using` is reached. So as soon as `End Using` is done, the `sourceImage` variable is dead and gone. In fact, because its scope is defined as part of the `Using` statement, `sourceImage` isn't accessible outside of the `Using` ... `End Using` code block.

You only need to explicitly dispose of resources if they are deemed expensive resources, such as files (images, text files, and so forth) or graphics resources that use lots of memory. For normal variables and objects, even those you might think take a lot of memory such as a DataSet, should not be disposed of explicitly.

Database Connections

Fetching data from a database can be done automatically by way of the data source controls, or manually though the objects in the `System.Data` namespaces. One of these objects applies to connecting to a database — for SQL Server or SQL Server Express that object is the `SqlConnection`. In general, databases are limited to the number of connections they can have; each connection takes resources and may stop another application from connecting, so these should be used as sparingly as possible, and only kept open for as short a time as possible. The general rule is to open the connection as late as possible, fetch the data, and close the connection as soon as possible, disposing of the connection once done. The `Using` statement is excellent for this:

```
Using conn As New SqlConnection(". . .")
  ' code that uses the connection
End Using
```

Here the `Using` statement keeps track of the connection object, `conn`, which is closed and disposed of when the `End Using` is reached.

In general, if you are manually creating connections, you should dispose of them as soon as you are finished. If you are using the data source controls, object disposal is handled automatically for you.

Stored Procedures

In the examples you've seen so far in this book the data has been fetched either using a data source control such as the `SqlDataSource` or using code, where a `SqlCommand` or `SqlDataAdapter` were used. In all cases the command that fetched the data, the SQL, was entered directly, such as:

```
SELECT [ProductID], [Name], [Description], [Price], [PictureURL] FROM [Products]
```

Now there's nothing intrinsically wrong with this, it's a standard SQL statement that works fine. However, it's not the fastest way to fetch data, because the database has to work out exactly how it is going to fetch the data when the command is executed. This involves creating what's known as an execution plan — a plan of how the SQL is going to be executed, how tables are to be joined if there are multiple tables, which indexes to use, and so on, and it does this every time. Once the plan has been created the stored procedure is also compiled and the compiled copy is the one that is executed.

A much better solution would be to work out the execution plan and store it for subsequent use. So when a query is executed the plan is ready and doesn't need recalculating. You can do this by way of *stored procedures*, which are a way of wrapping up SQL into an easily manageable form; it's a bit like a procedure or a function in that the SQL to be executed can be wrapped in a stored procedure and the stored procedure name used to execute it. Consider this `SqlDataSource`:

```
<asp:SqlDataSource id="SqlDataSource1" runat="server"
  ConnectionString="<%$ConnectionStrings:WroxUnited%>"
  SelectedCommand="SELECT [ProductID], [Name], [Description], [Price], [PictureURL]
FROM [Products]"
</asp:SqlDataSource>
```

Using a stored procedure, the code would look like this:

```
<asp:SqlDataSource id="SqlDataSource1" runat="server"
  ConnectionString="<%$ConnectionStrings:WroxUnited%>"
  SelectedCommand="usp_Products"
  SelectCommandType="StoredProcedure"
</asp:SqlDataSource>
```

From the code perspective this is already better for two reasons: It makes the code neater and easier to read; and it abstracts the SQL into a central place, the database. Having the SQL in the database is good because it's the natural place for it; it's code that deals directly with the tables and columns. It also means your code is easier to manage because you know that all of the SQL is in one place. A sensible naming scheme means stored procedures are easy to locate; we've used the naming scheme of `usp_` followed by the name of the table. The prefix `usp_` is a common one and denotes User Stored Procedure — many of system stored procedures that SQL Server provide are prefixed by `sp_`, so adding the `u` makes it obvious which procedures are ours and which are the server's. The other addition when using stored procedures is the `SelectCommandType` attribute, which tells the `SqlDataSource` that the command being issued is a stored procedure, rather than a textual SQL statement.

The syntax for creating a stored procedure is as follows:

```
CREATE PROCEDURE ProcedureName
AS
  SqlStatement
```

where `ProcedureName` is the name of the procedure (`usp_Products`) and `SqlStatement` is the SQL statement that will be run when the stored procedure is called. So, how do you actually go about creating stored procedures, and what exactly do they contain? You give this a go in the following Try It Out.

Try It Out — Creating and Using Stored Procedures

1. In the WroxUnited VWD application for this chapter (Chapters/Begin/Chapter14/WroxUnited)e, load the `Shop.aspx` file and change the `SelectCommand` to `usp_Products`.
2. Add the following new attribute to the `SqlDataSource`:

```
SelectCommandType="StoredProcedure"
```

3. Save the file.

4. Select the Database Explorer tab and expand `WroxUnited.mdf`, which will appear under Data Connections (see Figure 14-1).

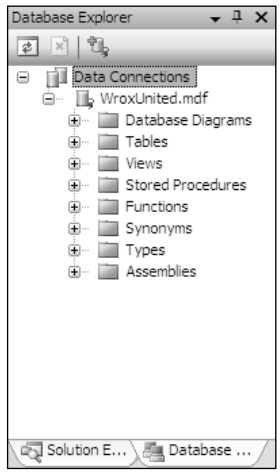


Figure 14-1

5. Right-click Stored Procedures and select Add New Stored Procedure from the menu.
6. Modify the procedure so that it looks like this:

```
CREATE PROCEDURE dbo.usp_Products
AS
  SELECT ProductID, [Name], Description, Price, PictureURL
  FROM Products
  ORDER BY [Name]
```

7. Save and close the procedure.
8. Right-click `WroxUnited.mdf` and select Close Connection from the menu. This ensures that when you run the application you don't receive an error telling you that the data file couldn't be opened because it is in use by another process.
9. On the Wrox United web site, navigate to the Shop page to confirm that the page displays as you expect it to. You'll see no change from the user perspective, because stored procedures are a programming concept, and apart from speed, have no impact on what the user sees.

How It Works

The first thing to look at is the stored procedure itself:

```
CREATE PROCEDURE dbo.usp_Products
AS
  SELECT ProductID, [Name], Description, Price, PictureURL
  FROM Products
  ORDER BY [Name]
```

So you can see that the name of your stored procedure is `usp_Products`. The `dbo` part indicates the owner of the procedure, and in this case the owner is `dbo` — a synonym for the database owner. Anything after the `AS` statement is the actual procedure itself, and yours simply consists of a `SELECT` statement. In fact, this is the same `SELECT` statement that was generated by VWD when the `SqlDataSource` was created, with the addition of an `ORDER BY` clause to order the results by the product name. This is actually a good way to combine the ease of data source controls with stored procedures; let the designer create the control, then copy the SQL statement into a stored procedure and use the procedure name in the data source control. The column `Name` is wrapped within square brackets because `Name` is a keyword with in SQL. The stored procedure works without the brackets, but using them tells SQL Server that this use of `Name` is a column, and saves SQL Server having to work that out on its own.

The procedure name starts with `usp_` for usability and historic reasons. You don't want your stored procedure to have the same name as the table, but keeping the table name is useful, because it helps to identify which stored procedures are related to which tables. In SQL Server, the system stored procedures start with `sp_` (an acronym for stored procedure), so using that as a prefix would confuse your stored procedures with the system ones. So `usp_` (an acronym for user stored procedure) is generally used instead. This isn't a requirement, but you'll find that it is a common practice.

SQL is both case and context insensitive, meaning no line continuation characters are required.

In the ASP.NET page, the SQL statement has simply been replaced by the name of the stored procedure. By default, the `SqlDataSource` control expects a SQL statement, so when using a stored procedure you have to add the `SelectCommandType` attribute, setting its value to `StoredProcedure`. This tells ASP.NET that the command isn't a SQL statement to be executed, but that the named stored procedure should be used instead.

Modifying Stored Procedures

To modify a stored procedure you simply open it (double-click or right-click and select Open from the menu) from within the Database Explorer, where you will be presented with the following:

```
ALTER PROCEDURE dbo.usp_Products
AS
  SELECT ProductID, Name, Description, Price, PictureURL
  FROM Products
  ORDER BY Name
```

Notice that `CREATE PROCEDURE` has been replaced with `ALTER PROCEDURE`. The `CREATE` statement is only used when creating stored procedures, and subsequently `ALTER` is used. Once you've completed your changes, perhaps changing the columns being selected, you can just save the file, and the procedure in the database will be updated. In fact, just the matter of saving a new query changes the `CREATE` into `ALTER`.

Using the Query Builder

If you don't want to use the copy-and-paste method for creating SQL statements, you can use the Query Builder. This can be accessed when creating or modifying a stored procedure by selecting the Insert SQL item from the right mouse menu — just click anywhere in the stored procedure editor window to get the menu. You first see a window allowing you to select the table (see Figure 14-2).

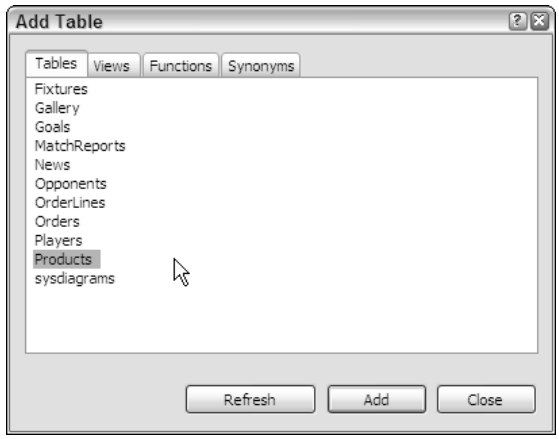


Figure 14-2

You can double-click a table to add it, or select the table and use the Add button. When you have selected your table and closed the window you see the Query Builder, shown in Figure 14-3.

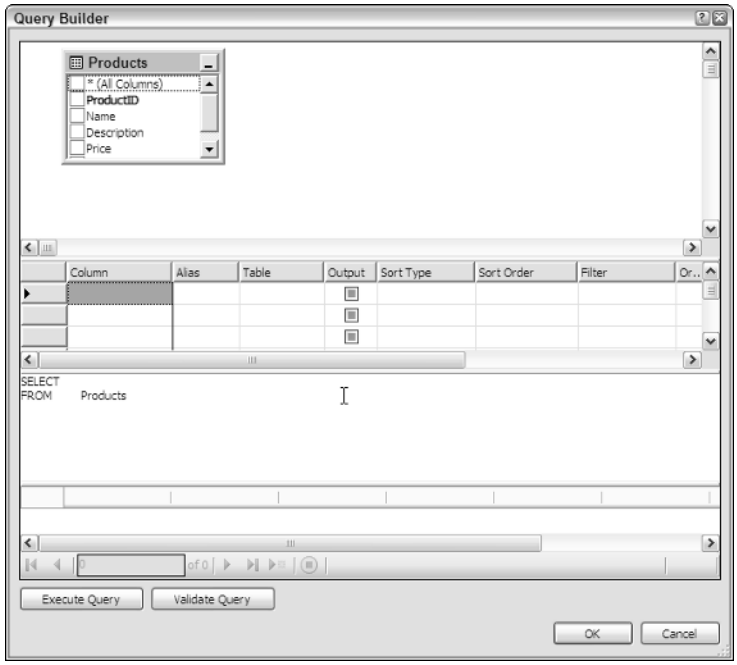


Figure 14-3

The Query Builder is an excellent way of learning SQL, because it presents you with an easy-to-understand graphical way of designing queries, and shows the actual SQL statement. When the Query Builder is closed, the SQL is inserted into the stored procedure; it doesn't update the existing SQL but inserts the new SQL instead.

If you want to use the Query Builder to edit the existing SQL in a stored procedure, you need to place the cursor within the SQL block when editing the procedure — this block is outlined in blue — and select the Design SQL Block from the right mouse menu. When you select this option the Query Builder comes up right away with the existing SQL in place.

Modifying Data and Parameters

The query and stored procedure shown earlier only fetch data, but three other types of queries can be run: updates, inserts, and deletes. Just like `SELECT` queries these update queries can also be converted into stored procedures. As an example, take a look at the administrative Edit News page, where the `SqlDataSource` is defined like so:

```
<asp:sqldatasource id="SqlDataSource2" runat="server"
  ConnectionString="<%$ ConnectionStrings:WroxUnited %>"
  SelectCommand="SELECT * FROM [News] WHERE [NewsID] = @NewsID"
  UpdateCommand="UPDATE [News] SET [DateToShow] = @DateToShow, [Description] =
@Description, [PictureURL] = @PictureURL, [Category] = @Category, [Title] = @Title
WHERE [NewsID] = @NewsID"
  InsertCommand="INSERT INTO [News] ([DateToShow], [Description], [PictureURL],
[Category], [Title]) VALUES (@DateToShow, @Description, @PictureURL, @Category,
@Title)"
  DeleteCommand="DELETE FROM [News] WHERE [NewsID] = @NewsID"
  OnDeleted="SqlDataSource2_Deleted"
  OnInserted="SqlDataSource2_Inserted"
  OnUpdated="SqlDataSource2_Updated">
```

The important parts are the `SelectCommand`, `UpdateCommand`, `InsertCommand`, and `DeleteCommand` attributes, which define the SQL used when fetching and modifying data. There are also a number of parameters, which provide the mapping from the ASP.NET controls to the queries:

```
<DeleteParameters>
  <asp:Parameter Type="Int32" Name="NewsID"></asp:Parameter>
</DeleteParameters>
<UpdateParameters>
  <asp:Parameter Type="DateTime" Name="DateToShow"></asp:Parameter>
  <asp:Parameter Type="String" Name="Description"></asp:Parameter>
  <asp:Parameter Type="String" Name="PictureURL"></asp:Parameter>
  <asp:Parameter Type="String" Name="Category"></asp:Parameter>
  <asp:Parameter Type="String" Name="Title"></asp:Parameter>
  <asp:Parameter Type="Int32" Name="NewsID"></asp:Parameter>
</UpdateParameters>
<SelectParameters>
  <asp:ControlParameter Name="NewsID" Type="Int32" ControlID="GridView1"
PropertyName="SelectedValue"></asp:ControlParameter>
</SelectParameters>
<InsertParameters>
  <asp:Parameter Type="DateTime" Name="DateToShow"></asp:Parameter>
```

```
    <asp:Parameter Type="String" Name="Description"></asp:Parameter>
    <asp:Parameter Type="String" Name="PictureURL"></asp:Parameter>
    <asp:Parameter Type="String" Name="Category"></asp:Parameter>
    <asp:Parameter Type="String" Name="Title"></asp:Parameter>
  </InsertParameters>
```

When converting these queries to stored procedures, the parameters can remain the same, because the stored procedures will still require information to be passed into them. So in the next Try It Out, you convert this page and see how the parameters and other queries work.

Try it Out — Modifying Data and Parameters

1. Open the `Admin\EditNews.aspx` page and find the `SqlDataSource2` control.
2. In the Database Explorer, expand the `WroxUnited.mdf` file and add a new stored procedure (select the Stored Procedures item in the Database Explorer and from the right mouse menu select Add New Stored Procedure).
3. Delete the existing contents of the new stored procedure and replace them with the following:

```
CREATE PROCEDURE dbo.usp_NewsByID
  @NewsID int
AS
  SELECT * FROM News
  WHERE NewsID = @NewsID
```

   You can copy and paste the SQL from `EditNews.aspx` if you like. You don't have to worry about the square brackets — these were placed around column names when the data source control was created and ensure that the column names are not interpreted as keywords.

4. Save and close the procedure.
5. Create another new procedure, replacing the default text with the following code:

```
CREATE PROCEDURE dbo.usp_NewsUpdate
  @DateToShow datetime,
  @Description text,
  @PictureUrl varchar(50),
  @Category varchar(50),
  @Title varchar(50),
  @NewsID int
AS
  UPDATE News
  SET DateToShow = @DateToShow, Description = @Description,
      PictureUrl = @PictureUrl, Category = @Category,
      Title = @Title
  WHERE NewsID = @NewsID
```

6. Save and close the procedure.
7. Create another new procedure, replacing the default text with this code:

```
CREATE PROCEDURE dbo.usp_NewsInsert
  @DateToShow datetime,
  @Description text,
```

```
    @PictureUrl varchar(50),
    @Category varchar(50),
    @Title varchar(50)
  AS
    INSERT INTO News(DateToShow, Description, PictureUrl, Category, Title)
    VALUES (@DateToShow, @Description, @PictureUrl, @Category, @Title)
```

8. Save and close the procedure.

9. Create another new procedure, replacing the default text with the following:

```
CREATE PROCEDURE dbo.usp_NewsDelete
  @NewsID int
AS
  DELETE FROM News
  WHERE NewsID = @NewsID
```

10. Save and close the procedure.

11. In the Database Explorer, close the database connection by right-clicking `WroxUnited.mdf` and selecting the Close Connection menu item.

12. In `EditNews.aspx` change the SQL commands to their appropriate stored procedures, using the following table as a guide:

Command	Stored Procedure
`SelectCommand`	`usp_NewsByID`
`UpdateCommand`	`usp_NewsUpdate`
`InsertCommand`	`usp_NewsInsert`
`DeleteCommand`	`usp_NewsDelete`

13. Add the following attributes to `SqlDataSource2`:

```
SelectCommandType="StoredProcedure"
UpdateCommandType="StoredProcedure"
InsertCommandType="StoredProcedure"
DeleteCommandType="StoredProcedure"
```

14. Save the page and run the application to prove that the page still works as expected; like the previous example you won't see anything different when running the application. To edit the news items you'll have to be a user in one of the following roles: Reporter, Owner, Manager, or Admin. You can find out login details by using the "help" link on the login box when not logged in to the site, but you can use dave, dan, jim, chrish, chrisu, or john.

How It Works

From the first example you can see that the SQL statements in the data source control have been replaced by names of stored procedures, and the appropriate `CommandType` attributes set to indicate this. The stored procedures are rather different from the one used in the first example, though, so take a look at some of the specifics, starting with the one to fetch a row to be edited:

```
CREATE PROCEDURE dbo.usp_NewsByID
  @NewsID int
AS
  SELECT * FROM News
  WHERE NewsID = @NewsID
```

The first thing to notice is that there is an extra line between the `CREATE PROCEDURE` and the `AS` statement. This is where parameters are placed and is very similar to parameters for methods, as discussed in Chapter 9. In this case you have a parameter called `@NewsID`, whose data type is an `int` (an integer). Parameters in SQL are always preceded by the at symbol (`@`). The value for this parameter is supplied in the same way as if this `SelectCommand` were a SQL statement, by the `SelectParameters`:

```
<SelectParameters>
  <asp:ControlParameter Name="NewsID" Type="Int32"
    Control="GridView1" PropertyName="SelectedValue"></asp:ControlParameter>
</SelectParameters>
```

The value of the `Name` attribute is passed through into the `@NewsID` parameter of the stored procedure. Within the procedure the parameter is used to restrict the rows returned, so only rows where the `NewsID` matches the value of the `@NewsID` parameter are returned.

The same technique applies for the other stored procedures. For example, to update a news story the following stored procedure is used:

```
CREATE PROCEDURE dbo.usp_NewsUpdate
  @DateToShow datetime,
  @Description text,
  @PictureUrl varchar(50),
  @Category varchar(50),
  @Title varchar(50),
  @NewsID int
AS
  UPDATE News
  SET DateToShow = @DateToShow, Description = @Description,
      PictureUrl = @PictureUrl, Category = @Category,
      Title = @Title
  WHERE NewsID = @NewsID
```

There are more parameters here, with each being separated by a comma. The data types are also slightly different from what you might expect, because SQL handles strings differently from .NET. For example, the `Description` and `PictureUrl` are both a `String` type in .NET, but there are two data types used in SQL. This is because SQL allows for strings of a fixed maximum length, in which case the `varchar` data type is used with the maximum in parentheses, or for unlimited strings, in which case the `text` data type is used. A `varchar` only defines the maximum length for the string, and doesn't necessarily store that much data. For example, `PictureUrl` is declared as `varchar(50)`, but if the `PictureUrl` only contains 10 characters, then only 10 characters are stored. There is another data type for handling strings, which is `char`, but that does store all characters. So if `PictureUrl` was declared as `char(50)` and only 10 were used, what is stored is the actual string followed by 40 spaces. Those spaces would be

automatically added when the string was inserted into the database and would remain when the data is fetched, which would mean you might have to truncate your data when displaying it. So unless you are storing a string that you know is fixed (three-character currency codes for example), then a `varchar` data type is best.

We don't have time to go into more detail on the SQL itself, because it's really outside the scope of what we're teaching. The important thing to remember is that using stored procedures improves performance as well as centralizing data access statements.

For more on SQL get hold of *Beginning SQL*, by Paul Wilton and John Colby, and for more on database access in ASP.NET see *Beginning ASP.NET 2.0 Databases* by John Kauffman. Both books are also by Wrox Press.

Strongly Typed Collections

Chapter 9 briefly mentioned generics as a way to improve code in a number of areas: readability, reducing errors, and performance. We're not going to go into much detail about generics — it's a wide topic — but it does have an impact on performance, especially in regard to collections. So it's worth reiterating the differences between a normal collection and a generic one. Take the standard `ArrayList` as an example, which can be used like this:

```
Imports System.Collections

Dim myList As New ArrayList()
myList.Add("abc")
myList.Add("def")

Dim s As String  = DirectCast(myList(0), String)
```

Now there's nothing wrong with this code; it works fine and is probably used in lots of web sites, but it's not the most efficient way to store a list of strings. This is because the `ArrayList` stores objects, so when a string is placed into the list it is converted to an `Object` data type. Likewise, when fetching data from the list it needs to be converted back to its native type. This conversion between types is an overhead.

With a generic collection the overhead is avoided because the collection is automatically of the correct type. Instead of an `ArrayList`, a generic `List` can be used:

```
Imports System.Collections.Generic

Dim myList As List(Of String)
myList.Add("abc")
myList.Add("def")

Dim s As String  = myList(0)
```

When declaring the `List` you set the type of object it contains — in this case `String`. When objects are added to the list they don't need to be converted because the list is only storing strings. Similarly, no conversion is required when reading a value from the list. As a result, there's a performance improvement when adding data and fetching it.

The added benefit of generic collections is that you can't store anything other than the defined type in them. This reduces potential error situations, because attempted storage of the wrong data type will result in a compiler error.

Session State

Chapter 6 explained the stateless nature of web sites, and that without programming they forget information between requests. The ASP.NET controls retain information about their state, and the Profile retains information about a user, but there is no storage of data about a session, unless this is coded into the application. The session can be described as the time spent browsing a site; from the moment you first start browsing to the moment you close your browser. That's an important point, because once the browser closes the session ends — if you start browsing after closing the browser you have a new session.

In previous versions of ASP.NET many things that are now part of the framework had to be coded, and the session was often used for temporary storage of items such as user details, shopping carts, and so on. With the Profile storing user preferences and the Membership services storing user details, the need for session storage has reduced. Membership is covered in Chapter 4 and the Profile is covered in Chapter 11, so refer to those chapters for details of what is stored.

This is important to know because session state takes resources, both the processor and memory, and if it's not required then why have it there? By default the session is enabled for read and write access, but this can be disabled if your application is never going to use session state. You can do this in the application configuration file (`Web.config`), by using the `sessionState` element:

```
<sessionState mode="Off" />
```

This turns off session state, which will save valuable resources.

If session state is required, but none of the pages need to update it, then it can be made read-only (or turned off for pages) by changing the `enableSessionState` attribute of the `pages` element in `Web.config`:

```
<pages enableSessionState="ReadOnly" />
```

The values can be `False` to turn off session state, `True` to enable it, and `ReadOnly` to make it read-only. The `ReadOnly` property can also be applied to the `Page` directive on individual pages as follows:

```
<%@ Page enableSessionState="ReadOnly" %>
```

It should be noted that for low-user sites, turning off session state probably won't make much difference, but it could have an impact on a high-performance site with a large number of active users. You should also make sure that developers know that session state is turned off for a site, otherwise they may try to code for it when it isn't available.

View State

The way ASP.NET server controls retain their state is a great boon for the programmer and makes construction of web sites far easier than it used to be. The retention of state is called the *view state* and is stored within a hidden control on the page, so no extra programming is needed. This does, however, come with a downside, and that downside is that the size of the page increases, which in turn leads to a slower-loading page. Now by and large the advantages of view state outweigh the disadvantages, but it's useful to understand how it works. Take a look at the Wrox United home page, which contains many controls. There are some links at the top, a menu and the login and shopping cart on the left, and then the main content, which consists of the news. All of these are handled by controls, and only the central content is specific to the individual page — the rest is supplied by the Master page, and therefore appears on every page.

This is important from the performance perspective because the view state for the menu is 2780 bytes. That might not seem like a lot, but it's sent on every page request and returned on every postback. Plus that's just the menu control; others have view state too. Essentially any control that participates in post-back will probably have view state and thus the more controls, the more view state.

Like session state, view state can also be disabled, both at the page and control level, using the `EnableViewState` attribute. To enable this for all controls on a page (or the Master page) you modify the `Page` directive as follows:

```
<%@ Page EnableViewState="False" %>
```

For controls the attribute is the same. For example, the menu control in `site.master` could have view state disabled like so:

```
<asp:Menu id="MyMenu" runat="server"
  EnableViewState="False" />
```

The menu continues to work as before, but now has no view state so the page has more than 2000 bytes less to transmit every time. This technique can be applied to other controls, especially those such as grids or lists. One case is the Players page (`players.aspx`), which uses a `DataList` to show the player details, and has no interaction. Turning off view state for this control reduces the page size by another 2700 bytes.

In fact, many of the controls don't actually need view state, and those that do interact with the page might be able to have view state disabled. This is different from previous versions of ASP.NET where disabling view state stopped some controls from working. View state can be disabled for the entire application in a similar way to session state, by modifying the `pages` element in the `Web.config` file:

```
<pages enableViewState="false" />
```

If this was done, you could then turn on view state for those controls that need it.

Later in the chapter you look at how you can find out how large controls are and how much view state they store. But first, the next section looks at how you can use code to improve performance.

Pages and Code

Many techniques can be used in code to help with performance, from simple use of framework classes to a properly architected application. Some techniques will only come from experience, some will only be relevant to certain applications, and some are things you should generally know.

One of these general points is to know the .NET Framework class library. You don't have to know it inside out, nor remember all of the classes, but it's a good idea to familiarize yourself with the classes and namespaces. It's definitely worthwhile spending some time just browsing through the reference documentation, getting a feeling for what's possible. For example, many string handling routines are built right into the `String` object, there are data type conversion classes, collections for storing multiple copies of objects, and so on.

Data Binding and Postback

If you aren't using data source controls for your data binding, one thing you should make sure you do is only to bind when you need to; data binding involves fetching the data from the database (and we've already said data access is expensive) and binding each row and column from the data to the rows and columns in a control. There's no point doing all of that data access and binding unless it's absolutely necessary. For example, consider the following code:

```
Protected Sub Page_Load(ByVal Sender As Object, ByVal E As EventArgs)

  GridView1.DataSource = SomeCollection
  GridView1.DataBind()

End Sub
```

This simply binds a `GridView` control to a collection of data (the data is irrelevant for this discussion), but remember that if the page has buttons that post back, then the `Page_Load` event is run every time, so the data is bound every time. If the grid isn't going to change, and it retains its state, why rebind it? Using the `IsPostback` property can avoid this:

```
Protected Sub Page_Load(ByVal Sender As Object, ByVal E As EventArgs)

  If Note Page.IsPostback Then
    GridView1.DataSource = SomeCollection
    GridView1.DataBind()
  End If

End Sub
```

Now the grid is only bound the first time the page is loaded. This may seem like an obvious point, but you'd be surprised how easy it is to forget, and remember that database access is relatively expensive—it consumes both time and resources.

If you are updating data and you do need to rebind the grid after a postback, you can bind in the button event as well, after the data has been changed. What you don't want to do is bind the grid in when the page loads, update the data, and then rebind the grid again.

Object References

One standard performance optimization is the use of references to objects or items in collections. For example, imagine you are processing some user input, perhaps a name, entered into the text box with an ID of NameTextBox. You have to work with the entered name in several places in some code, so you do this:

```
ValidateName(NameTextBox.Text)
UpdateDatabase(NameTextBox.Text)
DisplayName(NameTextBox.Text)
```

You can see that the `Text` property of the name is referenced three times. What happens if you realize the user could have entered leading and trailing spaces, but that your routines need these stripped off? You might be tempted to just trim the spaces each time, like so:

```
ValidateName(NameTextBox.Text.Trim())
UpdateDatabase(NameTextBox.Text.Trim())
DisplayName(NameTextBox.Text.Trim())
```

A much better solution is to only reference the name once, storing the value in a local variable as follows:

```
Dim Name As String = NameTextBox.Text.Trim()

ValidateName(Name)
UpdateDatabase(Name)
DisplayName(Name)
```

Not only is this easier to read, but it's also more efficient — you're performing the `Trim` once, and only referencing the `Text` property once.

In general this technique should be used wherever you reference objects properties, or call methods, several times. There's probably very little performance improvement for referencing a `Text` property a few times, but it does sometimes aid readability, and it would certainly improve performance in a high-volume site; consider the search box on Amazon — how many times a day does that get used?

StringBuilder Versus String Concatenation

Joining strings together is a common occurrence and the technique most people use is *concatenation*, like so:

```
Dim FirstName As String = "Bill"
Dim LastName As String = "Barker"
Dim FullName As String = FirstName & " " & LastName
```

Here the ampersand (`&`) is used to join strings; the `FullName` is created from the `FirstName`, a space, and then the `LastName`. With just these three strings, trying to improve performance probably isn't worthwhile, but when more strings are added together there is a significant overhead. The reason is that strings are immutable, which means once they are created they can never be changed. For example, consider creating a mail message to send to new members of the Wrox United fan club:

```
Dim Message As String = "Dear " & MemberName & _
  ". Welcome to the Wrox United Fan Club. As a member you'll" & _
  " receive regular newsletters to keep you up-to-date with the" & _
  " activities of the club, special discounts in the club store," & _
  " advance notice of special events, and many more exciting freebies."

EmailMessage.Body = Message
```

This is fine as it stands because most of this is literal strings — that is, text within quotation marks. When literal strings are concatenated, the compiler will join them together so there is no overhead. But what if the strings are user-supplied? For example, you might have the following code, where the strings are taken from a Web Form:

```
Dim Address As String = AddressLine1.Text & AddressLine2 & AddressLine3 & _
                        AddressLine4.Text & AddressLine5.Text
```

This also is fine, and despite what you might read elsewhere this is still very efficient because the compiler knows how many strings there are and can optimize the code for you. We've mentioned these two scenarios because certain books and articles explicitly state that this code is very inefficient; ignore them, because the code is fine. Where you might have a performance problem is when the number of strings is large (more than 10, say) or unknown. For example, imagine a string being built up from some rows in a database (returned as a `SqlDataReader`, `rdr`), where you might have the following code:

```
Dim str As String
While rdr.Read()
  str &= rdr.GetString(0)
End While

Return str
```

This loops while the reader has some data and appends the data from column `0` to the string variable `str`. As it stands, this is very inefficient because the compiler doesn't know how many strings there will be, so it cannot perform any optimization. Although this looks innocuous you have to remember that strings are immutable, so once created they are never changed. The preceding code, therefore, doesn't really append one string to another; it actually creates a new string made up from the two being appended. This new string is then assigned to `str`. To improve performance the `StringBuilder` class can be used, which is in the `System.Text` namespace:

```
Imports System.Text
Dim sb As New StringBuilder()
While rdr.Read()
  sb.Append(rdr.GetString(0))
End While

Return sb.ToString()
```

When the `StringBuilder` object is created it allocates a buffer of memory, and as strings are appended to it using the `Append` class, the buffer gradually fills up. When full, another chunk of memory is allocated ready for more strings, so memory allocation happens infrequently and in chunks. This is far more efficient than appending strings to each other where the memory allocation happens for each string.

In general you should use a `StringBuilder` object where you are appending a large number of strings, or where the number of strings is unknown.

Picking the Right Collection

Numerous collections exist and at first glance some seem just as good as others, but you need to carefully consider the use of the collection to ensure optimal performance. The following section lists the collections and what their best use is:

- The `ArrayList` dynamically resizes as items are added and is best used to store custom object types when the data changes frequently — for example, when you are performing frequent inserts and deletes.
- The `HashTable` is a collection of pairs of data (a key and a value) and is best suited for data that doesn't change frequently, and is especially useful for data that is queried often.
- The `ListDictionary` should only be used to store small amounts of data, generally fewer than 10 items.
- The `NamevalueCollection` is a sorted collection of keys and values and is best for data that is already sorted. It is efficient for data that frequently changes or needs to be queried often.
- The `Queue` provides first-in, first-out storage, so it should be used when sequentially ordered data is required.
- The `SortedList` stores keys and values in a sorted order. This makes adding data slow, because existing items need to be rearranged to ensure the new item is in the correct order. A `SortedList` is best for data that doesn't change often.
- The `Stack` provides first-in, first-out storage, so it should be used when sequentially ordered data is required.
- The `StringCollection` is a strongly typed `ArrayList`, so it is useful for storing strings in an arbitrary order, and for strings that change frequently.
- The `StringDictionary` is a strongly typed `HashTable`, so it is useful when strings need to be stored and those strings don't change often.

Using the correct collection not only improves performance but also reduces the potential for errors. For example, if you need to store strings, use a `StringCollection` or a `StringDictionary`, because they only store strings; trying to store another data type results in a compiler error, so your code is protected against storage of incorrect types.

Now it's time to turn away from the coding aspects of performance and look toward a feature that ASP.NET provides for us. Although coding and configuration is still required, it's not the code itself that will improve performance; rather, it is ASP.NET itself.

Caching

Caching is the term given to keeping a copy of something for later use, and provides a way of avoiding resource-intensive operations. For example, we've already talked about databases being expensive in terms of performance, but there's no real way to avoid them with data-driven sites. So what you can do is minimize database access, by fetching data and storing it elsewhere (but not another slow resource such as a file). Another type of caching can just involve operations that don't need to be done multiple times; storing the result of that operation saves having to redo it when required.

Caching can be used in many ways, but luckily ASP.NET has made some of these easier for us.

Page Caching

You already know that ASP.NET pages are compiled, but probably haven't thought much about it. After all, it works, so what's the big deal? Well, knowing how it works means you can understand how page caching works, and means you can use it effectively. The following set of diagrams show how the compilation works and how it affects caching. Figure 14-4 starts with the first request of a page, which is compiled and stored on disk in intermediate language; this isn't a fully compiled executable, but is a shortened source code format. The .NET runtime then compiles the intermediate code, which executes, and the result of that execution is the HTML that is returned to the browser.

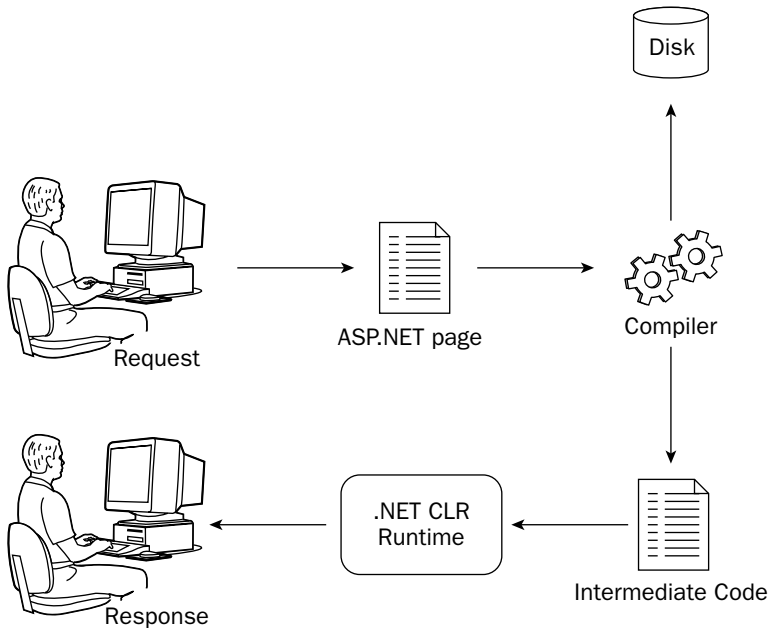


Figure 14-4

The second time the page is requested (see Figure 14-5), assuming the source hasn't been changed, the intermediate code is still available, so the compilation stage is bypassed.

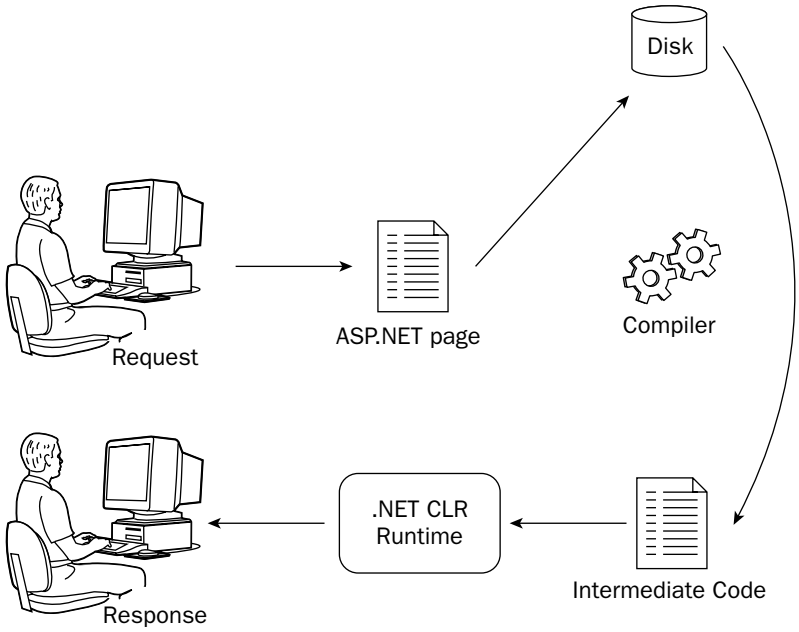


Figure 14-5

So already we have an improvement, just by the intermediate code being cached. What can also happen is that the page output can be cached, if designed as part of the page. When the intermediate code is compiled, the HTML is not only returned to the browser, but also stored on disk, as shown in Figure 14-6.

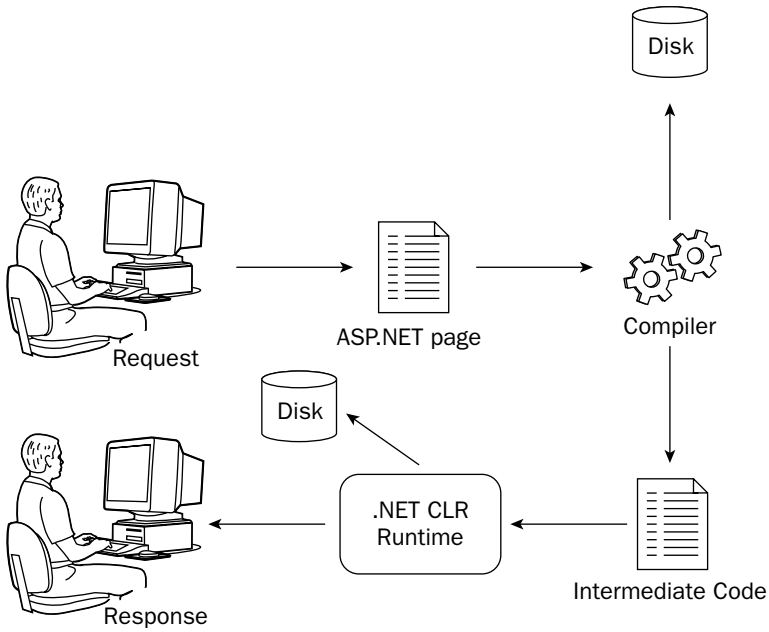


Figure 14-6

Now you have a great situation, because subsequent requests for the page simply get the HTML from the cache. All areas of compilation are avoided, as illustrated in Figure 14-7.

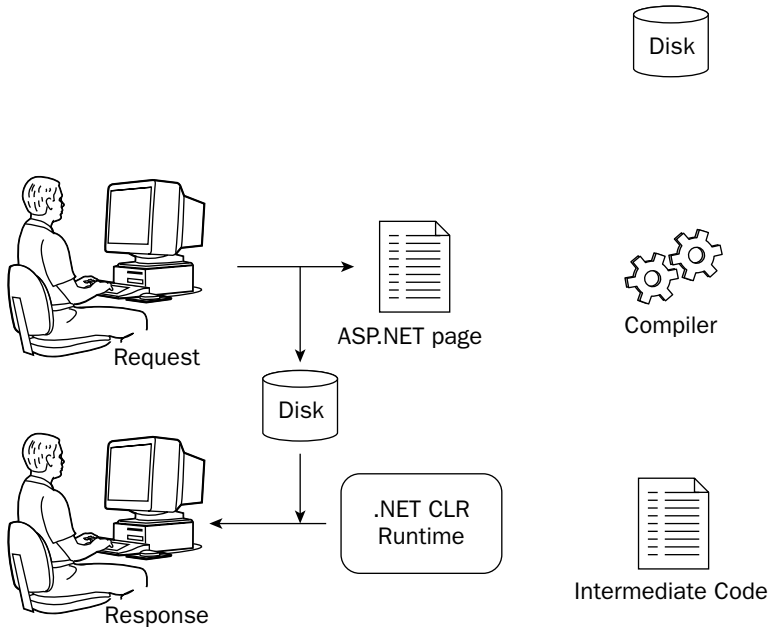


Figure 14-7

Now take a look at how you can implement this type of caching.

Output Caching

Output caching is the simplest of the page caching techniques shown in the previous section, whereby the entire page is cached. Give this a go in the next Try It Out to see how easy it is.

Try It Out Output Caching

1. In VWD, open `History.aspx`.
2. As the first line in the content, above the existing `h1` element, add the following:

```
<div class="boxFloatRight"><%=DateTime.Now%></div>
```

3. Save the file and run the application, navigating to the History page under the About menu. Notice the time to the right of the title, and press F5 to refresh the page. Press F5 several times, noting that the time is updated.
4. Close the browser, and back in VWD edit the `History.aspx` page again, adding the following line:

```
<%@ OutputCache Duration="30" VaryByParam="none" %>
```

5. Save the file and re-run the application. Try pressing F5 several times and notice that now the time isn't updated. Wait at least 30 seconds (or go make some coffee/tea/favorite beverage — you deserve it) and refresh the page again — notice that the time has changed.

How It Works

Output caching works in exactly the way shown in Figures 14-4 through 14-7. The `OutputCache` directive tells ASP.NET that once the output of the page has been created it is to be stored in the cache. The `Duration` is the time in seconds that the page is to remain in the cache; any requests within those 30 seconds are served from the cache. Once the 30 seconds is up, the cached page expires and is removed from the cache. The next request will re-execute the page, whereupon it is placed into the cache once more. The `VaryByParam` attribute is discussed in a just a bit.

The `div` displaying the current time shows the time the page was executed. So the first time you request the page the current time is shown, because this is when the HTML is generated. But because the HTML is cached, subsequent views of the page receive the cached HTML, which of course has the time fixed. It's only when the page is removed from the cache that it's re-executed and the time updated.

The advantage of this system is that pages that are used frequently will be often cached, whereas pages that aren't used often get discarded from the cache.

The `VaryByParam` attribute dictates whether any external influences affect how the page is cached. Setting the value to `none` means that nothing affects the caching — only one copy will be cached. However, what about pages that allow selections and fetch data based upon those selections? One example is the Fixtures page, which can either show past fixtures or future fixtures, depending on a value passed in as part of the querystring. If `VaryByParam="none"` is used, only one copy of the page would be cached, so the first Fixtures page requested would be cached. Say two people view the fixtures one after another, and that the first view is for future fixtures, which would be cached. If the second person requests past fixtures he or she would be returned the cached page, which was for future fixtures. In fact, with this model the past fixtures wouldn't be viewable until the first page was evicted from the cache.

To get around this `VaryByParam` can be set to the name of the querystring variable, which means that a copy of the page would be cached for each different value of the variable. This could be implemented in the Fixtures page simply by adding the following cache directive:

```
<%@ OutputCache Duration="30" VaryByParam="type" %>
```

The two menu entries for fixtures have the following as their URLs:

```
Fixtures.aspx?type=future
Fixtures.aspx?type=past
```

Now when two people request the different fixture pages, two copies are stored in the cache, one for each type.

Fragment Caching

Fragment caching allows portions of a page to be cached while the rest of the page remains dynamic. This is ideal for those pages that contain a mixture of static and dynamic content, and is achieved by having the content that is to be cached contained within a user control. The user control then uses the `OutputCache` directive to dictate how it should be cached, in the same way that pages use it:

```
<%@ Control OutputCache Duration="30" VaryByParam="none" %>
```

When the user control is placed on the page, only the content for the user control will be cached, allowing the rest of the page to remain dynamic.

This is useful for pages where the data is very dynamic and changing often and you don't want the page cached, but there is some content (perhaps from a database) that doesn't change often and can be cached.

Post Cache Substitution

Post cache substitution is the opposite of fragment caching, where the page is cached but a portion of the page is dynamic. This is achieved by use of the `Substitution` control, which works differently from other forms of caching. You still use the `OutputCache` directive on the page to determine the caching, but the `Substitution` control is simply a placeholder into which the content is to be placed, and this content has to be created manually. The `Substitution` control has a property called `MethodName` that indicates a function that will return a string of data to be substituted into the cached page. For example the page would be as follows:

```
<%@ Page CodeFile="PCS.aspx.vb" Inherits="PCS" %>
<%@ OutputCache Duration="30" VaryByParam="none" %>
<html>
  <form runat="server">
    <div class="boxFloatRight"><%=DateTime.Now%></div>
    <asp:Substitution id="sub1" runat="server" MethodName="Substitute" />
  </form>
</html>
```

The code-behind would be as follows:

```
Partial Class PCS
  Inherits System.Web.UI.Page

  Shared Function Substitute(ByVal myContext As HttpContext) As String
    Return "Date fetched on " & DateTime.Now.ToString()
  End Function
End Class
```

When this page is run it will be cached so the `div` with the date and time will remain the same, but each time the page is requested the `Substitute` method will be called, so the data that it returns will not be cached. Here's how it works.

The first time the page is requested by a user, the normal caching regime is applied — the page will be placed into the output cache. However, because there is a `Substitution` control on the page the output cache keeps a note of the `MethodName` (for each `Substitution` control if there is more than one on the page). When the page is next requested, instead of being returned directly from the cache, the method

detailed in `MethodName` is called, which changes the contents of the `Substitution` control, at which point it is integrated with the copy of the page in the output cache and returned to the user. In this case, you get the benefit of output caching but with the flexibility of dynamic content.

What's interesting about post cache substitution is that it's available to you if you write custom controls, meaning you can drop controls onto a page that automatically display up-to-date content irrespective of whether or not the page is cached. The `AdRotator` control actually works like this, so if you place an `AdRotator` onto a page, the ads will always be updated even if the page is cached. This works because within the `AdRotator` code there is a post cache substitution that is dependent on the file that stores the ads. When the `AdRotator` is on a page and that page is rendered, the `AdRotator` always checks the cache because that's what the post cache substitution does. If the ad's file hasn't changed, the cache entry will still be present, but if the file has changed the cache entry will have been removed, so the ad's file is re-read. With the `AdRotator` you get the benefits of caching but without the problem of stale ads, an important consideration if customers are paying for ad space.

Designing for Performance

This is the most vague area of the book, because much of the topic varies upon the particular application. While there are general techniques that can be used, some specific things depend upon your site. For example, you wouldn't want to go to extreme lengths to extract the last ounce of performance from an intranet site with only 50 users. Sure, make it perform as best as you can, but sometimes there are tradeoffs that aren't really justified. Is it worth spending a week of your time to gain an extra couple of seconds? Possibly, but not always.

When designing for performance you have to think ahead and perhaps answer the following questions:

- **How many people are going to use the site?** For an intranet site you'll have a fixed number of users — the employees in the company. For an Internet site the user base is unlimited. More users mean more resources will be required on the web server.
- **How much page interaction is there going to be?** Do the pages just fetch and display data, or will the user be answering questions, making selections, and so on? You obviously want your pages to respond quickly whichever the interaction type, but for the latter, shaving off those extra seconds might be worthwhile.
- **Can any of the pages be pure HTML?** If there is no reason for having an ASP.NET page, then don't. HTML and ASP.NET pages can interact, and HTML pages are faster because they don't require processing by ASP.NET. Also, when using Internet Information Server 6 on Windows Server 2003, HTML pages are particularly fast because of the way in which they are stored and processed by the web server.
- **How much database access will there be?** This may affect how you configure some of the caching options shown earlier.

One thing you have to be aware of is what ASP.NET does and what the web server does. For example, in Chapter 4 you looked at security and saw how to protect sites and pages so that only certain users can access them. This security only works for ASP.NET pages and not HTML pages, so you have to weigh up any performance improvements you might gain from HTML pages over the security implications. If you have pages that need to be secure then they need to be ASP.NET pages, even if they don't contain

any dynamic content. Using ASP.NET pages also allows you to take advantage of other aspects of ASP.NET, such as Master pages, themes, and navigation. Alternatively, you can configure Internet Information Server so that HTML pages are processed by ASP.NET as well as ASP.NET pages. This brings the addition of security, but at the loss of performance.

By and large you should use the topics shown in this chapter, such as stored procedures and caching. There are other things that you shouldn't do, though, such as allowing users to free-search on a large database; it's inevitable that users will at some stage try to query for more data than they really need, causing a slowdown on the database and a slow-loading page. This they'll complain about. You may think it's their fault for running that query, but it reality it would be your fault (or rather the designer of the application, which may not be you). You can avoid this situation by designing the application so this sort of long-running query isn't possible, or that if it is necessary you ensure your database tables are indexed adequately.

Web Server Hardware and Software

This is always a controversial topic, but the physical platform shouldn't be ignored. Though it's easy to throw more hardware at the problem of poor performance, spending money is never the entire solution, nor is it always possible; the bean counters who control the money often can't see the justification or just don't have the money. But, that shouldn't mean it's not a valuable topic to think about, and act on if possible. You don't necessarily have to spend a lot on hardware to benefit. Swapping your processor for a faster one is a choice many people would consider, but could be a waste; not only is it relatively expensive (a new motherboard might also be required, as well as the expense of the processor), but it also might not be required. Memory, on the other hand, is nearly always a cost-effective upgrade. Memory is cheap, and a web server with lots of memory will perform better than one with little memory; there's more memory for the web server to work with plus more available for caching.

The software also shouldn't be ignored. Windows Server 2003 uses Internet Information Server 6 and in a like-for-like situation will generally perform better than version 5 (on Windows Server 2000). There are obvious licensing costs involved, but if you have the option IIS6 is a worthwhile upgrade.

Testing Performance

So how do you go about testing the performance of applications? Perhaps you want to test a new application or an application you've inherited, and you want to see if it's performing to its best capability. A number of techniques and tools are available that you can use, not all of them computer-based. One of them is just natural common sense, and this involves being realistic about your expectations, and the expectations of the web site users. For example, if you were creating an application that showed a picture gallery, you'd expect there to be some delay because pictures can be large and take time to load. But the aforementioned free database query is another matter; whereas you understand the complexities involved your users may not, and they'll expect all queries to return with the same speed.

One of the first things you need to do is establish a *baseline*; this is the set of expectations and numbers that detail how the site performs currently: how fast pages are returned to the user, the number of pages served within a time period, and so on. This is important, because without any numbers you have no accuracy; you're in the realms of guesswork. With numbers you can make changes and see whether they improve performance (more pages served over a given timeframe means more users). The following sections look at some simple ways of getting these numbers.

Tracing

The simplest method is to use ASP.NET *tracing*, and though not designed as a performance tool it can be used to gain a great deal of understanding into how your pages are performing. One of the primary uses for tracing is to help with debugging, and you'll look at that in detail in the next chapter, but for now you can concentrate on its use for analyzing performance.

Tracing works by a simple configuration change, either in the page or in `Web.config`, which instructs ASP.NET to output additional information at the bottom of the page. You do this in the following Try It Out.

Try It Out Tracing

1. From the Wrox United web site in VWD open the `Shop.aspx` file — it's in the main directory.
2. Add the `Trace` attribute to the `Page` directive. It doesn't matter where in the `Page` directive it goes:

```
<%@ Page Language="VB" Trace="True" MasterPageFile="..."
```

3. Save the file and run the application. You'll see something resembling Figure 14-8. You may see more or less depending on your screen resolution:

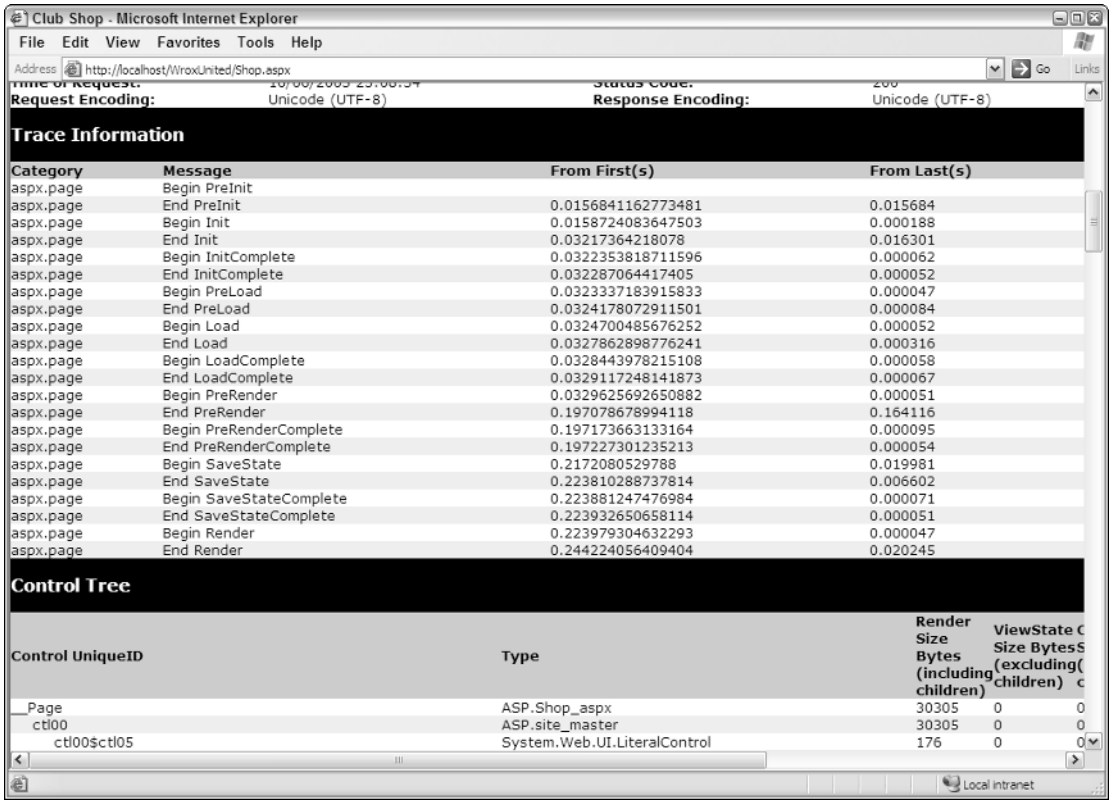


Figure 14-8

How It Works

It's not so much how it works as what it does, adding several pages worth of information to the end of the page. Chapter 15 looks at some of these sections in more detail, but for now let's concentrate on the Trace Information and the Control Tree.

The Trace Information shows four columns:

- **Category,** which is the category of the message. All messages generated by ASP.NET for the page have the page name as the category.
- **Message,** which is an individual trace message. By default some of the ASP.NET events are shown, with two messages for each, one for the start of the event and one for the end.
- **From First(s)** is the time in seconds since the first message was displayed.
- **From Last(s)** is the time in seconds since the last message was displayed.

Immediately you can see that you have some rough performance information, because the total time taken to render the page is shown in the From First column for the End Render method (shown in the Message column). In general this isn't a great guide to performance, but the trace information can help you narrow down slow running areas when you realize you can add your own messages. This is achieved by use of the `Write` method of the `Trace` class, for example:

```
Trace.Write("My Category", "My Message")
```

This means you can wrap sections of code within trace statements to see which perform poorly. Chapter 15 looks at the tracing in more detail.

The second section that is of use for performance analysis is the Control Tree, which shows all of the controls on the page as a hierarchical list. Earlier in the chapter we talked about view state and how minimizing it meant that less was being sent to the browser, and it's this section that allows you to see the view state. There are five columns:

- **Control UniqueID** is the unique ID of the control on the page. This will differ from the ID you've given a control, because it is a combination of the supplied ID plus the IDs of parent controls.
- **Type** is the data type of the control. You can clearly see from this that all content, even straight text, is converted to a control.
- **Render Size Bytes (including children)** is the size, in bytes, of the control. For the entire page, which shows as `__Page`, the first control in the Control Tree section, this tells you the size of the page.
- **ViewState Size Byes (excluding children)** is the size, in bytes, of the view state for this control. Note that this doesn't include child controls.
- **ControlState Size Bytes (excluding children)** is the size, in bytes, of the control state for this control. Note that this doesn't include child controls.

For performance purposes it's the numbers that are useful. The render size indicates the size of the controls, so you can see if controls are outputting more code than necessary. The view state can be turned off in many areas, further reducing the size of the page (which in turn reduces the time taken to render it). The control state can't be turned off, but in general, controls use very little control state so this shouldn't be taken as a performance issue.

Tracing only gives rudimentary information about the performance of a site, but it's a useful starting point for analyzing pages. What it doesn't give is how well a site performs as a whole, or when multiple people access it. For that you need specialist tools.

Stress Testing Tools

Stress testing is the term given to running an application under high load, with lots of users. You could try to persuade lots of people to access the site, but that's not generally practical, so tools are used to simulate multiple users. Stress testing tools work by accessing pages continuously for a defined period of time, and recording the statistics for those pages. This gives accurate data on how a site performs under stress, and because the tools can take into account things such as certain pages being accessed more than others, the data is very accurate. Another great feature is that some of these tools can read existing web log files and build a stress test from them, which means they are using real-life data to perform testing.

A detailed look at stress testing tools is outside the scope of this book, but if you want to look into this in more detail, Visual Studio 2005 comes with a stress testing tool. If you're working in a corporate environment you might already have all of the tools you need. You can find a cut-down version of the Visual Studio tool from the Microsoft Download site at `www.microsoft.com/downloads`. Search for "Web Application Stress Tool." The related resources on the download page point to documents showing how this tool works.

One very important change to make before running any stress tests is to turn off debugging. So make sure that the `debug` attribute is either removed from a page or is set to `False`:

```
<%@ Page debug="False" ... %>
```

In the `Web.config` file you should also ensure that the `debug` attribute of the `compilation` element is set to `false`:

```
<compilation debug="false" ... />
```

The importance of this cannot be over-emphasized, because an application with debugging will perform slower than one without. This is because the .NET runtime tracks debug code, and ASP.NET doesn't batch compile pages and also creates additional temporary files. All of these can have a significant impact on performance tests.

Performance Monitor

Another area that's really too detailed to go into here is that of performance counters, which can be viewed from the Performance Monitor tool in the Windows Administrative Tools folder. This allows you to measure all sorts of statistics about the workings of your computer, including the CPU usage, the amount of memory being used, and so on. There are also groups and counters for ASP.NET so you can see how well ASP.NET is performing. For more details on performance monitoring, see the *Performance Counters for ASP.NET* topic in the ASP.NET documentation for more details.

Summary

This chapter looked at a variety of topics that will help your web sites perform to their best capability. It started by looking at some SQL issues, such as database connections and stored procedures, and showed how they not only will help with performance, but also make your code easier to read and maintain. The latter of these is worthwhile achieving on its own, so these techniques really are useful. Additionally, this chapter covered the following topics:

- Generic collections, which you won't encounter too many times as a beginner, but certainly one that you should strive to use as you grow in expertise. Generics, as a specific area of programming, offers much more that just the collections, but these alone bring great benefits such as readability and improved performance.
- Session state and view state, showing how both can be turned off to reduce the amount of processing that ASP.NET needs to do when running pages.
- Binding, object references, concatenation, and collections. All of these are topics that will make you think about your code as you design and write it; stepping back and thinking about code is often a good exercise because it makes you think about the site as a whole.
- Caching, which is an easy thing to implement, yet brings great performance improvements. Caching can happen at many levels, from ASP.NET to the database, and all reduce the amount of work required to create pages, and caching should be used wherever data isn't changing frequently.
- Finally, you took a brief look at design and testing, to see what you have to think about and how you go about seeing if your site can perform faster.

The next chapter looks at what happens when things go wrong, examining things like debugging and error handling.

Exercises

1. Convert the two shop pages, `Shop.aspx` and `ShopItem.aspx` from using SQL statements to stored procedures.
2. Add caching to the `ShopItem.aspx` page, so that the page is cached. Note that you need to take into account that this page shows different products, so the cache needs to be varied by the product being shown.

15

Dealing with Errors

This chapter covers another topic that you need to think about during the whole of site construction — that of how to deal with errors. In many ways this chapter could fit at the beginning of the book, because it's highly likely you'll get errors as you work through the book and what this chapter covers could be useful. But some of what's discussed here uses code and depends upon other chapters, so we've left it until now.

It's a fact that you will get errors when creating applications, and that's okay. We all make mistakes, so this is nothing to be ashamed of or worried about. Some will be simply typing mistakes and some more complex, maybe due to lack of practice, but these go away with time (apart from my typing mistakes, but that's another story!). So what this chapter looks at is a variety of topics covering all aspects of handling errors. In particular it examines the following:

- How to write code so that it is error proof
- What exceptions are and how they can be handled
- How to centrally handle exceptions
- How to use debugging and tracing to work out where errors are occurring

The first section looks at how to bulletproof code.

Defensive Coding

Defensive coding is all about anticipation; working out what could possibly go wrong and coding to prevent it. One of the precepts of defensive coding is that you should never assume anything, especially if user input is involved. Most users will be quite happy to use the site as intended, but hackers will search for ways to break into sites, so you have to do anything you can to minimize this risk.

Being hacked isn't the only reason to code defensively. A coding bug or vulnerability may not be found by a user, but by yourself or a tester. Fixing this bug, then, involves resources — perhaps a project manager, a developer to fix the bug, a tester to retest the application, all of which take time and money. Also, any change to the code leads to potential bugs — there may not be any, but

there's always the possibility. As you add code to correct bugs, the original code becomes more complex and you occasionally end up with imperfect solutions because you had to code around existing code.

So what can you do to protect your code? Well, there are several techniques to defensive coding.

Parameter Checking

The first of these defensive coding techniques is checking the parameters of methods. When writing subroutines or functions you should never assume that a parameter has a valid value — you should check it yourself, especially if the content originates from outside of your code. Take the code for the shopping cart for an example — this is in `App_Code\Shopping.vb`. One of the methods of the cart allows the item to be updated, like so:

```
Public Sub Update(ByVal RowID As Integer, ByVal ProductID As Integer, _
                  ByVal Quantity As Integer, ByVal Price As Double)

  Dim Item As CartItem = _items(RowID)

  Item.ProductID = ProductID
  Item.Quantity = Quantity
  Item.Price = Price
  _lastUpdate = DateTime.Now()

End Sub
```

This is fairly simple code, but it does no checking on the parameters that are passed in. The reason for this is that the code that uses this gets the parameter values from the database before passing them in. So although you can say that the code is okay, what happens if this code is reused in another project? What happens if someone circumvents the calling code to pass in an incorrect price, one lower than that stored in the database? Or more simply, what if the `RowID` passed in is invalid? With this as an example, you could modify the code like so:

```
Public Sub Update(ByVal RowID As Integer, ByVal ProductID As Integer, _
                  ByVal Quantity As Integer, ByVal Price As Double)

  If RowID <= _items.Count Then
    Dim Item As CartItem = _items(RowID)

    Item.ProductID = ProductID
    Item.Quantity = Quantity
    Item.Price = Price
    _lastUpdate = DateTime.Now()
  End If

End Sub
```

You've now protected this against an incorrect `RowID`, so no errors will occur when this method is called. It's a simple check, ensuring that the ID of the row to be updated isn't larger than the number of rows.

In general, you should always check incoming parameters if the method is a public one; that is, called from outside the class. If it's a method that isn't accessible from outside of the class (Private or Protected) then this is less important because you're probably supplying those parameters yourself, although this

doesn't necessarily mean the parameters will be correct — you might get the values from elsewhere before passing them into the method.

Avoiding Assumptions

As well as checking parameters, you should also avoid assumptions in your code. For example, consider an example that I actually had just now while formatting this document, where there was an error in my own code (yes, shocking isn't it?). I have macros in Word to perform formatting for the styles of the book, one of which is for the grey code block. It's a generic routine that accepts three strings, which are the Word styles to use for the first line, the intermediate lines, and the last line, as shown here:

```
Private Sub FormatParas(First As String, Middle As String, Last As String)

    Dim iRow As Integer

    Selection.Paragraphs(1).Style = First
    For iRow = 2 To Selection.Paragraphs.Count - 1
        Selection.Paragraphs(iRow).Style = Middle
    Next
    Selection.Paragraphs(iRow).Style = Last

End Sub
```

This code uses Word objects to format paragraphs and assumes that there will be more than one paragraph; this seems sensible because each line is a separate paragraph and there is a separate macro to format code that is only a single line. The code works by setting the first paragraph in the selection to the style defined by `First`. For subsequent lines (line two downward) the `Middle` style is used, and for the final line `Last` is used as the style. However, if there is only one paragraph in the selection, the `For...Next` loop doesn't run (`Selection.Paragraphs.Count` being `1`), but it does set `iRow` to `2`. The final line fails because `iRow` is `2` and there is only one paragraph in the selection. I failed in this code because I didn't defend it against user failure (me being the user in this case), where the selection was only a single paragraph.

The corrected code is as follows:

```
Private Sub FormatParas(First As String, Middle As String, Last As String)

    If Selection.Paragraphs.Count = 1 Then
        Selection.Paragraphs(1).Style = Last
        Exit Sub
    End If

    Dim iRow As Integer

    Selection.Paragraphs(1).Style = First
    For iRow = 2 To Selection.Paragraphs.Count - 1
        Selection.Paragraphs(iRow).Style = Middle
    Next
    Selection.Paragraphs(iRow).Style = Last

End Sub
```

With this code, a check is made for the number of paragraphs before the loop is done, and if there is only a single paragraph, no looping is done.

This is a surprisingly common occurrence — errors made because of simple assumptions. This particular code has been in use for several years without failure, but today although it was user error that caused the problem, the failure is in the code for not protecting itself. The dumb user (me) had what looked like multiple paragraphs, but because of soft carriage returns in fact only had one. So the user was wrong, but the code didn't protect against it.

Query Parameters

If you build your applications using the wizards and data source controls then you won't run into this problem, because the generated SQL statements contain parameters. But if you manually construct SQL, or inherit an application, you may see code like this:

```
Dim SQL As String = "SELECT * FROM Products " & _
                    "WHERE ProductID=" & Request.QueryString("ProductID")
```

Or like this:

```
Dim SQL As String = "SELECT * FROM Employee " & _
                    "WHERE LastName='" & LastName.Text & "'"
```

Both of these dynamically construct a SQL statement, concatenating strings together; the first uses a value from the `QueryString`, the second from a `TextBox`. The problem here is that there's no validation on the user input, so it's easy to perform what's known as *SQL injection*, where rogue SQL statements are injected into existing ones. With the second example, if the user enters a last name, the SQL would be

```
SELECT * FROM Employee WHERE LastName='Paton'
```

However, the user could enter

```
Paton' OR 1=1 --
```

This would turn the SQL into

```
SELECT * FROM Employee WHERE LastName='Paton' OR 1=1 --'
```

The first thing to know is that `--` is a comment in SQL, so the trailing quote is ignored. The SQL statement matches any `LastName` that is `Paton`, which is the intended match, but also the `1=1` statement, which will always be true. The result is that all employees would be shown, which is definitely not the intended purpose. This is mild, however, compared to the user who enters this:

```
Paton' ; DROP TABLE Employee –
```

The SQL statement is now

```
SELECT * FROM Employee WHERE LastName= 'Paton' ; DROP TABLE Employee --'
```

The `SELECT` statement works as expected, but there's now a second SQL statement — the semicolon separates statements in SQL. So the query runs, and then the table is dropped — no more employees. Uh-oh, serious trouble. This could easily have been any other `SELECT` statement to find out more information about the database, or even dropping the entire database.

The solution to SQL injection is to use parameters, because these automatically prevent this type of attack. If you're using stored procedures, which you should be, then parameters are required for passing information into the procedure, but when building SQL dynamically you can still use parameters. So if you were running a `SqlCommand`, you could do this:

```
Dim SQL As String = "SELECT * FROM Employee " & _
                    "WHERE LastName=@LastName"
Dim cmd As New SqlCommand(SQL, conn)

cmd.Parameters.Append("@LastName", SqlDbType.VarChar, 50)

cmd.Paramaters("@LastName").Value = LastName.Text
```

Here `@LastName` is the parameter name, and because the value is assigned via the parameter no SQL injection can take place. This is because ADO.NET protects against SQL injection attacks when using parameters — the values passed into parameters are checked for specific content that would signify an attack.

Validation

We've already mentioned that any user input is automatically suspicious, and one of the things that can be done to mitigate the risk is to validate that input; let's stop the user from entering bad input in the first place. This is good for two reasons: first, it means the code is safer and second, users won't have to deal with potentially confusing error messages. They might still get messages telling them that their input is incorrect, but at least they won't get an obscure error message because your code failed.

To help with this problem there is a suite of five validation controls with ASP.NET 2.0 that can check user input before it even gets to your code.

- `RequiredFieldValidator`, which ensures that a field is not left empty.
- `CompareValidator`, which compares the entered text with a value, or with another control.
- `RangeValidator`, which ensures the entered text is within a specified range.
- `RegularExpressionValidator`, which matches the entered text against a regular expression.
- `CustomValidator`, which runs custom code to validate the entered text.

These are standard ASP.NET controls that are placed on the page, generally alongside the control they are validating. There is also a `ValidationSummary` control that allows display of error messages in one place. You add these in the following Try It Out.

Try It Out — Validation Controls

1. In VWD in the Wrox United project for this chapter (C:\BegASPNET2\Chapters\Begin\Chapter15\WroxUnited) open `FanClub\FanClubMatchReport.aspx`.

2. Find `FormView1` and find `TextBox1` in the `<EditItemTemplate>`. Between `TextBox1` and the `<br />`, add the following:

```
<br />
<asp:RequiredFieldValidator id="rfv1" runat="server"
  ControlToValidate="TextBox1"
  Text="You haven't entered the report!" />
```

3. Do the same for the `<InsertItemTemplate>` — enter exactly the same code between `TextBox1` and the `<br />`.

4. Save the file and run the application, logging in as a fan club member (use Dave or Lou as the user — the passwords are dave@123 and lou@123).

5. Select the Add Match Report from the Fan Club menu, pick a match, and select the Add New Report link.

6. Don't enter any text in the text area, but press the Save New Report link, and you'll see an error message, shown in Figure 15-1.

Figure 15-1

7. Now enter some text and save the report.

8. Click the Add New Report link again to add another report.

9. Don't enter any text, but click the Cancel New Report link instead. Notice that the error message is displayed again. You can't cancel unless some text has been entered, so let's correct that.

10. Stop the application and back in VWD edit the page. Find `btnCancelReport` (a `LinkButton` that is in both the `<EditItemTemplate>` and `<InsertItemTemplate>`), and for both occurrences add the following attribute:

```
CausesValidation="False"
```

11. Save the file and repeat Steps 5 and 6. Notice that you can now cancel even if no text has been entered.

How It Works

This works because the validation control is linked to the text box and won't allow the page to be posted back to the server until some text has been entered. Here's a look at the validator in more detail:

```
<asp:RequiredFieldValidator id="rfv1" runat="server"
  ControlToValidate="TextBox1"
  Text="You haven't entered the report!" />
```

The two properties you're interested in are the `ControlToValidate` and the `Text`. The first is what links the controls together — in this case it's `TextBox1` that the validator will check. If no text is entered, the contents of the `Text` property are displayed. If text has been entered, the validator does nothing and no output is shown.

Validation occurs whenever a control would cause the page to be posted back to the server — this could be a `Button`, a `LinkButton`, and so forth, but what's important to note is that by default no postback occurs because the validation is done client-side in the browser. This means that the user sees a responsive display without that refresh that can be so annoying. However, you don't want the validation to take place when you're trying to cancel an edit — if you're canceling it doesn't matter whether there's anything in the text box. By default all means of posting back cause validation to occur, but by setting the `CausesValidation` property to `False` for the cancel link, no validation takes place.

> **Validation should always be done server-side, but can optionally be done client-side as well. You should never rely solely upon client-side validation, because it's easy for hackers to post data directly to a page, bypassing the client-side validation. The default settings in ASP.NET 2.0 are for both client- and server-side validation.**

Validating Multiple Controls

The previous example showed how to validate a single control, with the error message shown directly by the control. However, there are times when you want to validate several controls, and in these cases it's not always sensible to have the error message presented directly by the control. For example, you might have a grid of data, or the data you are editing might be neatly aligned. Under these circumstances you might not want to have the message displayed, because it would change the layout of the screen. However you probably still want some form of indication as to which editable field failed the validation, as well as having the full error message displayed somewhere. For that you use the `ValidationSummary` control. The following Try It Out shows how this can be done.

Try It Out — The ValidationSummary Control

1. Open `FanClub.aspx` and add `RequiredFieldValidator` controls between the end of the text boxes and the `</td>`. You'll need the following validators,

```
<asp:RequiredFieldValidator id="rfv1" runat="server"
  ControlToValidate="txtName"
  Text="*" ErrorMessage="You must enter a value for your name" />
<asp:RequiredFieldValidator id="rfv2" runat="server"
  ControlToValidate="txtAddress"
  Text="*" ErrorMessage="You must enter a value for the address" />
<asp:RequiredFieldValidator id="rfv3" runat="server"
  ControlToValidate="txtCity"
```

```
    Text="*" ErrorMessage="You must enter a value for the city" />
  <asp:RequiredFieldValidator id="rfv4" runat="server"
    ControlToValidate="txtCounty "
    Text="*" ErrorMessage="You must enter a value for the county" />
  <asp:RequiredFieldValidator id="rfv5" runat="server"
    ControlToValidate=" txtPostCode "
    Text="*" ErrorMessage="You must enter a value for the post code" />
  <asp:RequiredFieldValidator id="rfv6" runat="server"
    ControlToValidate="txtCountry"
    Text="*" ErrorMessage="You must enter a value for the country" />
  <asp:RequiredFieldValidator id="rfv7" runat="server"
    ControlToValidate="txtEmail"
    Text="*" ErrorMessage="You must enter a value for the email address" />
  <asp:RequiredFieldValidator id="rfv8" runat="server"
    ControlToValidate="txtAlias"
    Text="*" ErrorMessage="You must enter a value for the membership alias" />
```

For example, the `Name` would be

```
  <tr>
    <td>Name:</td>
    <td><asp:TextBox id="txtName" runat="server" />
        <asp:RequiredFieldValidator id="rfv1" runat="server"
          ControlToValidate="txtName"
            Text="*" ErrorMessage="You must enter a value for the name" />
    </td>
  </tr>
```

2. After the validator for the e-mail address, add the following:

```
  <asp:RegularExpressionValidator id="rev1" runat="server"
    ControlToValidate="txtEmail"
    Text="*" ErrorMessage="Please enter a valid email address" />
```

3. Switch the page into Design View and select the `LoginView` control, `FCLoginView`. From the Common Tasks menu select RoleGroup[0]–FanClubMember from the Views list (see Figure 15-2). This will show the controls in the RoleGroup for users in the FanClubMemberRole.

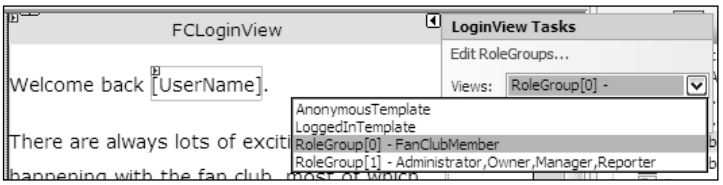


Figure 15-2

4. Scroll down the page to find the RegularExpressionValidator; this is the right-hand validator next to the Email text box. Select this validator and in the Properties area click the `ValidationExpression` property. Then click the button that appears, as shown in Figure 15-3.

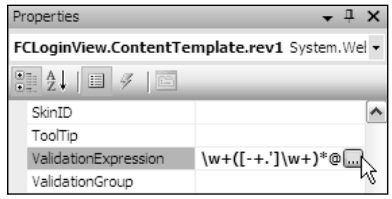


Figure 15-3

5. The window that appears is the Regular Expression Editor, which comes pre-filled with a selection of common expressions. Select Internet e-mail address and click OK, and the selected expression will be filled into the `ValidationExpression` property.

6. Switch the page back to Source View, and before the `LinkButton` (`btnSaveChanges`), add the following:

```
<asp:ValidationSummary id="vs" runat="server" DisplayMode="BulletList" /><br />
```

7. Save the file and run the application. Log in as either Dave (using the password dave@123) or Lou (using the password lou@123), and navigate to the Fan Club home page.

8. Add text to the fields, but leave the City and Email fields blank. Click the Save Changes link and you'll see Figure 15-4.

Figure 15-4

9. Now enter some text into the Email field, but make sure it isn't a valid e-mail address. Click the Save Changes link again and notice how the error message has changed.

10. Delete the text from the Name field and press the Tab key to move to the next field — notice how as soon as you tab out of the field a red star appears next to the field, indicating an error.

How It Works

Several differences exist between this example and the first one where you used only one `RequiredFieldValidator`. In this example there are several, each for different fields, as well as other validation controls. One thing you'll have noticed about the required field validators is that no error message was displayed alongside the field they are validating. That's because the `Text` property was set to `*` — just a simple marker to indicate an error in the field. The `Text` property is displayed inline — that is, wherever the validator is placed. The `ErrorMessage` property is used wherever the error is displayed, and in this case that is shown by the `ValidationSummary`.

The `ValidationSummary` is fairly obvious in its purpose, because it simply displays in one location all error messages from validators. This allows the validators to be discrete, showing just a simple asterisk to mark the field in error without causing displacement on the screen, but still to have a full error message. The `DisplayMode` for the summary can be a list, bulleted list, or a paragraph.

The other validator used was the `RegularExpressionValidator`, which checks the entered text against a regular expression — this is a format for defining character sequences. If you want to use regular expressions for other fields, such as postal codes, then the Regular Expression Editor has some expressions, otherwise you can find many others at `www.regexlib.com`, which has a searchable database of expressions freely available. You'll have noticed that the Email field had two validators, one to ensure some text was entered, and one to ensure that the entered text was valid. Both validate the same control because they both have their `ControlToValidate` property set to `txtEmail`. You can mix and match the other validators in the same way, which gives great flexibility in ensuring that entered data is correct.

The other thing you'll have noticed was that tabbing from field to field also showed the asterisk, but not the error message in the summary. Because validation is being done client-side, the client script knows that text is required for a field, so if left empty it can signal an error. But because the summary is intended to show all errors, this isn't filled in unless a postback is tried. So you get the best of both worlds — dynamic error handling with full error messages.

Exception Handling

Exception handling is the term given to anything out of the ordinary that happens in your application — it is exceptional circumstances. Although handling exceptions is part of defensive coding, there's a difference between programming for things that could quite easily go wrong, or are even expected to go wrong, such as incorrect passwords, and those things over which you have no control. For example, consider what happens if you can't connect to the database — what would you do? How would you handle that situation? Now it's likely that there's nothing you can really do in your application, because it may well be dependent upon the database, but you still don't want your users to see an ugly error message — you want to display your own message, maybe letting them know that there is a problem and they can try again later.

So the trick is to have a strategy, to work out in advance what you're going to do when something goes wrong.

What Are Exceptions?

Exceptions are a range of classes, all deriving from the same base class called `Exception`. Many different exceptions exist such as `FileNotFoundException`, which would occur when trying to access a file that doesn't exist; and `SqlException`, which would occur when there is a database problem. For example, at some stage while working through the examples in the book you may have seen something like Figure 15-5.

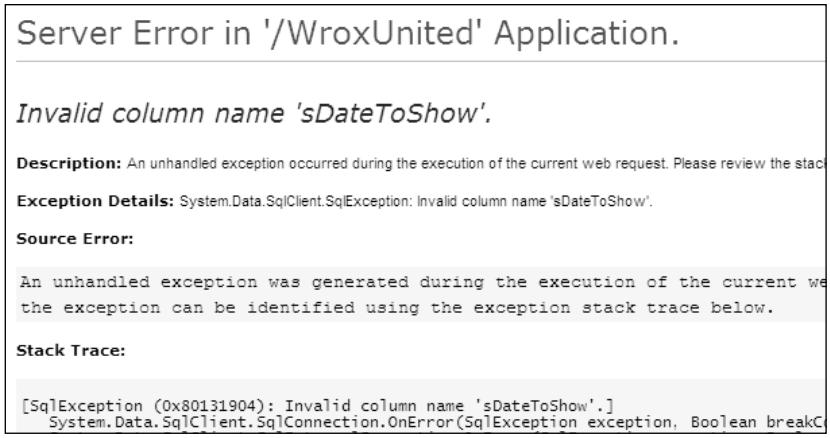


Figure 15-5

This occurred because of an incorrect SQL statement — one of the column names was wrong. This sort of exception is unlikely to get out into a live application, but other exceptions are, so you need to learn how to trap them.

The Exception Object

The `Exception` object is the base class for all exceptions and defines the base properties that all exceptions have. These properties are explained in the following table.

Property	Description
`Data`	A collection of key/value pairs that provide additional details about the exception.
`HelpLink`	The link to the help file that contains a description of the exception.
`InnerException`	The underlying exception that caused the problem.
`Message`	Text that describes the exception.
`Source`	The name of the application or object that caused the problem.
`StackTrace`	The trace of method calls that lead up to the problem.
`TargetSite`	The method that threw the current exception.

One thing that that you might notice is that there is an `InnerException` property. This allows exceptions to be stacked, which is useful when you have layers of code. For example, an underlying part of the .NET Framework may raise an exception, but that might be wrapped within another exception to provide more information.

Other exceptions might define additional properties to describe the specifics on the exception. For example, `SqlException` also defines the following properties:

Property	Description
`Class`	The severity of the error, as defined by SQL Server.
`Errors`	A collection of `SqlError` objects detailing the problem.
`LineNumber`	The line number within the SQL or stored procedure where the problem occurred.
`Number`	The error number.
`Procedure`	The name of the stored procedure where the problem occurred.
`Server`	The name of the SQL Server machine.
`Source`	The name of the data provider.
`State`	The error code from SQL Server.

You can see that when exceptions occur you have a certain amount of information regarding the problem, but that if you use the correct type of exception you get more information. This is discussed later in the chapter.

How to Trap Exceptions

Trapping exceptions is crucial to maintaining control of your application, and is done by way of `Try Catch` statements. This is easiest to understand through an example, using some code you saw earlier in the book (Chapter 14) — the code that generates thumbnails for uploaded images:

```
Public Shared Sub GenerateThumbnail(ByVal SourceImagePath As String, _
                                    ByVal TargetImagePath As String)

  Dim newHeight As Short
  Dim newWidth As Short

  Using sourceImage As Image = Image.FromFile(SourceImagePath)

    newHeight = CShort(sourceImage.Height * 0.25)
    newWidth = CShort(sourceImage.Width * 0.25)

    Dim cb As New Image.GetThumbnailImageAbort(AddressOf ThumbnailCallback)
    Using targetImage As Image = _
          sourceImage.GetThumbnailImage(newWidth, newHeight, cb, IntPtr.Zero)
      targetImage.Save(TargetImagePath, Imaging.ImageFormat.Gif)
```

```
      End Using
    End Using

  End Sub
```

At the moment this code doesn't protect itself in any way, but you can add both defensive coding and exception handling. The source image, for example, must exist before it can be converted, so that can be checked first, but the target image doesn't exist, so you need to protect against some problem when saving it. Here's how the code could look:

```
  Public Shared Sub GenerateThumbnail(ByVal SourceImagePath As String, _
                                      ByVal TargetImagePath As String)

    If Not File.Exists(sourceImagePath) Then
      Return
    End If

    Dim newHeight As Short
    Dim newWidth As Short

    Using sourceImage As Image = Image.FromFile(SourceImagePath)

      newHeight = CShort(sourceImage.Height * 0.25)
      newWidth = CShort(sourceImage.Width * 0.25)

      Dim cb As New Image.GetThumbnailImageAbort(AddressOf ThumbnailCallback)
      Using targetImage As Image = _
            sourceImage.GetThumbnailImage(newWidth, newHeight, cb, IntPtr.Zero)
        Try
          targetImage.Save(TargetImagePath, Imaging.ImageFormat.Gif)
        Catch ex As Exception
          Tools.Log("ImageHandling.GenerateThumbnail", ex)
        End Try
      End Using
    End Using

  End Sub
```

The first thing to note is the defensive coding for the source image; this uses the `Exists` method of the `File` class to see if the file exists, and if it doesn't you simply exit silently. The exception handling is wrapped around the saving of the target file and follows this general principle:

```
  Try
    Place the code here that you need to trap exceptions for
  Catch ex As Exception
    Place the code here to handle the exception
    This could be displaying a tidy message or logging the exception
  End Try
```

So in the code `targetImage.Save` is the line that could potentially cause an exception — it might not be possible to save the file for a variety of reasons: an incorrect file name, permissions, and so on. If an

exception does occur, execution immediately transfers to the `Catch` block, so any lines within the `Try` that were after the line in fault would not be executed.

The `Catch` block is interesting because there can be more than one of them. For example:

```
Try
  code to read from a database
Catch sqlEx As SqlException
  A SQL exception, so something is wrong with the database
Catch ex As Exception
  Any other error
End Try
```

When there is more than one `Catch` block and an exception occurs, the exceptions are compared in the order in which they are declared. So if an exception was raised it would be tested to see if it was a `SqlException` — if it was, the `SqlException Catch` block would be run. If the exception wasn't a `SqlException`, the next one down would be tried until a match was found or until the `End Try` was reached. Because all exceptions ultimately inherit from `Exception`, this is the last chance saloon — the default exception if you will.

It's important that when using multiple `Catch` blocks you place the most granular first. For example, in the previous code example, consider if this had been done:

```
Try
  code to read from a database
Catch ex As Exception
  Any other error
Catch sqlEx As SqlException
  A SQL exception, so something is wrong with the database
End Try
```

Even if a `SqlException` was raised it would never be trapped because the `Catch` for `Exception` would trap it. This is because `Exception` matches all exceptions, which is why you should always place it last when using multiple `Catch` blocks.

There is also another part to `Try Catch`, which is the `Finally` block. This is optional, and is a block of code that always runs, whether or not an exception is raised. Again, this is easier to see as code:

```
Try
  code to read from a database
Catch ex As Exception
  Code to handle the exception
Finally
  This code will always run
End Try
```

What happens here depends upon whether an exception is raised. If not, then all of the lines of code in the `Try` block are run, followed by the code in the `Finally` block. If an exception is raised, the appropriate `Catch` block is run, followed by the `Finally` block. This gives you a chance to perform any clean-up operations that might be required. A typical example of this is when performing some database action, and you want to close the database connection whether or not an exception was raised:

```
Dim conn As SqlConnection

Try
  conn = New SqlConnection(" . . . ")
  conn.Open()

  ' do some database action
Catch sqlEx As Exception
  ' log the exception
  Tools.Log("A database exception occurred", sqlEx)
Finally
  If conn IsNot Nothing Then
    conn.Close()
  End If
End Try
```

In this code the connection is declared outside of the `Try` block, allowing it to be referenced from within all code blocks (such as the `Catch` and `Finally` blocks). In the `Finally` block you don't just automatically close the connection because the exception might have been raised when trying to open the connection, so the connection object (`conn`) might not have a value. So `conn` is first checked to see if it has a value, and only then is it closed.

The following Try It Out gives you a better feel for how it can be used. You're going to update the Checkout page for the Wrox United shop to ensure that any database errors are handled gracefully and that they don't leave the database in an inconsistent state.

Try It Out — Trapping Exceptions

1. In the Wrox United application for the chapter, open the code file for `Checkout.aspx` and move to the `Wizard1_FinishButtonClick` event. This is the event that runs when the checkout wizard has finished collecting information from the user and will move the order from the shopping cart into the database.
2. Add the following variable declaration at the top of the method:

```
Dim trans As SqlTransaction = Nothing
```

3. Modify the first few lines after the variable declarations so it looks like the following code — the new lines to add are shaded:

```
Try
  conn = New SqlConnection( . . . )
  conn.Open()

  trans = conn.BeginTransaction

  cmd = New SqlCommand()
  cmd.Connection = conn
  cmd.Transaction = trans
  . . .
```

4. Now you need to do the same at the end of the method, so modify the code to look like this:

```
        cmd.ExecuteNonQuery()
      Next

      trans.Commit()

    Catch SqlEx As SqlException
      If trans IsNot Nothing Then
        trans.Rollback()
      End If

      CreateOrderErrorLabel.Visible = True
      Return
    Finally
      If conn IsNot Nothing Then
        conn.Close()
      End If
    End Try

    Profile.Cart.Items.Clear()
  End Sub
```

5. To ensure that the exception is seen in practice there actually needs to be some error, so you'll force one by making the SQL statement incorrect. Change the SQL statement that inserts into the `Orders` table to insert into `no_Orders`:

```
cmd.CommandText = "INSERT INTO no_ORDERS(MemberName ..."
```

6. Save the file and run the application.

7. Go to the shop and add some items to your cart and then go to the Checkout page. Step through the checkout wizard and after clicking the Finish button you'll see the message stating that an error has occurred. Although it says that the administrator and shop know about this, you'll be coding those bits later in the chapter.

How It Works

The code to trap any database exceptions is fairly straightforward, but you've added in something else to ensure the integrity of the database, and this is a *transaction*. A transaction, in database terms, ensures that either all commands succeed or none of them do. The problem is that an order is being created in the Orders table and the items being ordered are created in the Order Items table. So at least two commands are being run, one for each table, but there will be a command for each order line. With any database operation there is a chance of failure, and you need to ensure that both operations succeed, inserting the data into the Orders and Order Items table. You wouldn't want the order to be created but no order items, nor would you want the reverse. Both are problems. With only an order line, the system thinks that an order is there, but there are no items. The reverse means there would be order lines, but no corresponding order, and thus no way to access those order lines.

Wrapping all of these commands within a transaction means that the order and order lines are not only directly written to their tables but they are also placed in a transaction log, a special table handled by the database. If there are no problems during the transaction, it is committed and all is as expected. If there are problems, however, the transaction is *rolled back*, which means that the rows that were added as part of the transaction are removed. So there are only two outcomes — all rows are added, or none are added.

This means that an exception will leave the database in a consistent state, as it was when the transaction started. It's a bit like time travel, but without all those weird states of seeing your parents when they were your age.

Look at the code to see how this fits in with the exception handling. You saw the creation of this code in Chapter 13, when looking at e-commerce and the creation of the checkout process, but the explanation of the exception handling was postponed until this chapter.

The first thing is the declaration of a new variable, of type `SqlTransaction`:

```
Dim trans As SqlTransaction = Nothing
```

It is assigned an initial value of `Nothing` to avoid potential runtime errors. In your code this isn't a problem, but if you remove `= Nothing` from the declaration you can see that VWD displays a warning stating that *Variable 'trans' is used before it has been assigned a value. A null reference exception could result at runtime.* The reason is that the compiler cannot be sure that the variable will have an assigned value, so it gives a warning. You'll see where this assigned value of `Nothing` comes in later.

After the declaration, the code is wrapped within a `Try Catch` block:

```
Try
  conn = New SqlConnection( . . . )
  conn.Open()
```

Once the connection is open, a transaction is started. This gives you the marker point for the database commands, and it's to this state of the database that you will roll back to if an exception occurs. The `BeginTransaction` method of the `SqlConnection` returns a `SqTransaction` object, so later in the code this can be used to commit or rollback the database changes:

```
  trans = conn.BeginTransaction
```

With the transaction created it is then assigned to the command using the `Transaction` property:

```
  cmd = New SqlCommand()
  cmd.Connection = conn
  cmd.Transaction = trans
```

Now that the transaction has been assigned, the code can insert the required data into the tables. Once that has happened the transaction can be committed:

```
    trans.Commit()
```

That's all the code for a successful operation, but if there is a problem the exception needs to be caught:

```
  Catch SqlEx As SqlException
```

Within the `Catch` block the transaction needs to be rolled back because some problem arose. But, before the transaction can be rolled back the `trans` object needs to be checked to see if it contains a value. Remember that when the `SqlTransaction` object was declared it was given a value of `Nothing`. Within the `Try` statement, the first lines of code create and open a connection, and these two lines of code could raise an exception. If that happened, the `SqlTransaction` object wouldn't have been created, so the

`trans` variable would still have its default value of `Nothing`. That's why the compiler gives a warning and why the default value is set. So you only want to roll back the transaction if it was actually started, in which case the `trans` variable would not be `Nothing`:

```
If trans IsNot Nothing Then
  trans.Rollback()
End If
```

Once the transaction has been rolled back an error message is displayed, by simply making a `Label` control visible. Once done, you can return from the method:

```
CreateOrderErrorLabel.Visible = True
Return
```

Before you return, though, the connection needs to be closed, and this needs to be done whether or not an exception occurred, so a `Finally` block is used. Remember that the `Finally` block is always run. Like the transaction, the connection also has an initial value of `Nothing`, and this is used to ensure that there is a connection before you try to close it:

```
Finally
  If conn IsNot Nothing Then
    conn.Close()
  End If
End Try
```

The final thing to do is to clear the items from the cart, because they've now been added to the Orders and Order Items tables.

```
Profile.Cart.Items.Clear()
```

You can see that in use the `Try Catch` block is quite simple, and that in conjunction with transactions it allows the integrity of the database to remain. Displaying an error on the screen to let users know a problem occurred is a good thing, but the site administrators also need to know, so the next section looks at how these details could be logged to a file.

Logging Exceptions

Trapping exceptions is all very well, but you generally need to log them somehow. After all, if things go wrong you really want to know about it. Logging can be performed in many ways, with the log file being written to a variety of places, including a database table; the Event Log, either under Application events or a custom log; and a log file. There are advantages and disadvantages to all forms of logging. For example, you might not be able to write to the Event Log, because you might not have permission, or if you can write to the Event Log how would you then view the entries? Most web servers are tightly guarded and viewing the Event Log might not be allowed. The advantage of the Event Log is that exceptions are contained along with other application errors.

This section looks at the log file option, because it provides an easy way to log exceptions. A simple text file will be used to store details of exceptions, showing the time and the details of the exception. Each exception is appended to the existing file, or if no file exists it will be created. Although you are using a log file, the technique works for the other ways of logging; the difference is simply where you log the exception. Give this a try in the following Try It Out, modifying the exception code you added to the checkout.

Try It Out Logging Exceptions

1. In the Wrox United application for the chapter, open the code file for `Checkout.aspx` and move to the `Wizard1_FinishButtonClick` event.
2. In the section where the `SqlException` is caught, modify the code so that it looks like this:

```
Catch SqlEx As SqlException
  If trans IsNot Nothing Then
    trans.Rollback()
  End If

  Tools.Log("An error occurred while creating the order", SqlEx)

  CreateOrderErrorLabel.Visible = True
  Return
```

3. Save the file.
4. In the `App_Code` directory, create a new class called `Tools` (right-click App_Code and select Add New Item...).
5. In the new `Tools.vb` class file, add the following `Imports` statements after the initial one that imports the `Microsoft.VisualBasic` namespace:

```
Imports System.IO
Imports System.Web
```

6. Within the `Tools` class, add the following methods:

```
Public Shared Sub Log(ByVal Message As String)

  Log(Message, Nothing)

End Sub

Public Shared Sub Log(ByVal Message As String, ByVal Ex As Exception)

  Dim fileName As String = Path.Combine( _
      HttpContext.Current.Request.PhysicalApplicationPath, "WroxUnited.log")

  Using logFile As New StreamWriter(fileName, True)
    logFile.WriteLine("{0}: {1}", DateTime.Now, Message)
    If Ex IsNot Nothing Then
      logFile.WriteLine(Ex.ToString())
    End If
    logFile.Close()
  End Using
End Sub
```

7. Save the file and run the application. Log in and add some items to the shopping cart, then follow the checkout procedure. When you finish the checkout, the screen will say that an error occurred.
8. Navigate to the directory in which the web site is running and open `WroxUnited.log` and you'll see the exception details logged.

9. Don't forget to change the SQL statement back to a correct one after you've run this example. Just remove the `no_` from the table name:

```
cmd.CommandText = "INSERT INTO ORDERS(MemberName ..."
```

How It Works

The first code modification was to log the exception from within the `Catch` block in the Checkout page:

```
Tools.Log("An error occurred while creating the order", SqlEx)
```

This calls the `Log` method of the `Tools` class, passing into it a string describing the problem, and the exception `SqlException` object. The `Log` method is a Shared method so you haven't had to create an instance of the `Tools` class.

The exception will now be logged, so the logging class is created. This is a class file and is placed in the `App_Code` directory, which means that it will automatically be compiled. Within the `Tools` class the first thing that is done is to add some namespaces:

```
Imports System.IO
Imports System.Web
```

`System.IO` is required because that is where the file handling routines are stored, and `System.Web` will allow you access to details of the current web site.

Next is the routine that trapped the exception, where the following was added:

```
Tools.Log("An error occurred while creating the order", SqlEx)
```

This calls the `Log` method of the `Tools` class, passing in an error message and the exception. Notice that it wasn't necessary to create an instance of the `Tools` class; because the class is just a container for simple methods, those methods have been made `Shared`, so a class instance isn't required – `Shared` methods were explained in Chapter 9. The code for these is fairly simple, too, and shows a good case of overloaded methods.

The first method accepts a single argument, the error message to log. It doesn't actually do any logging itself, but calls another `Log` method, passing the message into that. It also passes `Nothing` as a second parameter:

```
Public Shared Sub Log(ByVal Message As String)

  Log(Message, Nothing)

End Sub
```

The second method, also called `Log`, is where the real work is done. This method accepts two parameters. The first is the error message and the second is an `Exception` object:

```
Public Shared Sub Log(ByVal Message As String, ByVal Ex As Exception)
```

Next, the file name needs to be worked out. This can be placed in any suitable location, but keeping it in the home directory of the web site is a good idea. The path for that directory can be retrieved by the `PhysicalApplicationPath` property of the current `Request`. However, because this code isn't within an ASP.NET page, but is a class, the `Request` property isn't directly available. To get access to it, `HttpContext.Current` is used; this is the context of the current HTTP request that the ASP.NET page is running under.

The full file name needs to contain both the path and the file, so these are combined using the `Combine` method of the `Path` class. This will append a directory separator (the \ symbol) if one is required:

```
Dim fileName As String = Path.Combine( _
    HttpContext.Current.Request.PhysicalApplicationPath, "WroxUnited.log")
```

Once the full file name is available, the file can be opened, and for this a `StreamWriter` is used:

```
Using logFile As New StreamWriter(fileName, True)
```

Streams can be of different types, such as memory, but passing in the `fileName` parameter when the `StreamWriter` is created allows you to write directly to a file. The second parameter, `True`, indicates that data should be appended to the file, rather than a new file being created (which is the default). The `Using` statement ensures that the reference to this file is disposed of when the code block is closed — this frees up the file resource as soon as it is no longer used, a technique that should always be followed.

Once the file is opened the `WriteLine` method is used to write data to the file:

```
      logFile.WriteLine("{0}: {1}", DateTime.Now, Message)
```

`WriteLine` is an interesting method, because it can take many parameters. It always takes at least one parameter, but there can be others. The first parameter is the string to be written, but you want the current date and time, plus the message to be written as well. Rather than concatenating a string with these details, they can be added as parameters and placeholders used in the string to identify where they should go. The placeholders are identified by a number within curly braces, so `{0}` will be replaced by the current date and time, and `{1}` will be replaced by the message.

After the main message has been written to the file, the exception, passed into the `Log` method as a parameter, is tested. If it is not `Nothing` then an exception has been passed in, so this is also written to the file. The `ToString` method of the exception is used to get the descriptive text of the exception:

```
      If Ex IsNot Nothing Then
        logFile.WriteLine(Ex.ToString())
      End If
```

The file is closed when all of the details have been written to the file:

```
      logFile.Close()
```

Once the `Using` code block is ended, the file resources will be freed:

```
    End Using
  End Sub
```

At the end of this procedure there is a `Log` method that can be called in two ways:

```
Log("error message")
```

Or:

```
Log("error message", exception)
```

This sort of overloaded method brings extra flexibility, because it allows you to use the same routine for different types of logging; if there's no exception, you use a different form of the `Log` method.

One thing you might have noticed is that the second parameter of the `Log` method is of type `Exception`, but when this method was called, a variable of type `SqlException` was passed in. This is acceptable because `SqlException` is derived from `Exception` — remember in Chapter 9 where inheritance was covered. `SqlException` inherits from `DbException`, which inherits from `ExternalException`, which inherits from `Exception`. It seems a long chain of inheritance, but that doesn't matter for parameter methods; as long as the type passed into a parameter ultimately derives from the type declared in the parameter, there will be no compilation errors. The types are compatible.

Mailing Exceptions

Log files are a great way to store exceptions, but they are generally passive — you have to go and look at them. A more active option for dealing with exceptions is to have them mailed to someone, perhaps the web site administrator. This is also easy to achieve in ASP.NET 2.0, because classes are built in for sending mail messages, and these live in the `System.Net.Mail` namespace. Here's some code that could be used as well as, or instead of, the file logging:

```
Public Shared Sub SendMail(ByVal Message As String, ByVal Ex As Exception)

  Using msg As New MailMessage("website@wroxunited.net", "admin@wroxunited.net")

    msg.Subject = "WroxUnited.net Web Site Error"

    If Ex Is Nothing Then
      msg.Body = "There was an error on the website"
    Else
      msg.Body = Ex.ToString()
    End If

    Dim client As New SmtpClient("MyMailServer")
    client.UseDefaultCredentials = True
    client.Send(msg)

  End Using

End Sub
```

Two classes are in use here. The `MailMessage` class defines the message to be sent — the constructor sets the "from" and "to" addresses for the message, and the `Subject` and `Body` properties set the subject line and the contents. The second class is the `SmtpClient`, the constructor of which defines the name of the mail server. Setting `UseDefaultCredentials` to `True` allows the ASP.NET code to connect to the server using Windows network credentials. Finally, the `Send` method actually sends the mail.

You can configure some of these properties in the web configuration file, `Web.config`, which is where you can also set authentication settings if they are required for connection to the mail server:

```
<configuration xmlns="http://schemas.microsoft.com/.NetConfiguration/v2.0">
<system.net>
  <mailSettings>
   <smtp deliveryMethod="Network">
    <network
      defaultCredentials="False"
      host="MyMailServer"
      password="MyPassword"
      port="25"
      userName="MyUserName"
      from="website@wroxunited.net"/>
   </smtp>
  </mailSettings>
 </system.net>
</configuration>
```

The properties for configuring mail are fairly simple. Setting `defaultCredentials` to `false` ensures that the user name (`userName`) and password (`password`) specified are used to connect to the e-mail server (`host`), and `from` sets the e-mail address of whom the e-mail is from. The `port` number is to do with TCP networking — e-mail uses port number 25 and you don't need to know any more about ports apart from that number.

Sending mail isn't just for notifying administrators of exceptions, and you can use it for all sorts of things. The security framework will use these settings when it sends out forgotten password requests if users request them.

You could use the e-mail code instead of, or in conjunction with, the logging to a file. For example you could have the following:

```
Tools.Log("My error message", SqlEx)
Tools.SendMail("My error message", SqlEx)
```

This would perform both actions, but includes repeated code — the error message. An alternative would be to add the e-mail code into the `Log` method, but that would always send the e-mail, which might not be required. A better option might be only sending an e-mail if required, perhaps adding another parameter to the `Log` method to indicate if the e-mail is to be sent:

```
Tools.Log("My error message", SqlEx, True)
```

The `Log` method could then have:

```
Public Shared Sub Log(ByVal Message As String, ByVal Ex As Exception, _
                      ByVal SendEmailMessage As Boolean)
  If SendEmailMessage Then
    SendEmail(Message, Ex)
  End If

' rest of logging code
End Sub
```

This gives a combination of the passive reporting to a log file, and the active, which lets the administrator know of problems as they occur.

Raising Exceptions

You've seen that you can trap exceptions, but you can also raise your own exceptions. One use for this is that you can use the same exception handling mechanism to deal with custom errors as you use for .NET errors. However, this comes with a warning, in that you should still adhere to the rule of only using exceptions for exceptional circumstances. If you can handle the problem gracefully without using exceptions, you should do so.

To raise an exception you use the `Throw` statement. For example:

```
Throw New Exception("exception description")
```

You can also pass in an underlying exception:

```
Throw New Exception("exception description", ex)
```

If you are within a `Catch` block you can also re-throw the existing exception by just calling the `Throw` statement on its own. You'll see how this can be used a little later when handling exceptions globally is discussed.

Exceptions Best Practices

Using exceptions is good practice, but certain rules should be followed when dealing with exceptions.

- For example, you should only catch an exception if you actually expect the exception. This doesn't mean that it will happen, but that it could. A database failure is a good example, because these aren't unheard of. If you can understand why an exception would occur and you know how to deal with it, then that's a good case for catching it.
- Dealing with the exception doesn't mean that you know how to cure it, but that something can be done. For example, in the Checkout page modified earlier in the chapter, catching `SqlException` was necessary to allow the use of transactions so the database wouldn't be left in an inconsistent state. That is dealing with the exception, even if there is nothing that can be done about the underlying problem.
- As a general rule it's a good idea to avoid catching only the base `Exception`. Because this is the base class for all exceptions, it's not narrow enough in its focus.
- If you are performing database work, catch the appropriate exception (`SqlException` for SQL Server).

Global Exception Handling

Handling exceptions where they happen is both good and bad. In the Checkout page the exception had to be dealt with locally because of the transaction, but in many cases you might want some form of centralized exception handling. You also might want some way to handle exceptions not trapped elsewhere. The Checkout page is again a good example, because there is handling for `SqlException`, but not for anything else. What happens if some other exception occurs? This is an important point because it really isn't sensible to put `Try Catch` around every piece of code just in case an exception might occur. In fact, that would be bad practice because it would make the code hard to read and isn't required at all.

The way global exception handling is managed is with the `Global.asax` file, which contains code for the application. In this case the term *application* has a special meaning, because code in `Global.asax` responds to application-level events; these are events that are raised at specific points during the running of the application, events that are raised by ASP.NET. `Global.asax` is a code-only page, and has no user interaction.

Several events are contained in the `Global.asax` page:

- `Application_Start`, which is raised when the application first starts. This will be when the first user accesses the site and should be used to set any initial start conditions.
- `Application_End`, which is raised when the application stops.
- `Session_Start`, which is raised when a user starts a session. This will be when the user starts accessing the site for the first time, and will include the time when a user closes the browser window and opens it again.
- `Session_End`, which is raised when a user session ends. This isn't when the browser window is closed, because sessions have a timeout — if there is no user activity within that time, the session ends.
- `Application_Error`, which is raised when an unhandled error occurs.
- `Profile_OnMigrateAnonymous`, which is raised when an anonymous user logs in, and allows migration of any Profile properties. The Profile is covered in Chapter 11.

As you can see, the event you're interested in is the `Application_Error` event, which is where you can add code to centrally handle untrapped exceptions. You see how the `Application_Error` event can be used in the following Try It Out.

Try It Out — Handling Global Errors

1. Using Windows Explorer, navigate to the web site directory, C:\BegASPNET\Chapters\Begin\Chapter15\WroxUnited, and check the `WroxUnited.log`.
2. In the Wrox United application, open the `global.asax` file.
3. Add the following code to the `Application_Error` event procedure:

```
Dim ex As Exception = Server.GetLastError()

Tools.Log("An unhandled error was caught by Application_Error", ex)
```

4. Save the file.
5. Open `checkout.aspx.vb` and move to the `Wizard1_FinishButtonClick` event.
6. Comment out the code that logs the error and replace it with the following:

```
Throw
```

7. To ensure that the exception is seen in practice, there actually needs to be some error, so you'll force one by making the SQL statement incorrect. Change the SQL statement that inserts into the `Orders` table to insert into `no_Orders`:

```
cmd.CommandText = "INSERT INTO no_ORDERS(MemberName ..."
```

8. Save the file and run the application.
9. Go to the Wrox United shop and add some items to your cart. Proceed to the Checkout page. Step through the checkout wizard and after clicking the Finish button you'll see the message stating that an error has occurred.
10. Using Windows Explorer, navigate to the web site directory, C:\BegASPNET\Chapters\Begin\Chapter15\WoxUnited, and check the `WroxUnited.log` file (or you can press the refresh button in the Solution Explorer, and the new file will appear). You'll notice that the exception has been logged. Check the first line and see that it states that an error was caught by `Application_Error`. Also notice that the next line states that an `HttpUnhandledException` was thrown, followed by details of the `SqlException`.
11. Delete `WroxUnited.log` and switch back to the `global.asax` code.
12. Change the `Throw` statement to this:

```
Throw New SqlException("An error occurred while creating the order", SqlEx)
```

13. Run the application again and follow the same procedure to generate the error.
14. Open `WroxUnited.log` again and look at the details. First there is the `HttpUnhandledException`, then `Exception` with the text you added, then the `SqlException`.

How It Works

The first thing to understand is that the `Application_Error` in `global.asax` is raised when any unhandled error occurs. In this event in your code you need to find out what the error was that caused the event to be raised, and for that you use the `GetLastError` method of the `Server` object; this returns an exception object. This is passed into the `Log` method to log the error. So if you had a `Try Catch` block around your code, how was it that you got to the `Application_Error` event? Well, it's because you re-threw the error using the `Throw` statement — although you handled the initial `SqlException`, the re-thrown exception wasn't handled.

The important thing to note about what happened is that the exception is wrapped in another exception — an `HttpUnhandledException`. All exceptions you get from within `Application_Error` will be like this. The actual `SqlException` is shown because in the `Log` method you used `ToString` to write out all of the details of the exception. If you didn't want the `HttpUnhandledException` shown you could use the `InnerException` property of the exception:

```
Dim ex As Exception = Server.GetLastError().InnerException
```

When the exception is logged, now it would only show the actual exception that was unhandled.

In the second case you used the following:

```
Throw New SqlException("An error occurred while creating the order", SqlEx)
```

This throws a new `SqlException` but passes into that the actual exception that caused the problem. So you've wrapped the original exception within your own — a useful technique if you need to store more details than are available in the original exception. Here you are just detailing that the problem arose when an order was being created.

Don't correct the SQL statement, leave it incorrect; you'll need this in a later exercise when you look at debugging.

In general, using this simple code in `Application_Error` and logging exceptions to a file means that you always have details of problems that occur during the normal running of a site. You can use the stack trace (more on them later) to see exactly where the problem was, and you don't have to rely on users telling you what they think the problem was (the two vary rarely match).

Custom Error Pages

One problem with the error handling code shown so far is that the user still sees a confusing message. Ideally you'd like to present the user with something less shocking than a stack trace (a list of the methods called so far — you'll look at these later), for two very good reasons. First, a stack trace is not what users need to see — if something has gone wrong then they need to see a clear description, explaining that it wasn't their problem, and that something is being done about it. Second, showing a stack trace gives away a lot of information about your site, details that can be used by hackers. Even if your site is secure, they could cause unnecessary slowdowns as they try to hack the site.

As well as exceptions there are also other types of errors that aren't nice for a user to see. For example, what if you rename a page but don't update the links to it, or perhaps the user types in the wrong name for a page. In these cases you'd see the 404 — the error number that indicates a page could not be found. ASP.NET applications can be configured to redirect the user to other pages, depending on the type of error.

Configuring Custom Error Pages

Configuration of custom error pages is done in the `Web.config` file using the `customErrors` section. For example:

```
<customErrors mode="On" defaultRedirect="customError.aspx">
  <error statusCode="404" redirect="missingPage.aspx"/>
</customErrors>
```

The `mode` attribute can be one of the following:

- `Off`, in which case the ASP.NET error details are always shown, even if a custom error page exists.
- `On`, in which case the custom error is always shown, and the ASP.NET error details are never shown.
- `RemoteOnly`, where the ASP.NET error details are only shown to local users, meaning users logged on locally to the machine. For remote users (everyone else using the site) one of two things is shown: a default page telling the user that an error has occurred, but without showing any error details, or a custom error page if one exists.

The values of `On` or `RemoteOnly` should be used for a live site, whereas `Off` can be used for debugging purposes.

The `defaultRedirect` attribute defines the page that is shown if an unhandled error occurs.

The `error` element details specific errors and the page to redirect to if that error occurs. In this case the `statusCode` is `404`, which means a missing page, so the user will be redirected to `missingPage.aspx` if the page they are looking for cannot be found. This allows you to have detailed pages for individual errors, so you can help the user correct the problem. The missing page example could explain that the page cannot be found and perhaps get users to check that they typed in the correct URL.

In the following Try It Out, you create your own custom error page.

Try It Out Custom Error Pages

1. In the Wrox United application for the chapter, open `Web.config` and add the following within the `<system.web>` section.

```
<customErrors mode="On">
  <error statusCode="404" redirect="missingPage.aspx"/>
</customErrors>
```

2. Save the file.
3. Create a new Web Form called `missingPage.aspx`, making sure that the code isn't placed in a separate file, but that you pick the `site.master` file for the Master page.
4. Within the `<asp:Content>` controls, add the following text:

```
We're sorry but the page you were looking for cannot
be found. It's probably hiding behind the couch. We'll
tell the Web site administrator to go and fetch it.
```

5. Save the file and run the application.
6. Navigate to a page that doesn't exist — perhaps `abc.aspx`. You'll need to type this page into the address bar of the browser. Notice that the text you entered is displayed rather than the normal message for a missing page.

How It Works

The working of this is quite simple, because when custom errors are enabled ASP.NET intercepts the errors. What it does depends on how you've configured the `customErrors` section. In this case the `mode` has been set to `On`, which means that custom errors will always be shown — this is required because you are logged on to the machine locally, so `remoteOnly` wouldn't work.

You've also configured a custom page for the `statusCode` of `404`, so whenever a page cannot be found, ASP.NET doesn't show the normal error message but instead redirects to the custom error page. This technique makes your site friendlier to use, which means that if an error does occur, the user isn't left with a frightening error message, but is presented with something more reassuring. Also, because this is an ASP.NET page you could make the error message more helpful. For example, you could check the name of the file the user was looking for and see if something similar exists on the site, perhaps by looking up the pages in the SiteMap or from a database. You could then either take the user to the nearest matching page, or present her with a list of possible matches.

Error pages can be combined with the logging to give very proactive feedback of problems within the site. For example, sites often expand or change and the names of pages sometimes change, but you might forget to change a link to the changed page. If a user clicks a link on your site and that page isn't found, then sending an e-mail to the site administrator is very useful; the page in error can be quickly corrected so that no other users see the problem.

Debugging and Tracing

Controlling how errors are shown to the user is only part of the story when developing web sites, and tracking down those errors is just as important. Ideally errors should be found during development and testing, and in many ways testing is just as specialized a job as development. Many companies, Microsoft included, have teams of testers running through development projects shaking out those errors.

As a developer you are bound to make mistakes, ranging from simple typing errors to more complex coding problems. The typing problems are usually easy to track down because they often cause compilation errors, but runtime errors can be more problematic. Tracing and debugging are the two main techniques to finding errors.

Using ASP.NET Tracing

Tracing is the technique of adding code to your pages, for a few reasons: for debugging purposes, to output values of variables, or simply to find out where in your code certain things happen. The great thing about ASP.NET tracing is that not only is it extremely simple to do, but also it's easily configurable and doesn't require tracing code to be removed if you don't want the trace information shown. What's also great is that you get a wealth of additional information about the page, which can be useful for both debugging purposes and for learning about ASP.NET.

Tracing Individual Pages

Tracing can be turned on for individual pages by adding the `Trace` attribute to the `Page` directive:

```
<%@ Page Trace="true" %>
```

On its own, this outputs a great deal of information about the page, but you can also add your own output by use of the `Trace` class, which has methods to write output to the trace log:

```
Trace.Write("my information")
```

The following Try It Out shows tracing in action.

Try It Out Page Level Tracing

1. In the Wrox United application for the chapter, open `Checkout.aspx` in Source View.
2. Add the `Trace` attribute to the `Page` directive:

```
<%@ Page Trace="True" %>
```

3. Save the file and run the application.
4. Add some items from the shop to your shopping cart and navigate to the Checkout page, where you'll see that the bottom of the page has lots of information added. You might have to scroll down the page to see all of the information.
5. Switch back to VWD and open the code file for the Checkout page.
6. At the top of the `Page_Load` event add the following line of code:

```
Trace.Write("In Page_Load")
```

7. Before the check to see if the user is authenticated, add the following:

```
Trace.Write("In page_Load", User.Identity.IsAuthenticated.ToString())
If User.Identity.IsAuthenticated Then
```

8. Save the page and run the application, once more navigating to the Checkout page.
9. Scroll the page down so you can see the Trace Information section, as shown in Figure 15-6.

Trace Information

Category	Message
aspx.page	Begin PreInit
aspx.page	End PreInit
aspx.page	Begin Init
aspx.page	End Init
aspx.page	Begin InitComplete
aspx.page	End InitComplete
aspx.page	Begin PreLoad
aspx.page	End PreLoad
aspx.page	Begin Load
	In Page_Load
In Page_Load	True
aspx.page	End Load
aspx.page	Begin LoadComplete
aspx.page	End LoadComplete

Figure 15-6

10. Here you can see that the output from the `Trace.Write` statements is mixed in with the output that ASP.NET puts into the trace. Take a look at how this works and look at what information the trace output produces.

11. Edit `Checkout.aspx` again and set the `Trace` attribute to `False`:

```
<%@ Page Trace="False" %>
```

12. Save the page and run the application, once more navigating to the Checkout page. Notice that the trace information has gone from the page, even though the `Trace.Write` statements are still in the code.

How It Works

The first thing to look at is what all of this trace information is, and what it is useful for. There are many sections, as detailed in the following table.

Section	Contains
Request Details	Details of the request, such as the status code.
Trace Information	The flow of page events, showing the category, message, and time from the first to last byte of information sent to the browser.
Control Tree	The hierarchy of controls in the page.
Session State	Any session variables in use.
Application State	Any application variables in use.
Request Cookies Collection	The cookies stored for the current site.
Response Cookies Collection	Any cookies set during the page processing.
Headers Collection	The HTTP headers.
Response Headers Collection	Any headers set during the page processing.
Form Collection	Contents of the form.
QueryString Collection	Any querystring parameters for the request.
Server Variables	The HTTP server variables.

All of this information is useful, although some is more useful than others. The Control Tree, for example, clearly shows the hierarchy of controls. You saw this in Chapter 14 when you looked at performance, but it's useful for understanding how the page is made up from the hierarchy of controls. At the top is the `Page` object, beneath that the Master page, and then controls within the Master page. This continues with all of the page objects, and shows the unique name of the control as well as its type.

The Trace Information section shows the events in the order in which they are raised, so it is great for seeing exactly when things happen. Without any trace information of your own, the standard page events are shown, and anything you write is slotted into its correct space. So take a look what you actually did:

```
Sub Page_Load(ByVal sender As Object, ByVal e As System.EventArgs) Handles Me.Load

    Trace.Write("In Page_Load")

    If Not Page.IsPostBack Then
        If Profile.Cart Is Nothing Then
            NoCartlabel.Visible = True
            Wizard1.Visible = False
        End If

        Trace.Write("In Page_Load", User.Identity.IsAuthenticated.ToString())
        If User.Identity.IsAuthenticated Then
            Wizard1.ActiveStepIndex = 1
        Else
            Wizard1.ActiveStepIndex = 0
        End If
    End If
```

In the first statement you used `Trace.Write` to output a single string and this is displayed in the Message column. With the second `Trace.Write` you passed in two parameters, and in this case the first becomes the Category and the second the Message. You can put trace statements anywhere within your code and the output will be displayed in the Trace Information section, so it's a great way to simply see what's happening in your code. There is a also a `Warn` method of the `Trace` class, which outputs in the same way as `Write`, but the content is in red. This is useful for picking out statements within the trace output.

The other thing you'll have noticed is that by changing the value of the `Trace` attribute at the top of page to `False`, no trace output is displayed. You didn't have to remove the `Trace.Write` statements from the code, because these are simply ignored if tracing isn't enabled. This is great during development, because you can liberally sprinkle `Trace.Write` statements throughout your code to give you a good understanding of the program flow, and you can turn on or off the tracing without having to remove or comment out these statements.

Tracing All Pages

Although tracing in individual pages is useful, what's great is being able to control tracing for the entire application. This is done by a configuration setting in `Web.config`, within the `<system.web>` section:

```
<trace enabled="True" />
```

When the `enabled` attribute is set to `True`, tracing is enabled for the application, but the output isn't shown in the pages. Instead, it is stored for viewing by way of a special URL — `Trace.axd` — which doesn't point to a physical file, but is instead interpreted by ASP.NET. You give application tracing a go in the next Try It Out.

Try It Out Application Level Tracing

1. In Source View in `Checkout.aspx`, remove the `Trace` attribute from the `Page` directive at the top of the page.
2. Open `Web.config` and add the following within the `<system.web>` section:

```
<trace enabled="True" />
```

3. Save the file and run the application, navigating to the Checkout page.

4. Within Internet Explorer select File ➪ New ➪ Window (or press control+N) to launch a new window from the same site.

5. In the address bar change `Checkout.aspx` to `Trace.axd` and press Enter. You should see something like Figure 15-7.

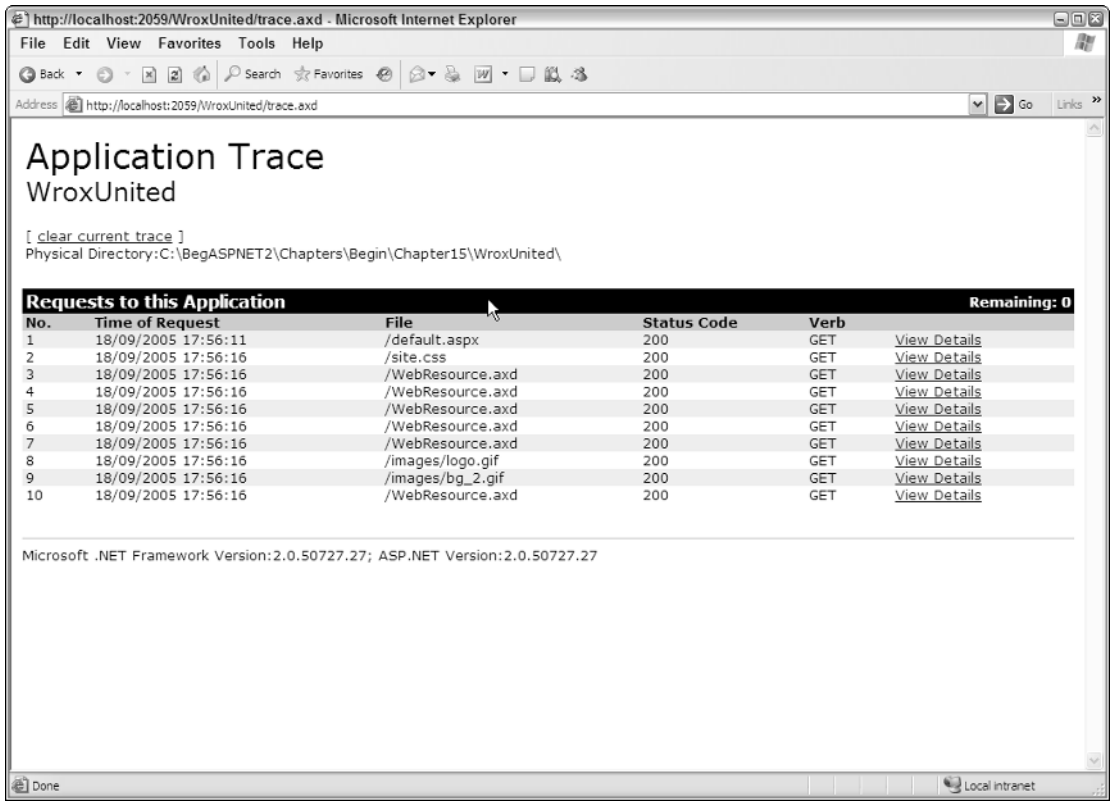


Figure 15-7

6. Click the View Details link on the `Checkout.aspx` line, and you will see the trace page you've already seen. Notice that it contains the two pieces of data that were added to `Checkout.aspx` in the `Page_Load` event.

How It Works

The working of this is simple; by enabling the trace element in `Web.config` you are instructing ASP.NET to keep track of the trace information, but not to show it in the page. When you navigate to `Trace.axd`, ASP.NET recognizes this special URL and instead of returning the standard 404 error page (or a custom page if you have one configured), it returns a list of pages that have been accessed in the application. Clicking the View Details link displays the trace information for that page.

The `<trace>` element has several attributes in `Web.config`:

Attribute	Description
`enabled`	Indicates whether or not application tracing is enabled. The default value is `False`.
`localOnly`	When set to `True` ensures that `Trace.axd` is only accessible from the local machine. `True` is the default value, and stops remote users of the site from accessing the trace information.
`mostRecent`	Indicates whether or not the most recent trace requests are kept. The default is `False`, which keeps the first n items, where n is determined by the `requestLimit` attribute. If `True` then the most recent n items are kept.
`pageOutput`	When set to `True` the trace output is shown in the actual page, as well as being stored for show by `Trace.axd`. The default is `False`, although this doesn't affect pages that have tracing enabled on them directly.
`requestLimit`	The number of trace requests to store.
`traceMode`	Indicates the order in which the trace requests are shown. The default is `SortByTime`, where the order is time-based, but this can also be `SortByCategory` where the requests are shown alphabetically.

The greatest thing about application tracing is that it can be invaluable in finding bugs in a running system. You can edit pages to add `Trace.Write` and turn on application tracing; the trace information will be stored but the users won't see any of it. You can then examine the trace details to help diagnose any problems.

Using the Debugger

The tracing features of ASP.NET 2.0 provide a great way to trace the flow of the application, but probably the most important weapon in your coding arsenal is the debugger. This allows you to halt the application while it is running, examine variables, and step through the code line by line. The debugger is built into Visual Web Developer and Visual Studio 2005, so you don't have to run a separate application; you simply run the application from the development tool. The best way to learn debugging is to actually use it, so give this a go in the following Try It Out.

Try It Out Debugging

1. In the Wrox United application for the chapter, open `Checkout.aspx.vb`.
2. In the `Page_Load` event, place the cursor on the line that checks to see if the cart has a value:

```
If Profile.Cart Is Nothing Then
```

3. Set a breakpoint on this line. You can do this in one of three ways. The first is by selecting the Toggle Breakpoint option from the Debug menu. The next is by pressing F9, and the last is by clicking the gray border at the left of the line of code:

4. Whichever method you use, this is a toggle, so performing the same action again removes the breakpoint. When a breakpoint is set the gray border will show a red circle and the line will be highlighted, as shown in Figure 15-8.

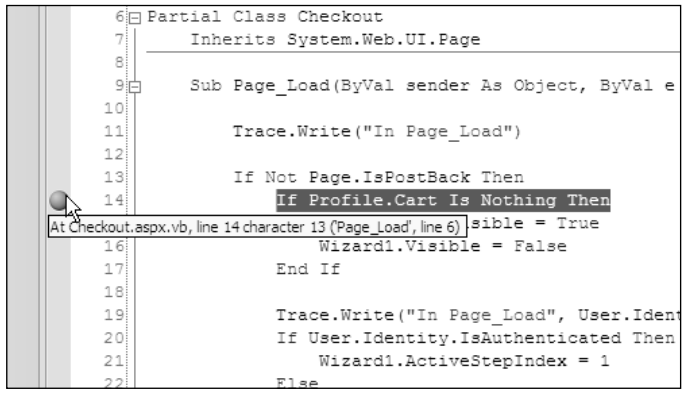


Figure 15-8

5. Scroll down to the `Wizard1_FinishButtonClick` event, and place a breakpoint on the following line:

```
For Each item As CartItem In Profile.Cart.Items
```

6. Run the application from VWD or VS and navigate to the Checkout page. The page will not display; you'll see that you are stopped in the debugger (see Figure 15-9).

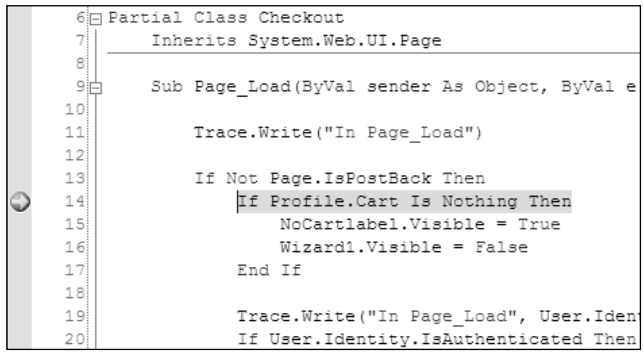


Figure 15-9

7. Press F5, or select Continue from the Debug menu. You'll see that the page now displays.

8. Add some items to the shopping cart and then navigate to the Checkout page again. When the breakpoint is reached, press F5 and you'll see the error message shown in Figure 15-10.

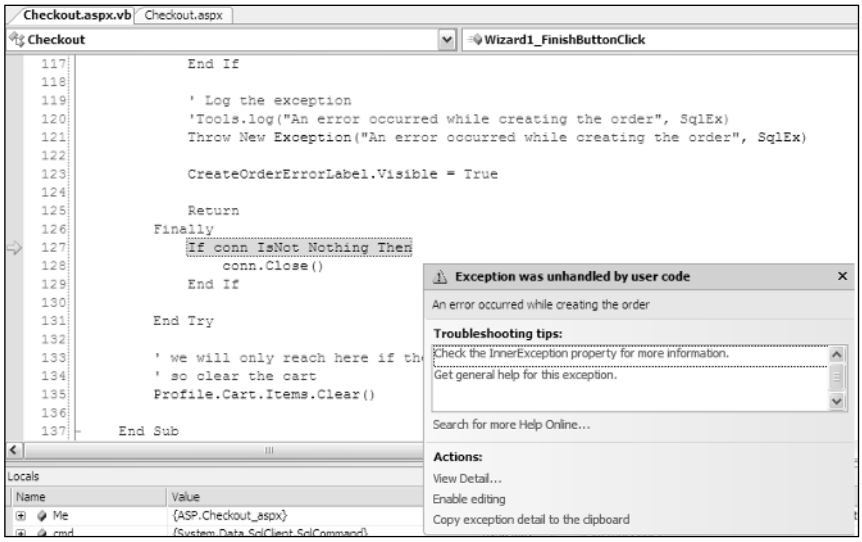


Figure 15-10

9. You've hit an exception so the debugger halts. This is because of a change to the checkout code you did earlier, where you had an incorrect SQL statement so that you could force an exception.

10. Click the View Detail link to show the details of the exception. Click the plus sign to expand the details (see Figure 15-11), and you'll see that the exception shows your custom text and that there is an InnerException.

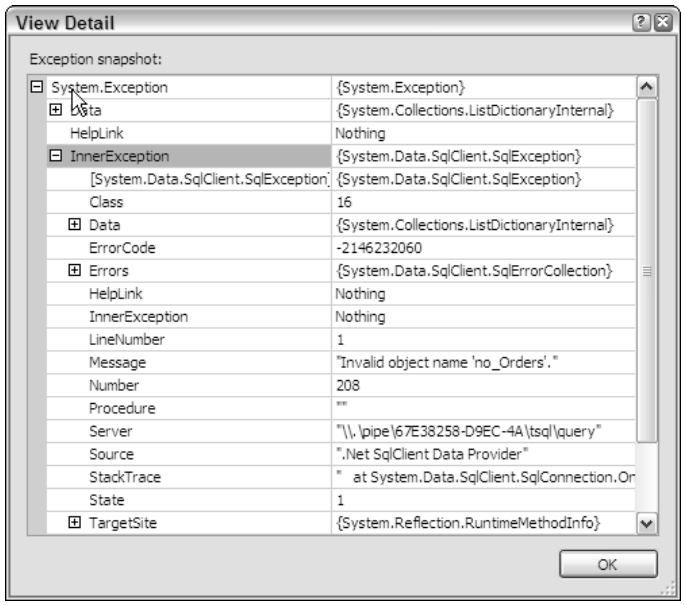


Figure 15-11

11. Clicking this open shows the original exception, in that there isn't a table called `no_Orders`. This isn't something that can be corrected while running the application, so you need to stop debugging.

12. From the Debug menu select Stop Debugging, or press Shift+F5.

13. Edit the code to correct the error, changing `no_Orders` back to `Orders`:

```
cmd.CommandText = "INSERT INTO ORDERS(MemberName ..."
```

14. Run the application again, and navigate to the Checkout page again, making sure you have logged in and there are at least three items in your shopping cart.

15. When the breakpoint is reached in `Page_Load`, press F5 to continue.

16. Continue through the checkout process, noticing that the breakpoint doesn't get hit when clicking the Next button. This is because the breakpoint in `Page_Load` will only be reached the first time the page is loaded because the code block in which the breakpoint is set is only when `IsPostBack` is `False`.

17. When you get to the end of the checkout process, click Finish, and another breakpoint will be reached, as shown in Figure 15-12.

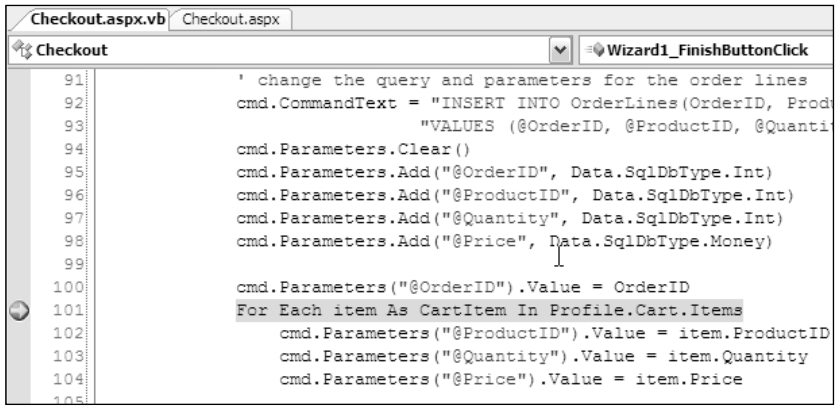


Figure 15-12

18. From the Debug menu select Step Over, or press F10. Notice that execution moves to the next line.

19. Keep pressing F10 until you get to the line that sets the `@Quantity` parameter. Notice how execution moves to the next line each time you step.

20. Hover the cursor over the item of `item.Quantity` and you'll see the tooltip showing the value of the variable.

21. Without moving the currently active line, hover the cursor over the item of the `For Each` line and you'll see another tooltip, but this time there isn't a value. That's because this is a complex type, a `CartItem`, but notice that there is a little plus sign on the left.

22. Hover over or click the plus sign, and the properties (both public and private) are shown for the item (see Figure 15-13).

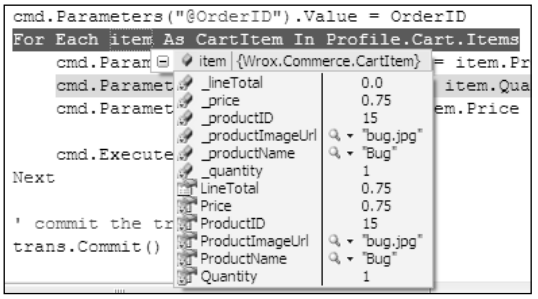


Figure 15-13

23. From the Debug menu select Step Into, or press F11. This will step into the line of code, opening up the code for the shopping cart, in the property `Get`, as depicted in Figure 15-14.

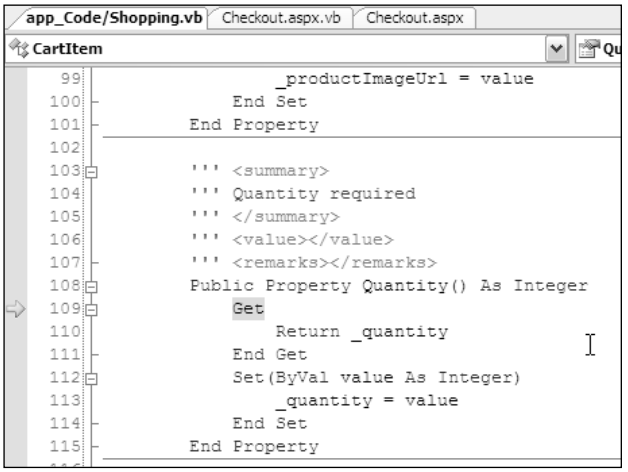


Figure 15-14

24. Keep pressing F11 until you are back into the checkout code.

25. Right-click the `trans.Commit()` line, and select the Run To Cursor option. Notice how all intermediate code is run, but that the next line is the `trans.Commit()` line.

26. From the Debug menu select Delete All Breakpoints, or select Control+Shift+F9.

27. Press F5 to continue the code, and you'll be back in the browser.

How It Works

Debugging works because VWD controls the interaction of code. Normally the code runs without interruption, but a breakpoint tells VWD to suspend code at the appropriate line. And because VWD is in control, its debugging capabilities allow you to view variables, step through code line by line, and so on. Stepping through code is further enhanced by the fact that you can step into code called from the

current routine. In this example you stepped from the code in `Checkout.aspx.vb` into `Shopping.vb`, allowing you to follow the program flow line by line.

Debugging is extremely useful for not only tracking down problems in code, but also for understanding the flow of code. You can use it to understand which methods are called, the order in which they are called, and what code does in those methods. It's a practical skill that will make you a good programmer, so it's worthwhile spending time getting used to the debugger.

It's worth pointing out the difference between the various actions of the debug toolbar, and these are summarized in the following table. An empty entry for the shortcut key means that there is no default key for that action.

Toolbar Icon	Shortcut Key	Description
	F5	Run the application if it currently isn't running, or continue running the application if it is currently paused at a breakpoint.
		Pause the running of the application.
	Shift+F5	Stop debugging the application.
	Ctrl+Shift+F5	Restart the application.
		Show the next statement, which highlights the next statement to be executed.
	F11	Step into a method. If the current line contains a method or property from another class, then stepping into that method will load the code file for the class and allow stepping through the code for the method or property.
	F10	Step over a method. If the current line contains a method or property from another class, then stepping over will execute the line without allowing stepping through the code for the method or property.
	Shift+F11	Step out, which steps out of the current method or property. This is useful if you have stepped into a method but don't want to continue stepping though the lines; stepping out will take you back to the calling routine.
		Hex display, which displays the output in hexa decimal.
		Show the output window, which shows the actions VWD or VS take during debugging.

It's worth getting used to using both the buttons and the shortcut keys because it makes debugging quicker.

During the debugging exercise you saw how you could hover the cursor over a variable to see the contents of that variable, but the viewing of variables is not just restricted to hovering the cursor over them, because there are special debugging windows that help with this. One of these is the Locals window (see Figure 15-15), which shows the local variables for the current procedure.

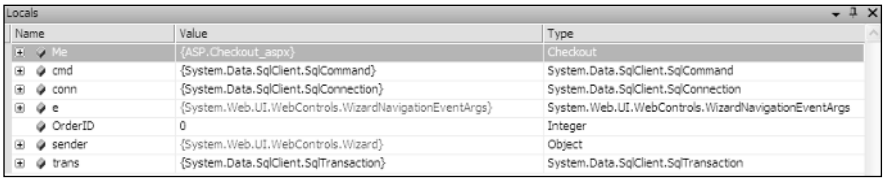


Figure 15-15

Here you have all of the local variables, and those that are complex types can be expanded to show the properties.

The Watch window allows variables to be watched. When in Debug mode you can highlight a variable, right-click it and select Add Watch from the menu. The use of the Watch window is the same as the Locals window, the only difference being that the Watch window only shows variables that you choose.

The Call Stack shows the current stack trace, which is the hierarchy of methods; which methods have been called from other methods. You can see the Call Stack at the bottom right of the screen when you are debugging. For example, in the shopping cart code, the stack trace displayed in Figure 15-16 might be shown.

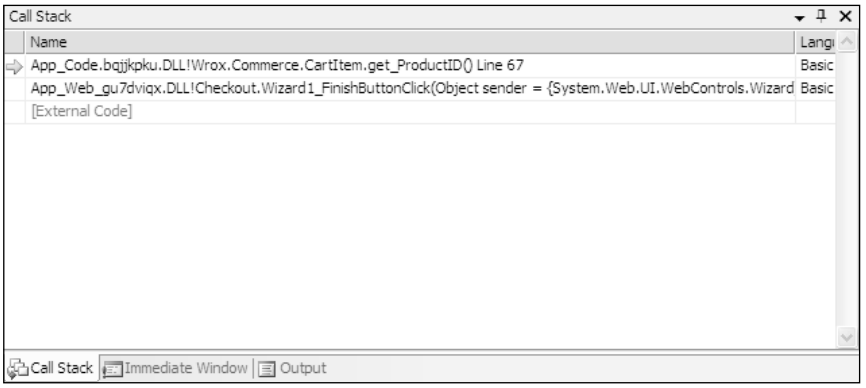


Figure 15-16

Here the highlighted line is the current line of code, and you can see that it is the `Quantity` property of the `CartItem` (`get_Quantity` is shown because this is actually how the underlying code works, showing it is the `Get` part of the property). The second line shows the method that called this `Quantity` property, and this is `Wizard1_FinishButtonClick`.

There are other windows, but Locals, Watch, and Call Stack will be the most common, and to get the best from the debugger you really have to practice. It's worth experimenting and playing around just to get a feel for how the debugger works, and the sort of things that are possible.

Summary

It may seem odd that we've had a whole chapter on the negative aspects of building web sites, but ultimately this will make you a better developer. After all, possessing knowledge is all well and good, but knowing how to cope with problems that arise is just as important. So this chapter looked at defensive coding, where you must take a pessimistic attitude. This takes the view that your code should be as robust as possible, not making assumptions about anything, such as parameters passed into methods. This is especially true when dealing with SQL statements that take data from the user, so you looked at how to replace the building of a SQL statement using concatenation with `SqlParameter` objects to prevent hacking attacks.

Another part of defensive coding is the use of validation controls, which provide a simple way to ensure that data entered by users is correct. Because these controls give both client- and server-side validation, users gets a great experience because the validation notifies them of problems before posting back to the server.

Additionally, this chapter discussed the following topics:

- Exceptions, where you learned how to cope with the unexpected (cue the inquisition leaping in from off frame — "Nobody expects the exception" — apologies to the Monty Python team). Dealing with exceptions is a tricky business, and should be limited to those situations where you can gracefully recover from the problem. One of the key tenets is that you should always leave the application in a stable state when recovering from exceptions.
- Handling exceptions globally or at least how to manage their details globally, by use of the `global.asax` file. Here you saw that for both trapped and untrapped exceptions the details can be centrally logged, ensuring that you always know of errors wherever they happen with the application.
- Tracing and debugging, and how you can track down problems within code. Tracing gives the capability to write the status of the running code, with the capability to switch the trace output on and off without affecting the trace statements themselves. Debugging delves into the code in more detail, allowing you to step through the code as it runs. These are the key techniques of learning how to find errors.

You're very nearly at the end of the book, and a lot of material has been covered. The final chapter looks at topics that will lead you from the book content to further learning and at topics of how to move forward with the knowledge you have. It also covers how to deploy your application so that it can be hosted by an ISP, allowing your great code to be seen by the whole world.

Exercises

1. Add defensive coding to the `GenerateThumbnail` method of the `ImageHandling` class stored in the `App_Code` directory.
2. Add validation controls to the Checkout page, the part that accepts the delivery address. There is a checkbox to copy the address from the membership details of the user, but there is nothing to ensure that all of the fields are filled in.
3. Use the debugger. No really, use it.

16

Deployment, Builds, and Finishing Up

It's been a long journey since you started this book by building a quick example web site, before starting to build your fully fledged Wrox United application. You now have a web site that uses e-commerce to take customer details and credit card numbers, displays up-to-the-minute content, allows users to view (and listen to) multimedia, and references a multitude of data sources, all within the course of 15 chapters. This is the kind of thing that could have taken six months in the past and a whole team of developers. However, it doesn't end here. I'm often tempted at the end of a project to put my feet up and say, well I've done all the hard work, it's all smooth sailing now. However, I have been painfully disabused of this notion on more than one occasion. Even if you're confident of the extremely unlikely scenario of your application having no bugs, being simple to maintain, and your client never having any further questions to ask or features to add, you still have to deploy your site. Visual Web Developer has a feature that allows you to copy your web site from a local folder to a remote location, and you'll make use of that in this chapter.

After you've deployed your site, well, what next? If you succeed in becoming a professional developer you will undoubtedly talk to plenty of companies who will set the final deadline as the day you deliver the working code to them. If you pencil in another project the day after this deadline you might end up getting into trouble, when you find yourself required back on site at your old project when something breaks down or doesn't work in the way it was intended. Testing is often completely overlooked by both companies and developers. Chapters 14 and 15 talked about various ways for testing your code as you create it, but testing your code after you've deployed the site should also feature in your timeline. If possible you should also test it alongside your proposed user base. Even if everything goes fine, you should be prepared to maintain this site, making adjustments, making sure that the site owners can run it in your absence.

And lastly, what should you do next after reading this book? Do you run out and apply for a set of developer jobs? Or do you have to go out and buy another book? You'll get a thorough grounding in what you should be looking to do next.

This chapter discusses the following topics:

- Deploying your site
- Testing and maintaining your site
- Where to now?

Site Deployment

Site deployment is the process of installing your site on the customer's machine and making your site available and accessible to the outside world; in other words, broadcasting it to the masses. In the very first versions of ASP, and indeed with any pure HTML site, the idea of deployment went little beyond "parcel up all your files in a zip file, and unzip them to the correct folder on the site." For simple sites this approach still works, but for more complex ones, you're asking for trouble if you follow this method and expect no problems.

One of the weaknesses of Visual Web Developer is that, unlike Visual Studio.NET, there isn't a special deployment wizard that can wrap up all the different bits and pieces into a single installation file. However, there is an option in VWD that allows you to take your existing web site and publish the web site on a remote machine. There is also a second method that can be used if you so prefer, which you learn about later in the chapter.

Before you do that, you should make sure you have everything necessary to ensure your site will work on another machine by compiling a checklist.

Checklist

Here's a simple checklist of common things you would normally expect to feature in a typical deployment.

- **HTML and CSS files:** Your design and structure.
- **ASPX files:** Your main pages.
- **ASPX.VB or ASPX.CS files:** The code-behind files.
- **ASCX and ASCX.VB/.CS files:** The user controls.
- **Database files (.MDB or .MDF):** The back end of the site.
- **Image files (.JPG, .GIF, .PNG):** Easily forgotten but vital to the sites working.
- **Multimedia files:** Includes both video and audio files.
- **XML files:** .XML and .XSD files.
- **Third-party components or controls:** ActiveX controls, Java applets or such like.
- **License files:** Required to make your components work.

Quite often you will find that despite your best intentions files can become spread out across folders all over your machine. It's a great idea to centralize them first and even try to deploy them on another local machine of your own if you have one.

Compiling and Running Your Application

The next step is to make sure that your site actually compiles and runs. In Chapter 15 you looked at simple reasons why a site might not compile, and there is no point in deploying a site that doesn't compile. Also be aware that even if your site happily compiles on your machine, it might not compile or run on your host's or client's machine. You must make sure that things like local references are changed so that file references are specific to the new machine and that the requisite components are installed. This is the most likely reason for your code failing on your host's machine. The best way to do this is to place any machine-specific information within the `Web.config` file and then reference it from inside the `appSettings`, as discussed in Chapter 2. Then you can change any information in the `Web.config` file without affecting your application.

Say, for example, you put a reference to a folder in the `<appSettings>` section of `Web.config` and add a key and a value attribute as follows:

```
<appSettings>
...
<add key="WroxUnited" value="C:\Program Files\Wrox United" />
...
</appSettings>
```

You can then access these values from your code as follows:

```
Dim WroxULocation As String = _
  System.ConfigurationManager.Configuration.AppSettings("WroxUnited")
```

Of course you will probably be faced with a scenario where you want to have a reference to a local file and also a reference to that same file in a location on your remote server. In this case you can place a reference to both locations in `Web.config`. Here `LOCALHOST` is the active file location:

```
<appSettings>
  <!-- LOCALHOST -->
  <add key="WroxUnited" value="C:\Program Files\Wrox United" />
...
  <!-- REMOTE
```

```
    <add key="WroxUnited" value="D:\Websites\Wrox United" />
    -->

  </appSettings>
```

All you need to do then is uncomment the `REMOTE` settings and comment out the `LOCALHOST` settings instead. In this way no code needs to change. Make sure you comment which of the locations is local and which is remote, because it might not be entirely obvious to anyone else who uses the code. If you have reason to change the location of the file, you only have to change it once in `Web.config` and not every time it is mentioned within your code.

This doesn't just stop with remote file locations, but also with connection strings too. If you are using a local database to test your code, you will have to change the connection settings as well. Your local database might use SQL Express, but your main server might be SQL Server 2005; once again, no extra code is needed, it can just be worked by commenting the line out:

```
  <ConnectionStrings>
    <!-- LOCALHOST -->
    <add key="WroxUnitedConnectionString" value="Data
  Source=.\SQLEXPRESS;AttachDbFileName=|Data Directory|\WroxUnited.mdf;Integrated
  Security=True;User Instance=True;" providername="System.Data.SqlDataClient"/>
  ...
    <!-- REMOTE
    <add key="WroxUnitedConnectionString" value=" Data
  Source=MainSQLServer;AttachDbFileName=|Data Directory|\WroxUnited.mdf;Integrated
  Security=True;User Instance=True;User ID=auser;Password=56gTR4fs "
  providername="System.Data.SqlDataClient" />
    -->

  </ConnectionStrings >
```

Once again `LOCALHOST` in this example is the active string. If you tweaked the provider name you could pass connection strings to other databases such as Access or MySQL or even Oracle.

Publishing the Site

Once you're sure everything is ready and that everything compiles, you can use Visual Web Developer to publish your web site for you. There isn't much more to say on the subject, it's literally easier to go ahead and do it!

Try It Out — Publishing the Wrox United Web Site

1. Open the chapter copy of WroxUnited (C:\BegASPNET2\Chapters\Begin\Chapter16\WroxUnited) and select the Web Site ➪ Copy Web Site option (see Figure 16-1).

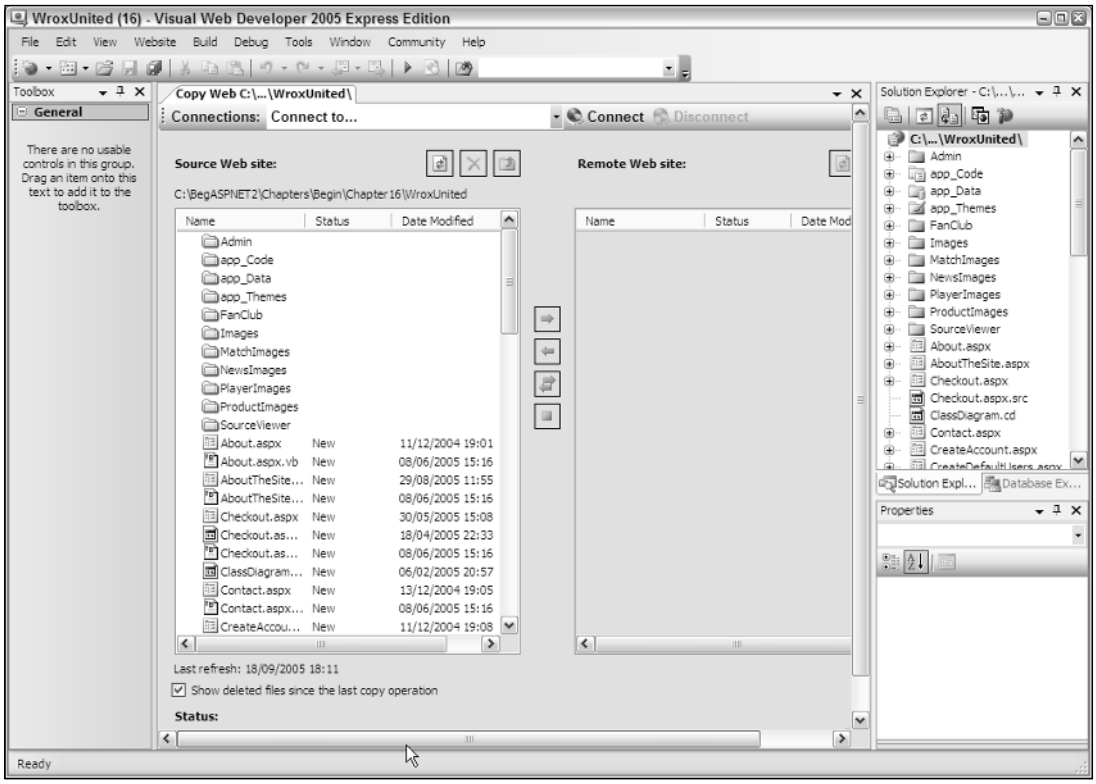


Figure 16-1

2. Click the Connections: Connect to box and enter **WroxUnited2** into the text box, as shown in Figure 16-2.

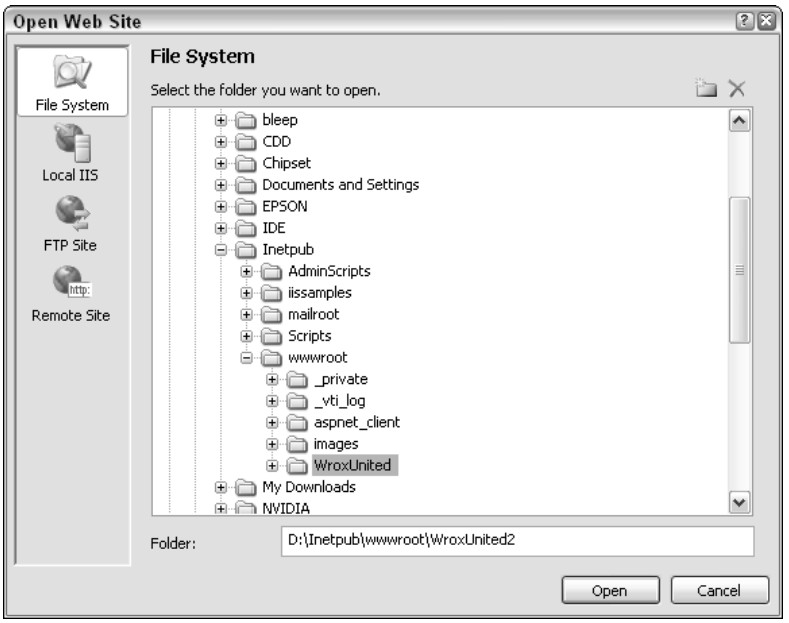


Figure 16-2

Notice that to actually deploy to a remote site, you need to select the Remote Site icon on the left-hand menu and then supply the URL or IP address of the location of the site, possibly entering relevant user ID and password details in along the way. It is unfortunately not possible to supply test web space for readers to deploy their sites to.

3. Click Open and click Yes when asked whether you would like to create a new folder.
4. Next select all the files, as shown in Figure 16-3.

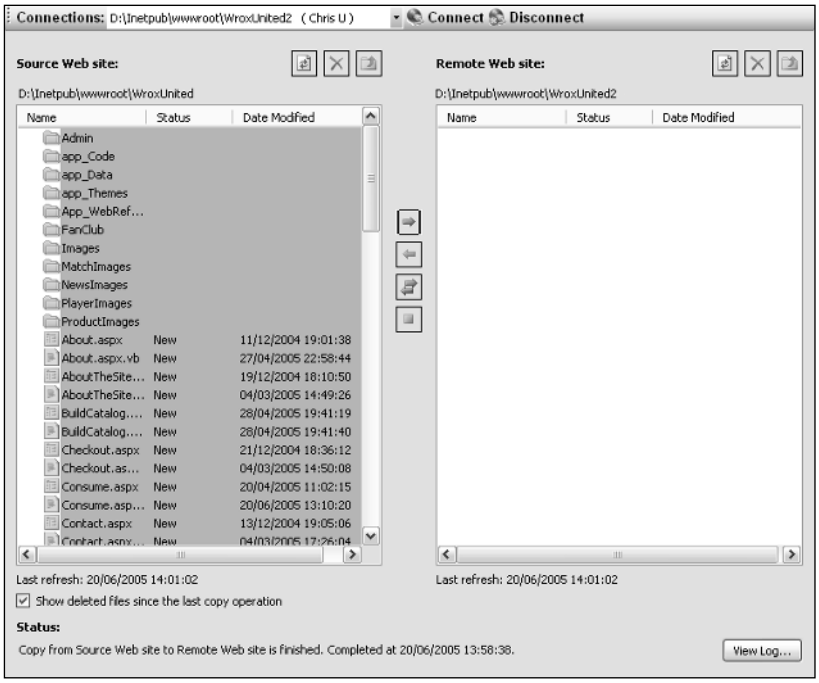


Figure 16-3

5. Then click the blue single right-arrow button to copy them across (see Figure 16-4).

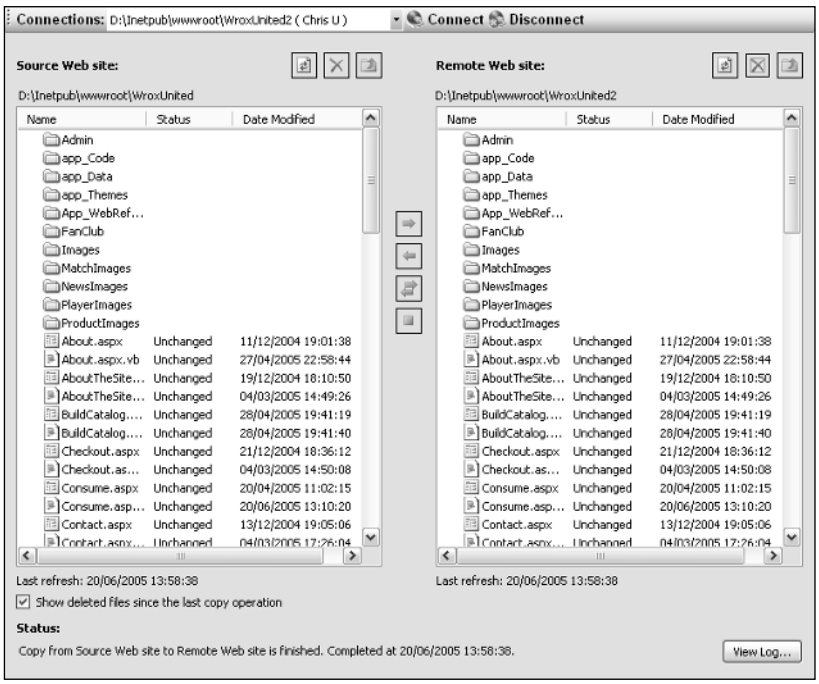


Figure 16-4

6. Close the web site down, by selecting Close Project from the File menu.
7. Select Open ➪ Web Site and select WroxUnited2.
8. Run the new web site; it should look just like the old one (see Figure 16-5).

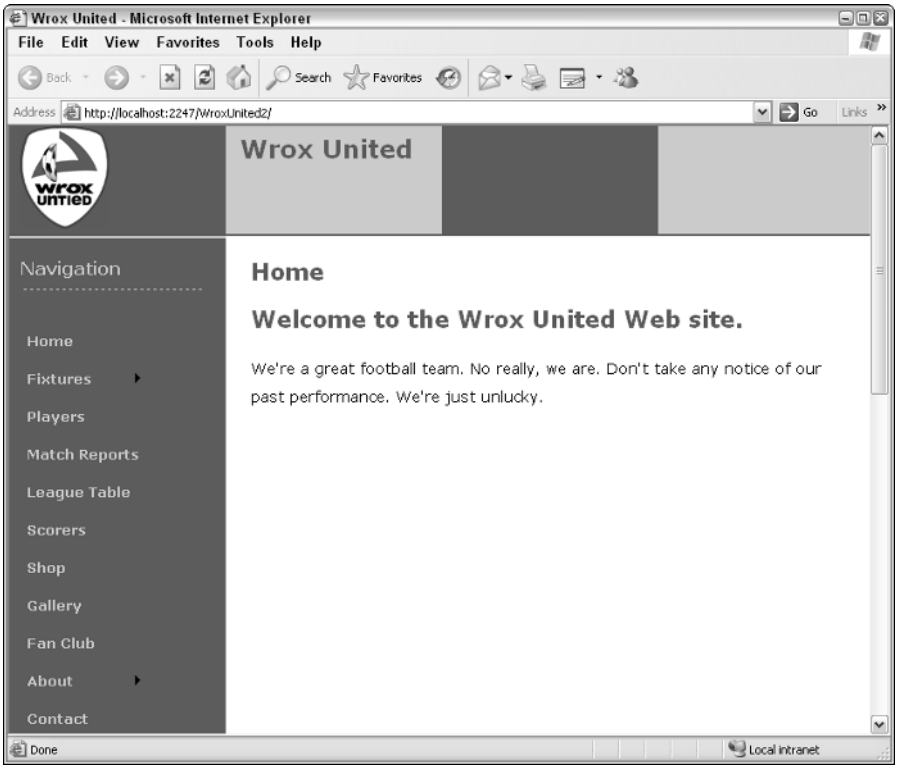


Figure 16-5

How It Works

In this Try It Out you have used the Copy Web Site option of Visual Web Developer to produce a complete, identical copy of the Wrox United site on your local machine. This mirrors the way in which you would go about deploying a web site to a remote location. In fact, if you have a remote machine that is also running ASP.NET 2.0, we would recommend that you try deploying the Wrox United site on it yourself.

There really is very little to the physical act of deployment; it should work out of the hat. The problems you may encounter are either caused by elements in your application that are locked in to your current setup (such as referencing files on a C:\ drive, when the host uses E:\ instead) or if you attempt to copy files into a folder or location where some files already exist. In this case, a blue question mark will appear next to the offending file in the left-hand dialog, and you will get a dialog (see Figure 16-6) asking you whether you want to copy over the existing file.

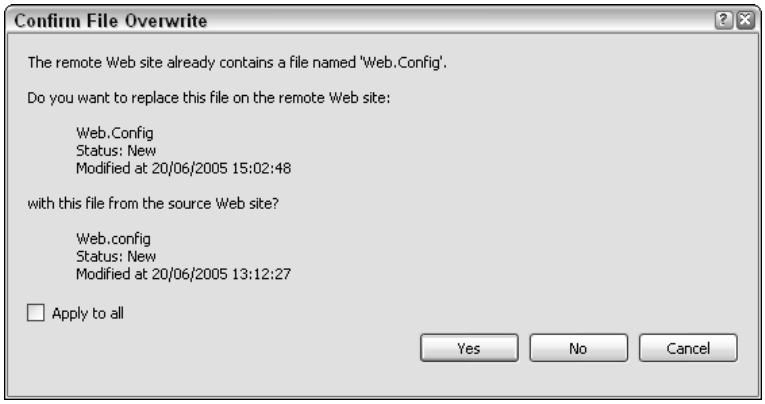


Figure 16-6

Before .NET, if you needed to install a component or control, this would require copying your component to the appropriate folder and registering that component via some ugly low-level tools we don't want to talk about here. In .NET, to install the component all you have to do is to copy the component's file into the bin folder of your application which occasionally had some unexpected and unpleasant side-effects, however in .NET 2.0 dropping components into the App_Code folder is all you need to do to be able to start using the component immediately.

XCOPY Deployment

There is a second way to deploy applications in .NET, if you don't have Visual Studio.NET. This is known as XCOPY deployment. This is a command-line tool that can be used to copy your site from one location to another. It takes a number of options, as detailed in the next section.

XCopy Options

- **/ E** copies folders, subfolders, and files, including empty ones.
- **/ H** copies both hidden files and system files in addition to the unhidden and non-system files.
- **/ I** specifies that the destination is a folder and to create the folder if it does not already exist.
- **/ K** keeps all of the existing file and folder attributes such as read-only, which would otherwise be lost.
- **/ O** retains all of the security-related permission ACLs (Access Control Lists — rules for who gets access to a particular resource) of the file and folders.
- **/ R** overwrites files marked as read-only.

All you need to do is provide the location of where you want to copy the web site from and where you need to copy the web site to, and along with the relevant options, it will copy everything that you need. So typing in the following command would copy all files and folders to the WroxUnited3 folder:

```
XCOPY C:\Inetpub\wwwroot\WroxUnited C:\Inetpub\wwwroot\WroxUnited3 /E
```

You can see how that works in the following Try It Out.

Try It Out — Publishing Wrox United Using XCOPY

1. Click Start ➪ Run and type in **CMD** to bring up the command prompt.
2. Type the following command and press Enter:

```
XCOPY C:\Inetpub\wwwroot\WroxUnited C:\Inetpub\wwwroot\WroxUnited3 /E
```

3. You are presented with the screen shown in Figure 16-7, and asked whether the target is a file name or directory. Press d because it is a directory. XCOPY will now copy all the files over.

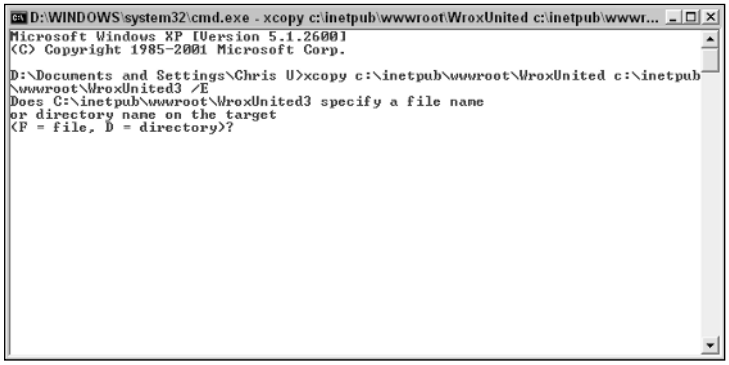


Figure 16-7

4. Close the command prompt.
5. Open Visual Web Developer, choose File ➪ Open ➪ Web Site, and select WroxUnited3.
6. Run the new web site; it should look just like the last one (see Figure 16-8).

Figure 16-8

How It Works

The XCOPY option works in the exactly the same way as the Copy Web Site option in Visual Web Developer. It copies all of the files from one location to another. The two main differences are that you don't need Visual Web Developer installed to do it, which is useful if you have been forwarded a web site from someone else in a zip file and want to, say, install it locally and test it and then deploy it. The second difference is that because it is a command-line tool it gives you more options on which files to copy and which files not to copy, with settings like /R to overwrite existing files that are marked as read-only.

Common Problems Encountered When Deploying a Site

So, you shouldn't have any problems with the physical act of deployment itself. However, what happens if you copy all of the files over, install all of the relevant components and install the third-party ones, and do it correctly and deployment still doesn't work?

With a fairly new technology it's harder to compile a definitive list of problems, bugs, and glitches the user might experience; these things are put together from years of user frustrations. However, on our travels in the beta versions of ASP.NET 2.0 we came across a couple of gotchas that could break your site that are worth talking about now.

Enabling App Data Permissions

If you are getting errors whenever the user runs a page that accesses a database, then suspect permissions problems immediately. Every time you move a database to a new server that uses SQL Server, you have to set up the relevant permissions for the NETWORK SERVICE for the `App_Data` folder. The reason you have to do this is ASP.NET 2.0 runs under this particular service, and so if ASP.NET 2.0 wants to access the database, a request to access it will come from this particular service.

> **In ASP.NET 1.1 you would add permissions for the ASPNET account to do this; in ASP.NET 2.0 the NETWORK SERVICE account does the same. However, there have been occasions in the beta where enabling NETWORK SERVICE didn't work and ASPNET permissions had to be enabled as well. If, after enabling permissions for NETWORK SERVICE, things still don't work in the way intended, you might want to enable permissions for the ASPNET account as well, in the same way as outlined next for the NETWORK SERVICE account.**

You can enable these permissions in two ways, either via Windows Explorer or via SQL Server Enterprise Manager.

Enabling Permissions via Windows Explorer

Go to the folder of your web application in Windows Explorer, right-click your application and select the Properties, and click the Security tab, which is shown in Figure 16-9.

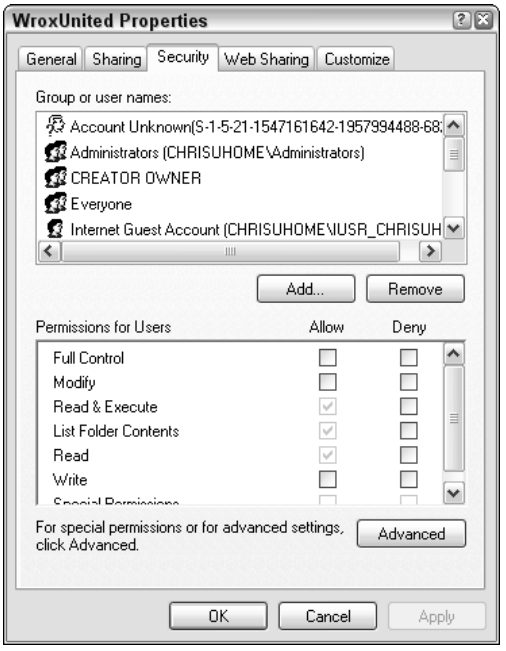


Figure 16-9

Important note for Windows XP Home Edition users: There is no Security tab visible because something called Simple File Sharing is enabled by default. To turn off Simple File Sharing, you need to restart your PC in Safe Mode (by pressing F8 before XP starts) and then log in as Administrator. You'll get a warning about running in Safe Mode. Click Yes to accept it and locate the folder whose permissions you want to change, then right-click that folder, select Properties, and change the permissions. You can find more details about this in Appendix B.

Click the Add button to bring up the Select Users or Groups dialog (see Figure 16-10). Type **Network Service** and click Check Names (if you don't type in the correct case, it will capitalize the name for you).

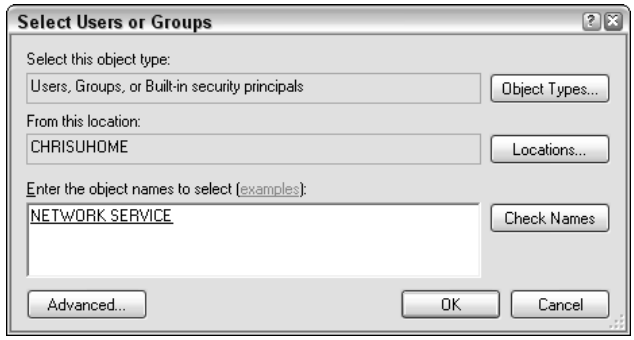


Figure 16-10

Click OK. In the Properties dialog (refer to Figure 16-9), make sure the Write checkbox is checked (it is unchecked by default) and click Apply. It's as simple as that.

If the machine is joined to a domain, the user must select the Locations button and pick the current machine, rather than the domain. That's because NETWORK SERVICE is an account on your machine. By default the dialog will attempt to add the domain name, rather than the machine name.

Enabling Permissions via SQL Server Enterprise Manager

The alternative way will only work if you have SQL Server installed. If you bring up SQL Query Analyzer you can run the following script (just type in the following code to SQL Analyzer), substituting in the name of the database you want to grant access to:

```
sp_grantlogin 'NT AUTHORITY\NETWORK SERVICE'

USE aspnetdb
GO
sp_grantdbaccess 'NT AUTHORITY\Network Service', 'NETWORK SERVICE'

USE aspnetdb
GO
sp_addrolemember 'database_you_wish_to_grant_access_to, 'NETWORK SERVICE'
```

Click Run to run the query, and this will have the same effect as the previous instructions.

Is Your Application Offline? (Using App_Offline.htm)

This is one of those things that I saw in the beta that really tripped me up; on one occasion I ran my Wrox United application to test it and was staggered to find that every single page returned an HTTP 404 error. Even stranger, I was browsing them from within Visual Web Developer at the time. It took me a few hours and help from the other people on the book to figure out what had happened. It actually turned out to be a really useful feature.

If you need to take your site offline very quickly, you can place a file called `app_offline.htm` in your main application folder to make your web site unavailable to everybody. You can place in the HTML file the text that you want your users to be able to view for the duration of the site's downtime. The advantage is that ASP.NET is working throughout this downtime, and you are able to test the site without having to worry about what users can see in the outside world. However, there are times when this file is created for you, which led to the problems I had.

Apparently during some operations, the `app_offline.htm` file is temporarily copied to your application folder and then in theory it should be removed when the operation is completed. A crash during an operation can leave the file behind. Unfortunately, this was a zero-length file in beta 2, and this provided no clue to the user as to what occurred. The user was just left with every single page in his or her site returning 404 errors. Normally, the `app_offline.htm` file should not be left behind, but unfortunately in some cases it gets left over. In the final release of ASP.NET 2.0 there is a message informing users of what happened so they know to remove the offending item (see Figure 16-11).

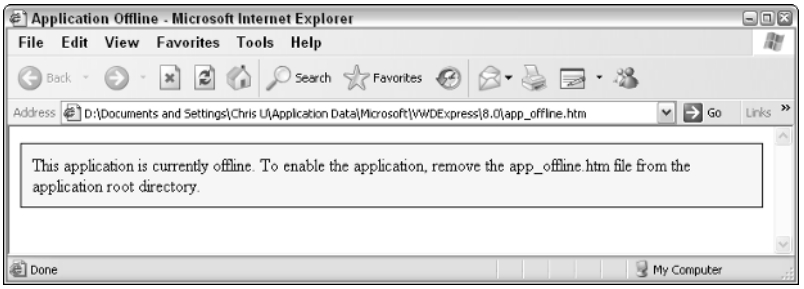


Figure 16-11

This can turn up quite a few times if your application is being unruly, so be warned. It will turn up in the root folder of your application folder. In Figure 16-11 you see the version of it that comes with Visual Web Developer by default.

Trial and Error

If there's still no joy, go back, delete all the files, and try it again. If you are getting a particular error consistently, look up that error on `http://support.microsoft.com` and see if that has any solutions. If not, try posting on one of the online forums recommended later in this chapter.

Testing and Maintenance

Once you've successfully negotiated deployment, you might be excused for doing a quick double take. Testing, haven't you already done that? Given this is the 21st century you would have perhaps expected attitudes toward testing to have improved considerably; however, if anything, trends have reversed. I can name-check several very popular games that arrived on the market in a practically unusable state because they hadn't been tested correctly. Hastily compiled patches of 20–50MB were required to rectify the situation. However, as a developer you will probably not have this luxury. You will probably see your client week in and week out, and if the application doesn't work they will tell you about it and maybe withhold payment until the problem is rectified. They might still not grant you any extra time to test, but that is the name of the game.

Testing Before and After

Of course while you're building an application you should test every component, but once the build is deployed and completed you should also make time to test the application as a whole. In particular, you should sit alongside your prospective users and watch them test it. Some clients believe that testing is the whole responsibility of the developer, but the relationship the developer shares with his code is similar to that between the author and his text. You wouldn't expect an author to be able to adequately edit his own text, and if an author uses incorrect grammar, then it's quite likely that he won't be able to spot their own incorrect grammar usage. If a developer creates a piece of logically unsound code, there's a fair chance he might not be able to spot it either. Only in hard testing, when a user who puts in often totally unpredictable values, are some errors revealed. Some textbooks will tell you to put aside as much time as you took to develop the application for testing it. This isn't over-cautious; the bigger the application, the greater the likelihood of bugs creeping in, and the longer it can take to find them. If possible with a web site for a client, get them to test it in-house, on a test server before they put it on a live server. And don't be worried to admit to bugs. Finding bugs isn't the sign of a bad developer; a bad developer is one who refuses to admit to the possibility of any bugs in the first place. The best advice I can give is get your clients to test the application thoroughly and make sure they have time to do it. A couple of testing methods are worth mentioning here.

Unit Tests

Unit tests are a particular form of testing where you write a test for every non-trivial function or method in the code. You can separate out the different sections of the program and demonstrate which parts are working in this way. Unit tests make it easier for programmers to change individual pieces of code because they can go back to the code and test the unit independently. So if you suddenly think of a new feature, you can add it without worrying about having to break the entire application.

Writing a Test Plan

Because unit tests, or indeed the whole practice of testing, can be time consuming, it's best to have a test plan up front to aid the organization of testing. A *test plan* is simply a systematic written approach to testing, detailing the experiments and tests you want to perform on the code. Test plans don't just apply to computer programs; they can apply to any kind of engineering. A single test case in a test plan for a dishwasher might be, "Test what happens when you open the dishwasher door halfway through a working cycle." Some dishwashers would shower you with scalding water, some would refuse to open, and some would stop mid-cycle and let you retrieve the last cup in the house. There isn't necessarily a right answer to what should happen, but you should write a list of scenarios that you would like to test,

and record the outcomes and check that the scenarios and outcomes are what you both want, and what your end-user thinks is satisfactory.

Maintenance

Maintenance is the practice of keeping your site up and running once it has been successfully deployed. In some ways it's like a glorified debugging process — some bugs might not show up until long after the site's deployment, but you'll still be expected to fix them. In other ways maintenance will be about performance monitoring: how fast is your site running? How many users is it handling? Can it cope with that? This is a science in itself. This is one area where ASP.NET 2.0 has come on in leaps and bounds, with the addition of instrumentation, and the capability to instrument your application.

Instrumentation and Health Monitoring

Instrumentation or *instrumenting* is a term you will come across if you have to do any monitoring or maintenance of your system. It doesn't refer to anything musical, though. Rather, the instrumenting of your application is the monitoring of your system or your application's function, checking to see that all is working the way it should be.

ASP.NET 2.0 has a lot of instrumentation features for the developer. You've already looked at the ability to run traces and logging and learned that there are performance counters that you can use, but are beyond the scope of this book. However, there is another new feature that is of great interest and of particular use after your application has been deployed, and that is the introduction of the `<healthMonitoring>` element.

The `<healthMonitoring>` element can be used at system or application level and allows you to monitor when specific events have occurred and write notifications of these events to either an event log, a SQL Server database, or even to e-mail the administrator. Events that might be of interest could be a failed login, or an error occurring in the application. Besides logging events the `<healthMonitoring>` element allows you to test the "health" of the system via a `heartbeat` attribute, which sets up an event that is generated at a predefined interval — if you can "hear" the heartbeat, you know your application is working fine. If you don't receive this heartbeat, you know there might well be problems.

To enable health monitoring, all you need to do is place the `<healthMonitoring>` element in your `Web.config` file and set the `enabled` attribute to `true`. Health monitoring is handled by three elements within `<healthMonitoring>`, which have a close relationship with each other:

- The `<providers>` element specifies where you want to send the information you have collected; this can be an event log or a database.
- The `<rules>` element specifies the name of the provider you want to write your information to and the event name you want to instrument.
- The `<eventMappings>` element specifies a name of event you want to monitor, and maps it to an actual event or set of events. The settings of this element must correspond to a valid event type. A list of valid types is contained within the `<eventMappings>` element in the `Web.config.comments` file.

It just takes a couple of attribute changes to alter an application that writes to the event log for failed logins, to one that e-mails the administrator with details.

Monitoring for Events

You can test for a range of events using the `<healthMonitoring>` element. These are as follows:

Event Name	Description of Event
`WebHeartbeatEvent`	A regular event that provides statistics about the application or system.
`WebManagementEvent`	A base class event for all events that carry application and worker process information.
`WebApplicationLifetimeEvent`	An event generated by every *significant* event that occurs in an application's lifetime, such as startup, restart, and shutdown.
`WebRequestEvent`	An event raised with every web request; contains information about the request and the thread on which it's executing.
`WebBaseErrorEvent`	A base class event for all health monitoring error events.
`WebErrorEvent`	An event generated when there are problems with configuration or application code.
`WebRequestErrorEvent`	An event raised when an error occurs during a web request. This ignores common types of error such HTTP 404, and focuses on things like unhandled exceptions.
`WebFailureAuditEvent`	An event generated upon the failure of a security-related event, such as a file authorization, a URL authorization, or a login authentication.
`WebSuccessAuditEvent`	An event generated upon the success of a security-related event, such as a file authorization, a URL authorization, or a login authentication.
`WebAuthenticationFailureAuditEvent`	An event generated upon an unsuccessful login authentication.
`WebAuthenticationSuccessAuditEvent`	An event generated upon a successful login authentication.
`WebAuditEvent`	A base class for all audit events, both authentication and authorization.
`WebViewStateFailureAuditEvent`	An event that is generated on view state failure. The failure may indicate an attempt to tamper with the view state, or its reuse from another machine with a different key.

There is also a broad range of providers (sources) to which you can write your event information. These can all be found in the System.Web.Management namespace, and are detailed in the following table:

Provider Name	What the Provider Holds
`MailWebEventProvider`	Writes to an e-mail.
`SimpleMailWebEventProvider`	Writes to a simplified e-mail.
`TemplatedMailWebEventProvider`	Writes to a templated e-mail.
`TraceWebEventProvider`	Writes to a trace.
`EventLogWebEventProvider` (the default provider)	Writes to the Event Log.
`SqlWebEventProvider`	Writes to a SQL Server database.

Which Events Are You Interested In?

So you have a list of events, and a list of possible places where you can write the events about how they were monitored. However, at the moment this is information overkill; you need to get back to basics and answer a simple question: Which events are you interested in monitoring?

Unfortunately, the answer is open-ended. This depends on what you want to monitor your application for. A lot of the events in your list generate huge numbers of events, both when working correctly, or when the application isn't.

A good place to start would be security. If you aren't regularly changing code in your application, then most likely the greatest threat to your application's longevity and well-being is someone trying to hack. A key to finding good security events to instrument for is to locate which events under normal circumstances shouldn't be generating a large number, but in the event of an attack or suspicious data being provided, will generate a lot of events. When your system is being attacked, you are likely to see a number of such events, which in turn can help act as an early warning system.

The key events that monitor the security-related aspects of the application might be as follows:

- `WebErrorEvent`
- `WebAuthenticationFailureAuditEvent`
- `WebRequestErrorEvent`
- `WebViewStateFailureAuditEvent`

The `WebError` event should be monitored because any code failure is suspicious; the `WebAuthenticationFailureAuditEvent` should be monitored because any suspicious login activity should be carefully monitored. The last two might have failures if a hacker is trying to intercept responses from the server and forwarding his or her own fraudulent page in response. By default, the `WebErrorEvent` and `WebAuthenticationFailureAuditEvent` are turned on. This means that in the case of any failure they are automatically logged to the Event Log. So if such an error (for example, a division by zero error) occurs in your application you would see what's shown in Figure 16-12 in your Event Log under Application, under the source ASP.NET version.

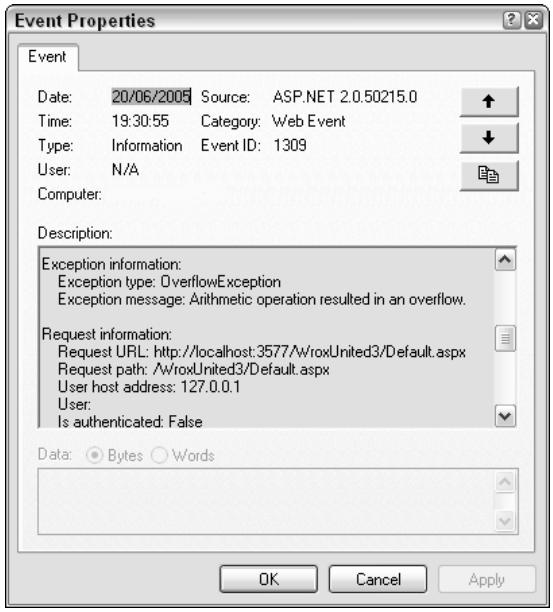


Figure 16-12

Because failed logins are written to the event log by default, take a look at how you could also log successful logins to your application in the Event Log. In this Try It Out you track when a user logs in to Wrox United successfully, and you write details about it to the Event Log.

Try It Out — Adding Health Monitoring to Wrox United

1. Open `Web.config` and in `<system.web>`, add a `<healthMonitoring>`element as follows:

```
<healthMonitoring enabled="true">
</healthMonitoring>
```

2. Create another child element inside `<healthMonitoring>` called `<rules>`:

```
<rules>
<add provider="EventLogProvider" name="Success Audits" eventName=" LoginSuccess" />
</rules>
```

3. Create another child element inside `<healthMonitoring>` underneath `<rules>` called `<eventMappings>`:

```
<eventMappings>
<add name="LoginSuccess"
type="System.Web.Management.WebAuthenticationSuccessAuditEvent,System.Web,Version=2
.0.0.0,Culture=neutral,PublicKeyToken=b03f5f7f11d50a3a"
 startEventCode="0" endEventCode="2147483647"/> </eventMappings>
```

4. Create a `<providers>` child element in the `<healthMonitoring>` element. The provider specifies where you want the event information to be sent; in this case you are specifying the Event Log:

```
<providers>
<add name="EventLogProvider"
type="System.Web.Management.EventLogWebEventProvider,System.Web,Version=2.0.0.0,
Culture=neutral,PublicKeyToken=b03f5f7f11d50a3a" /></providers>
```

5. Run the application and login as Dave, password dave@123.
6. Go to the Control Panel and select Administrative Tools ➪ Event Log, and you'll see the screen shown in Figure 16-13.

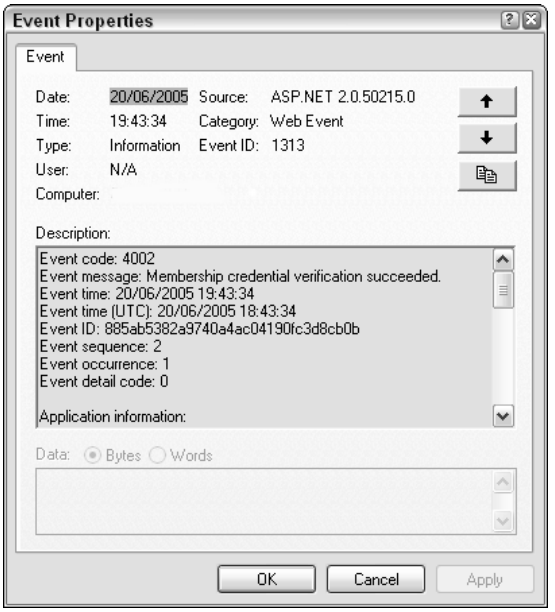


Figure 16-13

How It Works

The `<healthMonitoring>` element in the `Web.config` file does all of the work for you. You start by enabling `<healthMonitoring>` and then placing three elements inside it to make it work.

The `<rules>` element is used to map an event onto a provider. The `<rules>` element has three compulsory attributes: `provider`, `name`, and `eventName`. The `provider` attribute matches the `name` attribute specified in the `<providers>` element. You specify the Event Log in this element and a name for your rule, "Success Audits."

```
<rules>
<add provider="EventLogProvider" name="Success Audits" eventName="LoginSuccess" />
</rules>
```

The `<eventMappings>` element specifies a user-friendly name for the event and the specific type of the event you want to monitor. The type has to contain the system assembly details as well as information about that assembly such as the `Version` number, `Culture`, and `PublicKeyToken`:

```
<eventMappings>
<add name="LoginSuccess"
type="System.Web.Management.WebAuthenticationSuccessAuditEvent,System.Web,Version=2
.0.0.0,Culture=neutral,PublicKeyToken=b03f5f7f11d50a3a"
startEventCode="0" endEventCode="2147483647"/> </eventMappings>
```

The `<providers>` element specifies which source to write the error information to, such as Event Log or SQL Server database. Providers always have two compulsory attributes: `name` and `type`. The `<provider>` must use a `name` attribute corresponding with a name specified in `<eventMappings>`. Providers may have other compulsory attributes, but these will vary depending on the type of provider. The `EventLogProvider` only requires the `name` and `type` attributes:

```
<providers>
<add name="EventLogProvider"
type="System.Web.Management.EventLogWebEventProvider,System.Web,Version=2.0.0.0,
Culture=neutral,PublicKeyToken=b03f5f7f11d50a3a" /></providers>
```

If you scroll down the Event Log entry you will see a whole stack of useful information about the login. This information includes the event message, the time the error occurred, the location of the error, the error message, the user's IP address, whether or not they were authenticated, and much more.

Mailing an Administrator

Wrox United now writes to an Event Log, but this is only of use if the administrator is on hand to check the Event Log. A more proactive approach might involve e-mailing the administrator each time the monitored event takes place. Doing this requires only minimal alteration of the `<healthMonitoring>` element. You only need to change the rules of which provider you are indicating and the provider itself, and also add a SMTP section to the web.config file (if there isn't an existing one). You can change the details of the `<rules>` element and the `<providers>` element and add an SMTP section very simply.

Please note that this Try It Out also requires a working SMTP server. Only if you have IIS installed with the SMTP service (done via the Add or Remove Programs section of Control Panel) will you be able to do this.

Try It Out — Mailing the Administrator

1. Open `Web.config` and alter the `<rules>` element so that it now reads as follows:

```
<add provider="EmailProvider" name="My Failure Audit" eventName="Failure Audits" />
```

2. Go to the `<providers>` element and change it so that it now reads as follows:

```
<add name="EmailProvider"
        type="System.Web.Management.SimpleMailWebEventProvider"
        from="myemail@myserver.co.uk"
        to="myemail@myserver.co.uk"
        subjectPrefix="Failed Login Attempt:"
        buffer="true"
        bufferMode="Notification" />
```

Replace `myemail@myserver.co.uk` with your own SMTP server's domain name. If your machine is `TESTONE`, replace it with `myemail@testone.com`.

3. You'll also need to add a section to web.config to configure the SMTP section. An example setting would look like this, of course you'd need to substitute in your own mail server's settings:

4. To send an email successfully, you might also have to enable relaying on IIS. To do this open the Internet Information Services management console in the Administrative Tools window in the Control Panel. Set the properties for the Default SMTP Virtual Server as follows, on the Access tab, click Relay. Select Only the list below and then click Add and then under IP address type 127.0.0.1 and click OK. Click Apply, click OK, and then exit the Internet Information Services management console.

```
<system.net>
  <mailSettings>
    <!-- these settings define the mail server settings
      from: the user name from which the email is sent -
      this is the application that is sending the message
      host: the name of your mail server
      userName: the name the application will use to log into the mail server
      password: the password for the above user name
    -->
    <smtp from="admin@your-domain.com">
      <network host="your-mail-server-name"
               userName="your-user-name"
               password="your-password" />
    </smtp>
  </mailSettings>
</system.net>
```

5. Run the application and wait. You should receive an e-mail within the minute.

How It Works

Instead of placing something in the Event Log, you are now e-mailed the details that you previously viewed in the Application section of the Event Log. To do this you changed the rules and provider elements to specify a different provider.

The health monitoring features of ASP.NET 2.0 are a real godsend for those of us trying to maintain an application and for either tracking down security breaches or hard-to-find bugs.

Scalability

The last scenario you might have to consider is what happens if the web site takes off. What happens if instead of the anticipated hundreds or thousands, you get millions of visitors? On one level this might hit the performance of your application, it might exceed limits within your application, and it also might exceed the limits of your hardware.

For the former you should always consider when you create arrays and databases not to impose small limits on them. For the latter you might end up having to move your site onto a *web farm* (a collection of servers, any one of which can receive a request and deal with it). However, when creating your first site you're unlikely to have to worry about these considerations, but it never hurts to make sure.

Where To Now?

Perhaps the most difficult question to answer in this entire book is what to do next. You've built an application, and if you've managed to do the exercises as well you will have a fairly good grounding in ASP.NET 2.0 already, but probably not one that will let you walk into a well-paid job, so how can you improve on it? If you follow some philosophies you can find yourself signed up for thousand-dollar courses, or with a booklist the size of a wardrobe next, but while possibly helpful I don't think these are essential or advised courses of action.

I'm often asked by readers what is the most important part of becoming a developer or programmer, and the answer I give is hands-on experience. You read about coding and coding techniques until you're blue in the face but until you're faced with a problem that you have to solve, you can't really get a feel for coding. I think the first tentative steps on most coders' route are taking an existing application and modifying it. Improving it. Adding to it. That's what you should start now. Go back to the Wrox United application and start amending it. Think how you could improve it. Would you change the design, the way it works? Add some news articles, some new players, some new graphics, and get comfortable with the way it works. Then go away and think of an application that would be useful to you, but not too ambitious, and start creating that. If you can't think of anything then e-mail your friends to see if they've got anything that needs doing.

Developing is a very proactive job. The idea of a coder sitting in a room with no contact to the outside world is an outdated one. If your code is being used by thousands of people, you should at least be talking to a fraction of them. If you talk to people, they will undoubtedly have a million ideas you'd never have considered.

References

A lot of a developer's time will be spent on the Web looking up new concepts or error messages. Here's a list of some good places to start, if you get stuck:

- `http://p2p.wrox.com`: The Wrox forums and first place to ask with trouble on the book.
- `http://www.developerfusion.co.uk`: The UK developer community for ASP.NET.
- `http://www.asp.net`: The official Microsoft ASP.NET web site.
- `http://msdn.microsoft.com/asp.net/`: The MSDN reference for all things ASP.NET-related.
- `http://www.15seconds.com`: Great magazine-like site with loads of free articles on ASP.NET 2.0.
- `http://beta.asp.net`: Microsoft's coverage of the latest version of ASP.NET.
- `http://www.dotnet247.com`: A compendium, online cross-reference of all the Usenet newsgroups, including all of the ASP.NET 2.0 ones.
- `http://msdn.microsoft.com/coding4fun/default.aspx`: MSDN's site on fun coding topics.

Summary

This hasn't really been a chapter about a particular subject, but rather an extended wrapping up and welcome to the real world. To those ends, this chapter discussed the following:

- How you can go about deploying the Wrox United site with both Visual Web Developer and the command-line prompt tool.
- The importance of testing your application once it has been deployed and getting your potential users or your customer to test it as well.
- Maintenance, and introduced very briefly ASP.NET 2.0's new instrumenting features, the `<healthMonitoring>` element, and how you might go about using it.
- A quick recheck of the Wrox United application and what you learned from it.
- Some suggestions about what you should do next after finishing this book.

You're now ready to start developing without our help. Please begin.

Exercises

1. You are now developer and maintainer of the Wrox United web site. What else would you add to the Wrox United site? Make a list of possible add-ons, and prioritize them with the simplest to do first. Implement some of these add-ons. Just to get you thinking, you could add a facility to post pictures or video clips from Wrox United matches, or you could add player biographies. The possibilities are limitless here, so be creative!

A

Exercise Answers

Chapter 1

Exercise 1

Explain the differences among the .NET 2.0 Framework, ASP.NET 2.0, VWD, and IIS.

Solution

The .NET 2.0 Framework is a very broad set of code (contained in classes) that is used by many Microsoft products, including servers, database managers, and web servers.

ASP.NET 2.0 is a subset of the .NET 2.0 Framework that holds the classes used to create dynamic web pages.

VWD is a tool used to create ASP.NET 2.0 web pages.

IIS is a web server that can execute the ASP.NET 2.0 code to create dynamic web pages.

Exercise 2

List some differences between Cassini and IIS.

Solution

IIS is a powerful web server designed to support publicly deployed sites. IIS scales to heavy loads, multiple servers, and multi-processor machines. It has a robust security model. The user of IIS is a special account named ASPNET. IIS does not expect pages to be in development while it is serving them, so it does not lock pages.

Cassini is a lightweight web server designed to give developers a quick and easy way to serve a page on their development machine. Cassini cannot handle more than one of visitors at once. The user of Cassini is whoever is logged in to Windows at the time, and thus the security model is weak. Cassini locks a page in VWD while it is being served.

Exercise 3

When you drag the title bar of the toolbar it will only go to certain locations and certain sizes. How can you put the title bar where you want it?

Solution

Select the toolbar and choose Menu ➪ Windows ➪ Floating. You can now place the toolbar in the size and location you desire.

Exercise 4

How can you copy a .jpg file in `C:\MyPhotos` into your site for display on a page?

Solution

From VWD Solution Explorer you can right-click the receiving folder and then select Add Existing Item. Navigate to `C:\Photos` and select the photo of interest. Click OK.

A less powerful technique is to start from Windows Explorer and you can copy the .jpg file from its original folder to `C:\Website\MyWebName`. However, the file will be not immediately visible in VWD Solution Explorer.

Exercise 5

You want to add a subfolder to your site, but folder is not one of the items listed in Add Items. Why?

Solution

Adding a folder has its own entry in the menu that appears by right-clicking a folder in the Solution Explorer.

Exercise 6

Microsoft has written extensive code to make it easier for programmers to create web pages. How does a programmer actually use that code?

Solution

The code is available in server-side controls. These are tags that look like HTML but start with `<asp: . . . >`. Within the control you can set properties to determine the appearance and behavior of the control.

Exercise 7

Why are there no tools in the General panel of the Toolbox?

Solution

The General panel is a place for you to place snippets of code that you copy from a page and expect to use again later. It starts out empty.

Chapter 2

Exercise 1

Describe the functional difference between the `Web.config` file and `Global.asax`.

Solution

`Web.config` contains values (settings), whereas `Global.asax` contains code.

Exercise 2

What files discussed in this chapter are in XML format?

Solution

`Web.config` and `webSite.map`.

Exercise 3

Take a look at the code below for a Content page. Why does it lack directives and tags?

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head ></head>
```

Solution

This code lacks directives and tags because those are supplied by the Master page.

Exercise 4

What values must match between a set of Master and Content pages?

Solution

The Content page's first line directive of `MasterPageFile` must match the name of the master file.

The value of `xxx` in the Content page's `<asp:content ... ContentPlaceHolder ID="xxx">` must match the ID of the Master page's `<asp:ContentPlaceHolder ID="xxx">`.

Chapter 3

Exercise 1

Practice using the drag-and-drop functionality of VWD to put together a simple web page that displays the following information:

- The WroxUnited Logo (available for free download from `www.wrox.com` — or just use any small image of your choice).

- The names of the players and some information about each of them, arranged in a table. Refer to Figure 3-44 for visual reference.

Solution

The finished page should look like Figure A-1 when it is run.

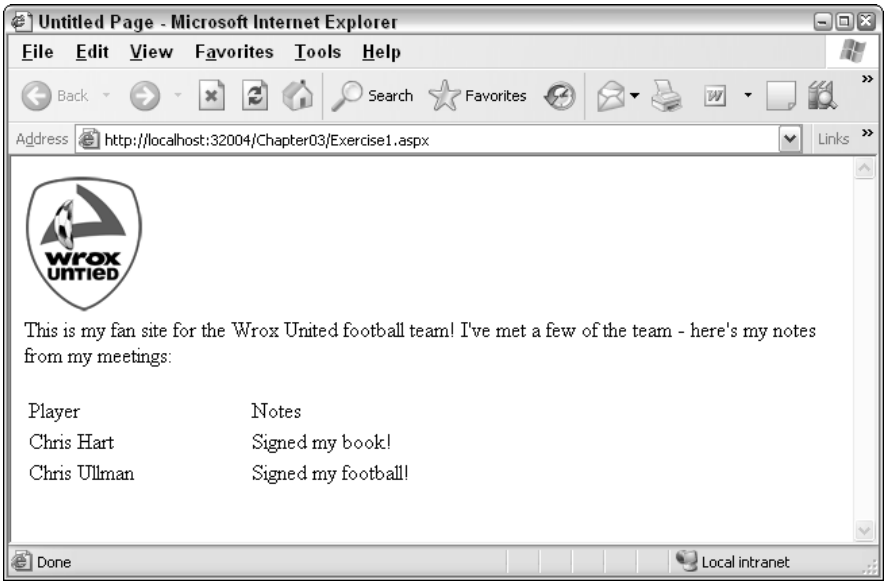


Figure A-1

The HTML that generates this page will vary according to how you set up your table, but it should be similar to the following code:

```
<html xmlns="http://www.w3.org/1999/xhtml" >
<head runat="server">
    <title>Untitled Page</title>
</head>
<body>
    <form id="form1" runat="server">
  <img src="badge.gif" />
  <br />
  This is my fan site for the Wrox United football team! I've met a few of the team
  - here's my notes from my meetings:<br />
  <br />
  <table width="600" cols="2">
    <tr>
      <td style="width: 150px">
        Player</td>
      <td style="width: 400px">
        Notes</td>
    </tr>
```

```
      <tr>
        <td style="width: 150px">
          Chris Hart</td>
        <td style="width: 400px">
          Signed my book!</td>
      </tr>
      <tr>
        <td style="width: 150px">
          Chris Ullman</td>
        <td style="width: 400px">
          Signed my football!</td>
      </tr>
    </table>
  </form>
  </body>
  </html>
```

Exercise 2

Head back to Wrox United and go to the Master page. Try deleting the `Menu` control and replacing it with a `TreeView` control. Bind that control to the `siteData` data source, and bingo — you should see a fully populated tree of items, both in Design View (refer to Figure 3-45) and when you run the page (refer to Figure 3-43).

Solution

Changing the `Menu` control to a `TreeView` control is a swift process, and you can see the results in Figure A-2.

Figure A-2

Once you have a `siteMap` data source, it's simple to plug in compatible controls and change the functionality of the site with minimal effort.

Chapter 4

Exercise 1

Change the configuration of your Chapter 4 web site to allow anonymous access, but to deny access to one specific user account.

Solution

Run through the Security wizard for the site and change the permissions as described, or modify the `Web.config` file. If you are successful, you will have code similar to the following in your `Web.config` file:

```
<roleManager enabled="true" />
<authorization>
  <allow users="?" />
  <deny users="chrishart" />
</authorization>
```

Exercise 2

Add a subfolder to the Chapter 4 web site called Admin. Within this folder, add a page called `MainAdmin.aspx` with a `LoginName` control on it and any other controls you might want. Change the access permissions for that specific folder so that only members of the Administrators group can view the page.

Solution

The `MainAdmin.aspx` page should have code similar to the following:

```
<form id="form1" runat="server">
  <div>
  This is the administration page for the Chapter 4 site.
  <br />
  <asp:LoginView ID="LoginView1" Runat="server">
    <LoggedInTemplate>
      You are logged in as <asp:LoginName ID="LoginName1" Runat="server" />
       <br />
    </LoggedInTemplate>
    <AnonymousTemplate>
      You are currently anonymous.
    </AnonymousTemplate>
  </asp:LoginView>
  <asp:LoginStatus ID="LoginStatus1" Runat="server" />
  </div>
</form>
```

And the `Web.config` file for the Admin folder should have the following code:

```
<?xml version="1.0" encoding="utf-8"?>
<configuration>
    <system.web>
        <authorization>
            <allow roles="administrators" />
```

```
            <deny users="*" />
        </authorization>
    </system.web>
</configuration>
```

Chapter 5

Exercise 1

You have an ASP.NET `Label` control on a page. The label has a `font-italic="true"` attribute, and a `CssClass="maintext"` attribute:

```
<asp:label id="myLabel" CssClass="maintext" font-italic="true"
  text="This is a label"></asp:label>
```

The page has an associated CSS style sheet (not associated with a theme) that defines a `.maintext` style class has the following attributes:

```
.maintext
{
  color: Navy;
  font-family: Verdana;
  font-weight: Bold;
  font-style: normal;
}
```

How will the label appear when it is rendered?

Solution

You should see some text rendered in bold, blue Verdana, and in italic, as shown in Figure A-3.

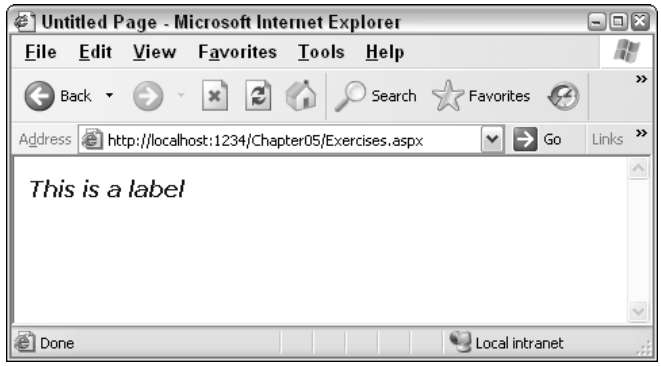


Figure A-3

The `font-style` attribute in the CSS style sheet is overridden by the element-specific style in the page.

Exercise 2

You now add a `Theme="ExerciseTheme"` to the preceding page. You place the CSS style sheet from the previous exercise within the ExerciseTheme theme folder. How will the label control appear now?

Solution

The `Theme` attribute specifies that the page should now inherit all styles within the ExerciseTheme theme folder, but the style attribute added to the element remains, and the font appears in italic.

Exercise 3

You define a skin for all labels within the ExerciseTheme theme folder and specify the following attributes:

```
<asp:Label CssClass="maintext" runat="server" font-italic="false"></asp:Label>
```

How will the label appear now?

Solution

This time around, the `Label` control's italic style will override the page's style, so you will see what appears in Figure A-4.

Figure A-4

Chapter 6

Exercise 1

In the Chapter06 project create a new Web Form called `Lists.aspx` and add a `ListBox` control to the page, and add three list items with values of `One`, `Two`, and `Three`. Add a `Label` control and a `Button` control to the page. In the `Click` event of the `Button`, display the selected value of the `ListBox` in the `Label`.

Solution

The controls you add to the page should be:

```
<asp:ListBox ID="ListBox1" runat="server">
  <asp:ListItem Text="One" />
  <asp:ListItem Text="Two" />
  <asp:ListItem Text="Two" />
</asp:ListBox>
<br />
<asp:Button ID="Button1" runat="server" Text="Button" />
<asp:Label ID="Label1" runat="server" Text="Label" />
```

For the `Click` event of the button you should have:

```
Protected Sub Button1_Click(ByVal sender As Object, _
         ByVal e As System.EventArgs) Handlers Butto1.Click
  Label1.Text = ListBox1.SelectedValue
End Sub
```

This event procedure relies on the fact that there is a property on the `ListBox` that identifies what the value is for the selected item — the `SelectedValue` property. In fact there is also a `SelectedText` value, because a `ListBox` has both a `Text` and a `Value` property; the `Text` is what's displayed, whereas the `Value` is stored in the page and not shown to the user. This is useful for values that come from a database, where the `Value` would be the ID of the item and the `Text` would be the description. The same is true for a `DropDownList` control.

Exercise 2

Modify Exercise 1 so that just selecting an item in the list posts back to the server (meaning you don't need to click the button). You'll need to add an event procedure to the `ListBox`, and in that event procedure you can use the same code from the `Click` event of the `Button` to display the selected value in the `Label`. Hint: The terms *postback* and *automatic* might be useful in your hunt for correct properties.

Solution

To allow the `ListBox` to post back automatically, you set the `AutoPostBack` property to `True`. Now when a list item is selected, the postback will happen right away, rather than waiting for a button to be clicked. On its own, this just posts back, so you also need an event procedure for the `ListBox`, and for this you use the `SelectedIndexChanged` event, which is raised when the selected item changes. The event is only raised when the selected item changes, so repeated clicking of the same item will not cause unnecessary postbacks. The event procedure should be

```
Protected Sub ListBox1_SelectedIndexChanged(ByVal sender As Object, _
         ByVal e As System.EventArgs) Handlers ListBox1.SelectedIndexChanged
  Label1.Text = ListBox1.SelectedValue
End Sub
```

The advantage of this event over a postback from a button event is that you can have your page change depending upon the user selection. For example, you could have a grid filter the data shown depending on the value in a list box.

Exercise 3

Modify the `EditSquad.aspx` example so that the `GridView` is refreshed when a new player is added to the squad. The technique is similar to the code you already have, but you'll need to use a different event. Remember that you can use the drop-down lists in the code view to find the events.

Solution

To refresh the `GridView` when a new player is added to the squad, you need to use the `Inserted` event. Just as when the data for a `SqlDataSource` control is updated, the `Updated` event is raised, when a new row is inserted, the `Inserted` event is raised. You can create this in exactly the same way as you did for the `Updated` event, and use the same code in the event procedure.

The code for the `Inserted` event procedure is

```
Protected Sub DetailsDataSource_Updated(ByVal sender As Object, _
        ByVal e As System.Web.UI.WebControls.SqlDataSourceStatusEventArgs) _
        Handles DetailsDataSource.Inserted
  GridView1.DataBind
End Sub
```

Chapter 7

Exercise 1

Describe the general capabilities of data source and data-bound controls.

Solution

Data source controls connect to the source of data and enable communicating to the database the information for behaviors such as reading, editing, and deleting.

Data-bound controls render spaces on the page that interact with the user, either to display values or to accept input for changes to the data.

Exercise 2

Which data-bound controls render data in tables?

Solution

`GridView` (one datum in each cell), `DataList`, and `Repeater` (all fields of one record in each cell).

Exercise 3

Compare and contrast the `DetailsView` and `FormView` controls.

Solution

Both present data in a tabular form with only one record displayed at a time. Both support reading and changing values, as well as creating and deleting entire records. The `DetailsView` control has a built-in default template, whereas `FormView` has no default template.

Exercise 4

Describe how a `GridView` control can limit its records to only those that match a player's name selected in a `DropDownList` of last names.

Solution

The `DropDownList` control displays names in its `Text` property, and also holds the player's ID number in the `Value` property. The `GridView` control has a `SelectCommand` that contains a `WHERE` clause that sets the ID equal to a parameter (prefaced by the @ sign). The `GridView` control also has a parameter tab containing a parameter that is filled with the value of the selected item of the `DropDownList`. Set `AutoPostBack` to `TRUE` in the `DropDownList` box so the following behavior is automatic. When a user changes a selection in the `DropDownList`, ASP.NET 2.0 automatically places the value of that selection into the `GridView` control's parameter tag, which means it will be employed in the `SelectCommand` `WHERE` clause. ASP.NET 2.0 will then cause the `GridView` control to create a new request for data using the new `SelectCommand`. The data returned will only have records that match the ID of the player selected in the `DropDownList`.

Exercise 5

Which data source control is best suited for the `Menu` or `SiteMapPath` data-bound controls?

Solution

The `SiteMapDataSource` is best suited because it is optimized to read the XML file holding the site description information.

Chapter 8

Exercise 1

Enabling the capability to write to a database requires changes to the properties of a data source control, a data-bound control, or both?

Solution

Both.

Exercise 2

Describe the difference between an `asp:Parameter` and an `asp:ControlParameter`.

Solution

An `asp:Parameter` holds the value that came from the record of the database. An `asp:ControlParameter` holds a value that was entered by the user into a control.

Exercise 3

What problem does the `DataKeyNames` property solve?

Solution

Some fields hold values that uniquely identify them among all the records. When a user changes values in those fields there is a conundrum in that ASP.NET 2.0 needs the old values in order to find the record and the new values for the writing. `DataKeyNames` are those fields for which ASP.NET 2.0 will hold both original and new values. When an update is made and a change is made to an ID field, ASP.NET 2.0 uses

the new value for the `SET` part of the command (which writes) and the old value for the `WHERE` part of the command (which finds the one record to change).

Exercise 4

A page needs to delete the date of birth value from one record. Which command should be used?

Solution

Update. Delete would only be used to eliminate the entire record, not just one value in the record.

Exercise 5

What tags must be added to a page to allow a `GridView` to create new records?

Solution

This is a trick question because a `GridView` cannot perform inserts. But the `GridView` can have a button that opens a `DetailsView` in `Insert` mode, which can create a new record.

Chapter 9

Exercise 1

Create a class and shared method (called `DeliveryDate`) to calculate delivery date given the date of an order. All deliveries should be made within three days of the order.

Solution

```
Public Class Orders
  Public Shared Function DeliveryDate(OrderDate As DateTime) As DateTime
    Return OrderDate.AddDays(3)
  End Function
End Class
```

This simply uses the `AddDays` method of the `DateTime` data type to add the required number of days.

Exercise 2

Continuing from Exercise 1, modify the `DeliveryDate` method to take into account that deliveries do not happen on the weekend.

Solution

```
Public Class Orders
  Public Shared Function DeliveryDate(OrderDate As DateTime) As DateTime

    Dim deliveryDay As DateTime = OrderDate.AddDays(3)

    If deliveryDate.DayOfWeek = DayOfWeek.Saturday Then
      deliveryDate = deliveryDate.AddDays(2)
    ElseIf deliveryDate.DayOfWeek = DayOfWeek.Sunday Then
      deliveryDate = deliveryDate.AddDays(2)
```

```
    End If

    Return deliveryDay
  End Function
End Class
```

Here the delivery date is calculated and checked to see if it falls on a Saturday or Sunday, in which case the delivery date is moved to the following Monday.

Exercise 3

Modify the `DeliveryDate` method to take into account that an order takes three working days to process. So orders falling on a Thursday will be delivered on the following Monday, and orders from Friday will be delivered on the following Tuesday.

Solution

```
Public Class Orders
  Public Shared Function DeliveryDate(OrderDate As DateTime) As DateTime

    Select Case OrderDate.DayOfWeek
      Case DayOfWeek.Monday, DayOfWeek.Tuesday, DayOfWeek.Wednesday
        Return OrderDate.AddDays(3)
      Case DayOfWeek.Thursday, DayOfWeek.Friday, DayOfWeek.Saturday
        Return OrderDate.AddDays(5)
      Case DayOfWeek.Sunday
        Return OrderDate.AddDays(4)
    End Select

  End Function
End Class
```

This version of the method uses the `Select Case` statement to calculate different dates depending on the day of week on which the order was placed.

Exercise 4

For each of the following Boolean expressions, say for what integer values of `A` each of them will evaluate to `True` and when they will evaluate to `False`:

a. NOT A=0

b. A > 0 OR A < 5

c. NOT A > 0 OR A < 5

d. A > 1 AND A < 5 OR A > 7 AND A < 10

e. A < 10 OR A > 12 AND NOT A > 20

Solution

a. `True` for all integers except zero. Without the `NOT`, the answer would only be zero. When you add the `NOT`, it reverses to be all numbers except zero.

b. `True` for all integers. The left side alone would be `True` for all integers greater than zero (only zero and negative integers would be false). The right side includes all integers that are less than 5, including zero and negative integers. With the `OR` clause an integer has to be within one of the two expressions in order for the entire expression to be `True`. When you combine these two sets of answers you get all integers. (The integers 1 through 4 are included by both expressions.)

c. `True` for integers 5 and below. Integers 6 and above will evaluate to `False`. The issue here is precedence between the `NOT` and `OR` operators. The `NOT` is only applied to the expression on the left of the `OR`. Think of this problem as `(NOT A > 0) OR (A < 5)`. On the left you have `True` for any numbers that are not greater than zero, so `True` is for zero and negative numbers. On the right you have `True` for any number that is less than 5. With the two sides of the `OR` combined, you have `True` for all negative numbers and zero and positive numbers up to 5. Numbers greater than and including 6 are `True` for either side and thus resolve to `False`.

d. `True` for 2, 3, 4, 8, and 9 only. Like the previous problem, the issue is to establish the precedence of the operators. Think of this as `(A > 1 AND A < 5) OR (A > 7 AND A < 10)`. On the left of the `OR` you can see that only integers 2, 3, and 4 would fit both criteria. On the right side of the `OR` the situation is similar; only 8 and 9 meet both criteria. When you consider the `OR` you have to combine those two answer sets.

e. `True` for all integers 9 and below (including zero and negatives) and for 13 through 20 inclusive. `False` for 10, 11, 12, and all integers above (and inclusive of) 21. Think of this problem with some parentheses. The `OR` is the last to be evaluated, so your parentheses are `(A < 10) OR (A > 12 AND NOT A > 20)`. First look at the right side of the `OR`. Integers must meet both tests when there is an `AND` clause, so that would be 13 through 20 are `True`. Now look at the left side of the `OR`. Any number less than 10 will be `True`. The final answer is the combination of those two answer sets.

Chapter 10

Exercise 1

Create a new web site and a new page called `CodeBehind.aspx` with a single label, but making sure that you don't check the box marked Placed Code in a Separate File. Now create a code-behind file manually for that page that displays the content of the label.

Solution

Create a class called `CodeBehind.cs`. Add the following line of code to the `CodeBehind.aspx`:

```
<@Page CodeFile="CodeBehind.cs" Class="CodeBehind" %>
```

In the `CodeBehind.aspx` file, add the following within the `Page_Load` event:

```
Label1.Text = "Hello World"
```

Exercise 2

How would you go about adding an image to accompany each news item? Note that it shouldn't display if there is no news image present for that article.

Solution

Add the following to `newsusercontrol.ascx`:

```
            <span class="newsContent">
                <asp:Image style="float:right" ID="NewsImage" Runat="server"
                    ImageUrl='<%# Eval("PictureURL", "~/NewsImages/{0}") %>' />
                <%#Eval("Description") %>
            </span>
```

Add the following event handler that is called when an item of news is bound:

```
        Sub NewsItem_DataBound(ByVal sender As Object, ByVal e As
        System.Web.UI.WebControls.RepeaterItemEventArgs)
            Dim row As DataRowView
            Dim img As Image
            If e.Item.ItemType = ListItemType.Item Or e.Item.ItemType =
           ListItemType.AlternatingItem Then

                row = CType(e.Item.DataItem, DataRowView)

                If row("PictureUrl").ToString().Trim() = "" Then
                    img = CType(e.Item.FindControl("NewsImage"), Image)
                    img.Visible = False
                End If
            End If
        End Sub
```

Chapter 11

Exercise 1

Create a new user account called Admin, and make this user a member of all of the groups. Log in to the Wrox United site as Admin and test to see whether you can access all of the different pages in both the fan club and the administration section.

Solution

Launch the ASP.NET Web Site Administration Tool and configure the Admin user as shown in Figure A-5.

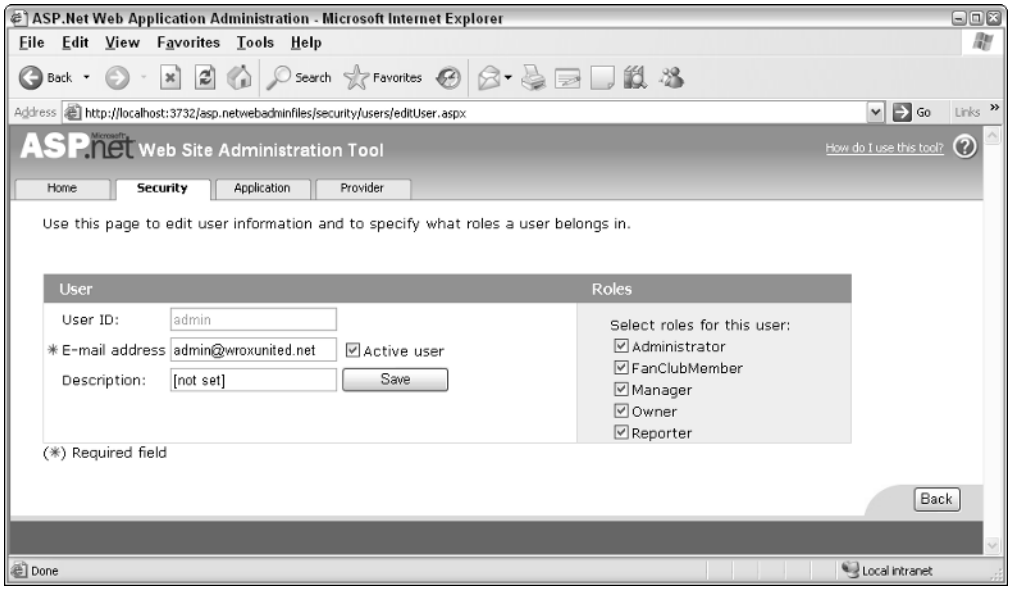


Figure A-5

Exercise 2

Remove the Admin user from any role other than the Administrator role and test the site again. Ensure that you can access the following pages:

- `Admin.aspx`
- `EditNews.aspx`
- `UpdateProducts.aspx`

Solution

The Admin user account should now have the configuration shown in Figure A-6.

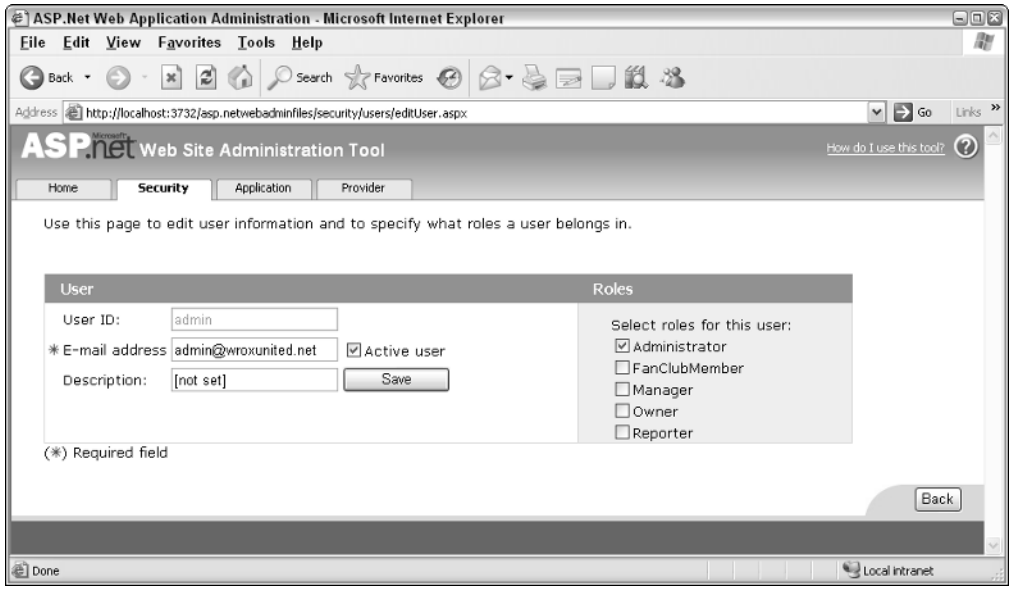


Figure A-6

And if you try to access the Wrox United site, you'll see the links in Figure A-7 within the Administration section.

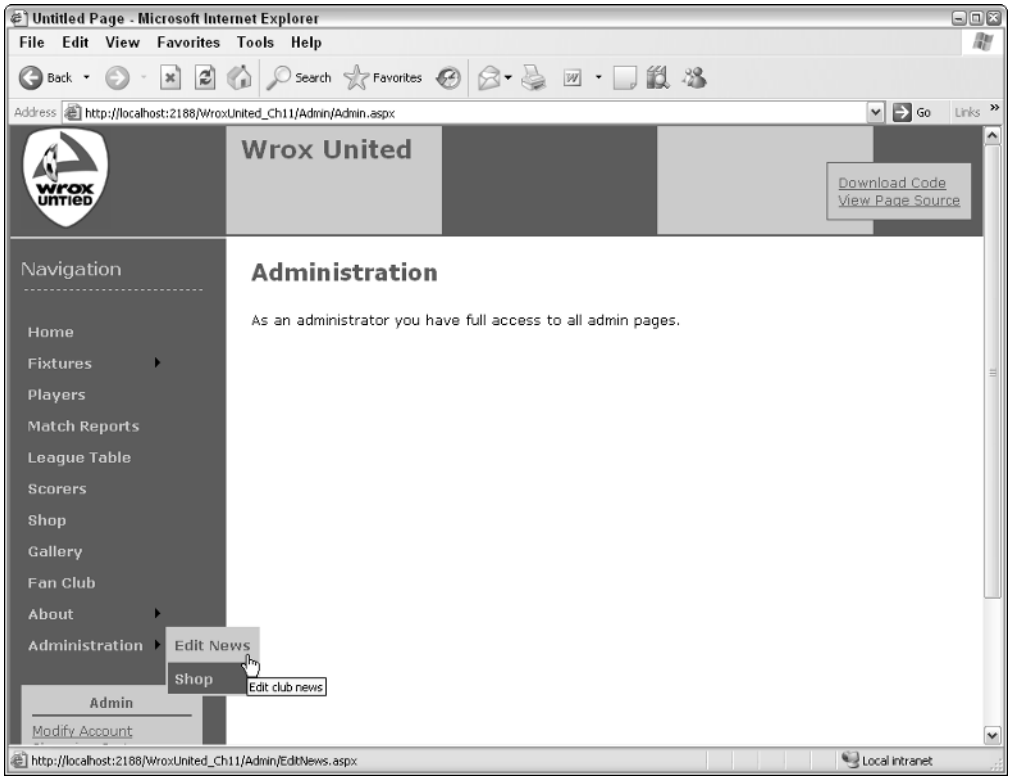


Figure A-7

Not only can you see these links, but clicking these links will take you to the appropriate pages.

Exercise 3

The Admin user has had a request by a reporter out in the field — he's uploaded a score for a match, but the score has just changed! Unfortunately, the reporter's laptop has run out of battery, so he's asked the Admin to update the score for him. Make sure that the Admin user can update the score of a match.

Solution

You have two options. First, you could add the Admin user to the Reporters role, thereby enabling the access to the page as desired. The alternative is to enable access to the `UpdateScore.aspx` page on the site to all site Administrators by making the following change to the `Web.config` file within the root of the Admin folder:

```
<location path="UpdateScore.aspx">
    <system.web>
      <authorization>
        <allow roles="Administrator, Reporter" />
      </authorization>
    </system.web>
  </location>
```

Whichever method you decide on, the Admin user needs to be able to access the `UpdateScore.aspx` page. If you are successful, you will see Figure A-8.

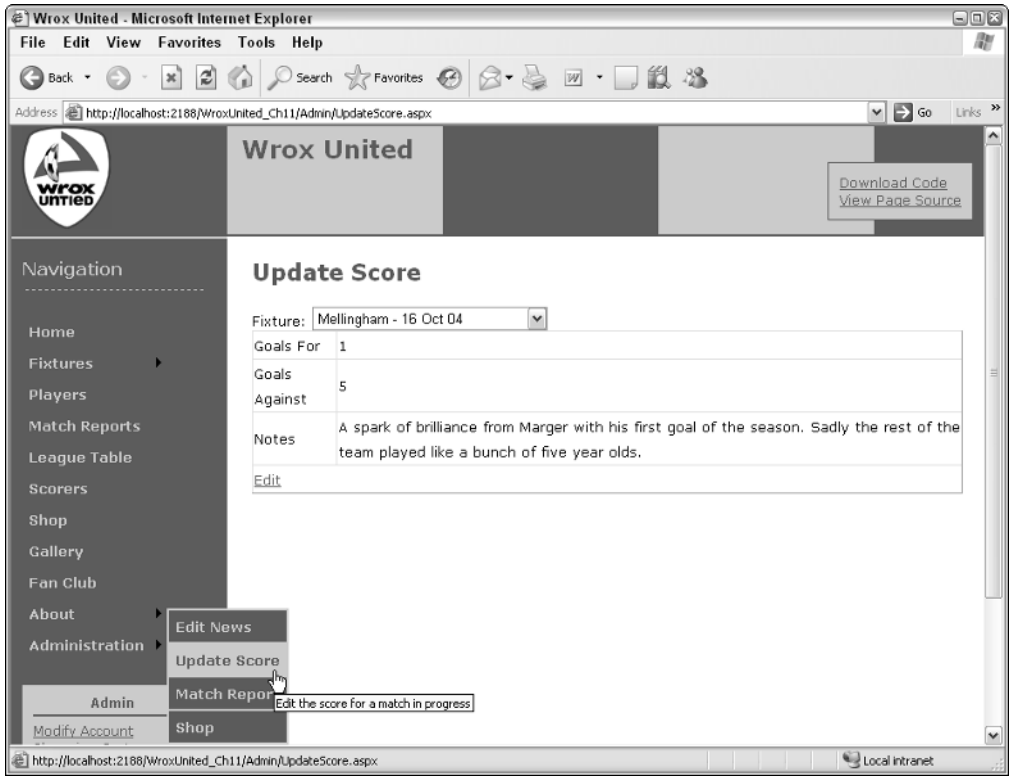


Figure A-8

Exercise 4

Add a field to the user profile for the Wrox United application called `DateOfBirth`. Give this property a data type of `System.DateTime`. Add an input field to the `FanClub.aspx` page so that users can update their date of birth. Note that you will need to convert the value entered in a text box to a `DateTime` value when you save the data — you might want to try the `DateTime.Parse()` function for this purpose. To retrieve the data, use the `Profile.DateOfBirth.ToShortDateString()` function.

Solution

1. First, add the following highlighted line to `Web.config`:

```
<profile enabled="true">
  <properties>
    <add name="MemberName"/>
    <add name="Name"/>
    <add name="Address"/>
    <add name="City"/>
```

```
      <add name="County"/>
      <add name="PostCode"/>
      <add name="Country"/>
      <add name="Mailings" type="System.Boolean"/>
      <add name="Email"/>
      <add name="DateOfBirth" type="System.DateTime"/>
      <add name="Theme"/>
      <add name="Cart" serializeAs="Binary" type="Wrox.Commerce.ShoppingCart"
allowAnonymous="true"/>
    </properties>
</profile>
```

2. Next, modify `FanClub.aspx` to include a text box for entering and displaying the date of birth:

```
<span class="boxFloat">Name:<br />
  Address:<br />
  <br />
  <br />
  <br />
  City:<br />
  County:<br />
  Postcode:<br />
  Country:<br />
  Subscribe to email updates:<br />
  Email:<br />
  Date of Birth: <br />
  Membership Alias:<br />
  Theme:</span><span>
    <asp:TextBox ID="txtName" runat="server" Columns="30" />
    <br />
    ...
    <asp:TextBox ID="txtEmail" runat="server" />
    <br />
    <asp:TextBox ID="txtDoB" runat="server" />
    <br />
    <asp:TextBox ID="txtAlias" runat="server" />
    <br />
    ...
  </span>
```

3. The code file for the `FanClub.aspx` page also needs some changes. First, modify the `btnSaveChanges_Click` event handler code:

```
Sub btnSaveChanges_Click(ByVal sender As Object, ByVal e As System.EventArgs)

  Profile.Name = CType(FCLoginView.FindControl("txtName"), TextBox).Text
  Profile.Address = CType(FCLoginView.FindControl("txtAddress"), TextBox).Text
  Profile.City = CType(FCLoginView.FindControl("txtCity"), TextBox).Text
  Profile.County = CType(FCLoginView.FindControl("txtCounty"), TextBox).Text
```

```
    Profile.PostCode = CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text
    Profile.Country = CType(FCLoginView.FindControl("txtCountry"), TextBox).Text
    Profile.Mailings = CType(FCLoginView.FindControl("chkMailing"), CheckBox).Checked
    Profile.Email = CType(FCLoginView.FindControl("txtEmail"), TextBox).Text
    Profile.MemberName = CType(FCLoginView.FindControl("txtAlias"), TextBox).Text
    Profile.Theme = CType(FCLoginView.FindControl("ThemeList"),
DropDownList).SelectedValue
    Dim DoB As TextBox = CType(FCLoginView.FindControl("txtDoB"), TextBox)
    If DoB.Text <> "" Then
      Profile.DateOfBirth = DateTime.Parse(DoB.Text)
    End If

    Server.Transfer(SiteMap.CurrentNode.Url)

End Sub
```

Note that you need to check that the text box is not empty (if you try to save with an empty text box, you'll see an error page due to an exception).

4. Finally, add the following code to the `DisplayProfileProperties()` method:

```
Private Sub DisplayProfileProperties()
  Dim NameBox As TextBox = CType(FCLoginView.FindControl("txtName"), TextBox)
  If Not (NameBox Is Nothing) Then
    CType(FCLoginView.FindControl("txtName"), TextBox).Text = Profile.Name
    CType(FCLoginView.FindControl("txtAddress"), TextBox).Text = Profile.Address
    CType(FCLoginView.FindControl("txtCity"), TextBox).Text = Profile.City
    CType(FCLoginView.FindControl("txtCounty"), TextBox).Text = Profile.County
    CType(FCLoginView.FindControl("txtPostCode"), TextBox).Text = Profile.PostCode
    CType(FCLoginView.FindControl("txtCountry"), TextBox).Text = Profile.Country
    CType(FCLoginView.FindControl("chkMailing"), CheckBox).Checked = _
      Profile.Mailings
    CType(FCLoginView.FindControl("txtEmail"), TextBox).Text = Profile.Email
    CType(FCLoginView.FindControl("txtAlias"), TextBox).Text = Profile.MemberName
    CType(FCLoginView.FindControl("ThemeList"), DropDownList).SelectedValue = _
      Profile.Theme
    CType(FCLoginView.FindControl("txtDoB"), TextBox).Text = _
      Profile.DateOfBirth.ToShortDateString()
  End If
End Sub
```

This code will convert the `DateTime` value stored in the user's profile into its string representation so that it can be displayed on the screen. Because users are unlikely to know the exact time they were born, you can ignore the time part of the date—hence why you've used the `ToShortDateString()` instead of `ToString()` method. Once finished, you can test it out on the user of your choice. In Figure A-9, I've used Alan the Admin.

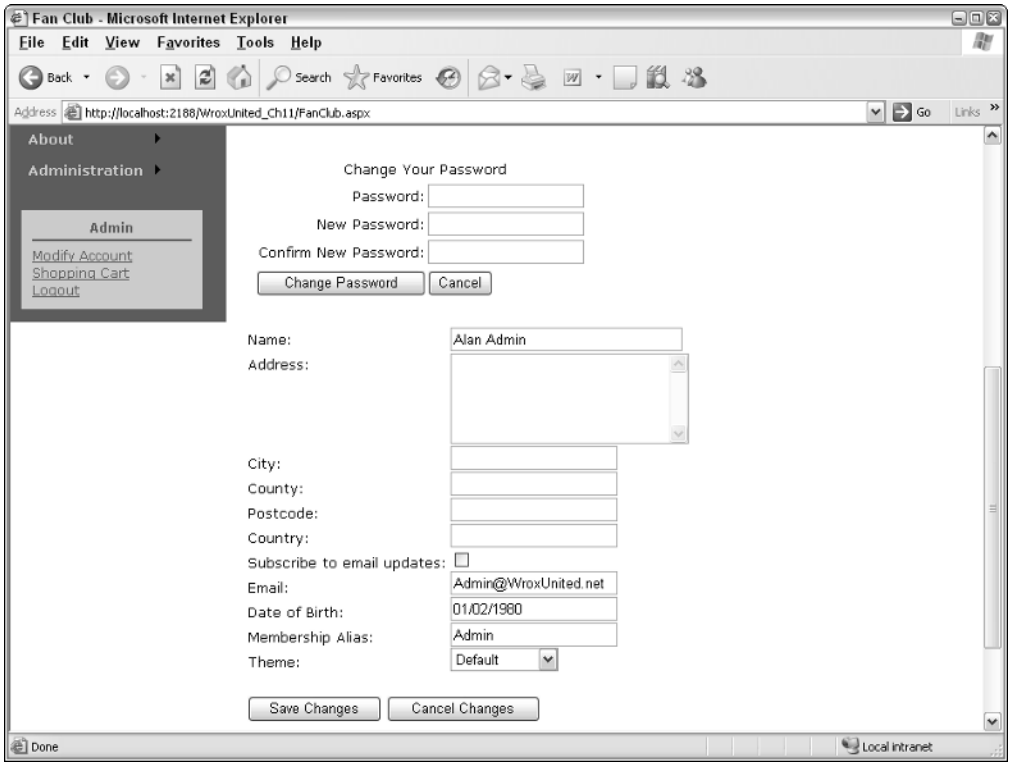


Figure A-9

Chapter 12

Exercise 1

What is the role of `SOAP` in web services?

Solution

`SOAP` is a framework for exchanging messages. Its role in web services is to parcel up function calls and parameters to enable you to call the web services remotely in a standardized way.

Exercise 2

Create a web service that retrieves a Wrox United score wherever they've scored more than one goal.

Solution

```
    <WebMethod()> _
    Public Function Fixtures() As DataSet

        Dim conn As New _
SqlConnection(ConfigurationManager.ConnectionStrings("WroxUnited").ConnectionString
)
        Dim adapter As New SqlDataAdapter("SELECT FixtureDate, Opponents, _
FixtureType, GoalsFor, GoalsAgainst FROM Fixtures WHERE GoalsFor>1 ORDER BY _
FixtureDate", conn)
        Dim ds As New DataSet()

        adapter.Fill(ds, "Fixtures")

        Return ds

    End Function

End Class
```

Exercise 3

Create a page that consumes the third-party weather forecast for Birmingham, United Kingdom. (Hint: You will also need to discover this service first.)

Solution

Add a Web Reference first via the Add Web Reference function and discover the service by typing the URL `www.webservicex.net/globalweather.asmx`.

Create a blank page and add a label called Weather Label to it. Then add the following code to the code-behind:

```
Partial Class WeatherPage
 Inherits System.Web.UI.Page

 Protected Sub Page_Load(ByVal sender As Object, ByVal e As EventArgs)
                                                                Handles Me.Load
        Dim wsConvert As New net.webservicex.www.GlobalWeather
        wsConvert.Credentials = System.Net.CredentialCache.DefaultCredentials
        WeatherLabel.Text = wsConvert.GetWeather("Birmingham", "United
       Kingdom").ToString()
End Sub
End Class
```

Chapter 13

Exercise 1

The member discount is something that is applied to the shopping cart as you add items to the cart. What do you need to add to the `ShoppingCart` object to make sure it can store a discount of 10% for fan club members? You can assume that you can detect a fan club member with the property: `HttpContext.Current.User.IsInRole("FanClubMember")`.

Hint: You will need to create a subtotal as well.

Solution

You need to create a `MemberDiscount` property first:

```
 Public Class ShoppingCart

        Private Const MemberDiscountPercentage As Single = 0.1
        ...
       Public ReadOnly Property MemberDiscount() As Double
            Get
                If HttpContext.Current.User.IsInRole("FanClubMember") Then
                    Return SubTotal * MemberDiscountPercentage
                Else
                    Return 0
                End If
            End Get
        End Property
```

Then you need to create a `SubTotal` property because between the total and the individual prices of the items, you need to show how you arrive at your figures — otherwise, it will just look like your shopping cart doesn't add up correctly:

```
Public ReadOnly Property SubTotal() As Double
            Get
                Dim t As Double
                If _items Is Nothing Then
                    Return 0
                End If
                For Each Item As CartItem In _items
                    t += Item.LineTotal
                Next
                Return t
            End Get
        End Property
```

Then you'll need in SourceView to add a Panel called DiscountPanel and add two labels, one called SubTotalLabel and another called MemberDiscount and make sure both contain nothing to begin with and that both are visible.

You'll also need to add some extra parameters to the checkout.aspx page called @subtotal and @memberdiscount and make sure they are added as part of the INSERT clause in this page as well.

Exercise 2

How can you display the member discount details on the Shopping Cart page so that only a fan club member will see them?

Solution

You need to check to see whether a user is in the role FanClubMember and only if they are do you then apply the extra formatting to show the subtotal and the member discount items. Last, you display the discount panel:

```
        If Context.User.IsInRole("FanClubMember") Then
            SubTotalLabel.Text = String.Format("Sub-Total:{0,35:C}",
            Profile.Cart.SubTotal)
            MemberDiscount.Text = String.Format("Member Discount:{0:C}",
            Profile.Cart.MemberDiscount)
            DiscountPanel.Visible = True
        End If
```

Chapter 14

Exercise 1

Convert the two shop pages, `Shop.aspx` and `ShopItem.aspx`, from using SQL statements to stored procedures.

Solution

For `Shop.aspx` you need to create the following stored procedure:

```
CREATE PROCEDCURE dbo.usp_Shop
AS
  SELECT ProductID, Name, Description, Price, PictureURL
  FROM Products
  ORDER BY Name
```

Next, change the `SelectCommand` from the SQL to `usp_Shop`.

For `ShopItem.aspx` the stored procedure should be

```
CREATE PROCEDURE dbo.usp_ShopItem
  @ProductID int
AS
  SELECT *
  FROM Products
  WHERE ProductID = @ProductID
```

Next, change the `SelectCommand` from the SQL to `usp_ShopItem`.

Exercise 2

Add caching to the `ShopItem.aspx` page, so that the page is cached. Note that you need to take into account that this page shows different products, so the cache needs to be varied by the product being shown.

Solution

For this you simply add the `OutputCache` directive to the page, but because the product being shown is defined in the querystring, you need to vary by the following querystring:

```
<%@ OutputCache Duration="3600" VaryByParam="ProductID" %>
```

Chapter 15

Exercise 1

Add defensive coding to the `GenerateThumbnail` method of the `ImageHandling` class stored in the `App_Code` directory.

Solution

Having learned what you have about defensive coding and exceptions, you might be tempted to change the code for `GenerateThumbnail` to that shown in the chapter, where both defensive coding and exception handling were used. However, during the chapter you used the `Application_Error` event to centrally log exceptions, so the explicit logging within `GenerateThumbnail` isn't required. But you still need to code against a missing source file, so the code could be changed to the following:

```
Public Shared Sub GenerateThumbnail(ByVal SourceImagePath As String, _
                                    ByVal TargetImagePath As String)

    If Not File.Exists(sourceImagePath) Then
      Return
    End If

    Dim newHeight As Short
    Dim newWidth As Short

    Using sourceImage As Image = Image.FromFile(SourceImagePath)

      newHeight = CShort(sourceImage.Height * 0.25)
      newWidth = CShort(sourceImage.Width * 0.25)

      Dim cb As New Image.GetThumbnailImageAbort(AddressOf ThumbnailCallback)
      Using targetImage As Image = _
            sourceImage.GetThumbnailImage(newWidth, newHeight, cb, IntPtr.Zero)
        targetImage.Save(TargetImagePath, Imaging.ImageFormat.Gif)
      End Using
    End Using

End Sub
```

This does assume that a failure generating the thumbnail isn't critical, which may not be a correct assumption. Thumbnails are generated when pictures are uploaded to the site, pictures such as products for the shop, match photos, and so on. The site can run quite happily when these images are missing, so it isn't critical, and any exception would be logged by the central code so the site administrators would know about it.

Exercise 2

Add validation controls to the Checkout page, the part that accepts the delivery address. There is a checkbox to copy the address from the membership details of the user, but there is nothing to ensure that all of the fields are filled in.

Solution

To ensure data is entered into the address boxes, `RequiredFieldValidator` controls can be used. You can add a validator for each `TextBox`, adding it next to the field it validates:

```
<tr><td><asp:TextBox id="txtName" runat="server" />
        <asp:RequiredFieldValidator id="rfv1" runat="server"
          ControlToValidate="txtName" Text="*"
          ErrorMessage="You must enter a value for the delivery name" />
</td></tr>
```

You will also need a `ValidationSummary`, which can be put after the table containing the address fields:

```
  </table>
  <asp:ValidationSummary id="vs" runat="server" DisplayMode="BulletList" />
</asp:WizardStep>
```

Exercise 3

Use the debugger. No really, use it.

Solution

This exercise is more important than you realize, because learning how to debug is critical, especially as a beginner. When learning, you tend to make more mistakes, or perhaps code less efficiently than you do with years of experience. That's only natural, and learning how to quickly track down bugs will make you a better developer, not only because you'll be good at finding bugs, but also because in finding those bugs you learn what the problem was and how to avoid it next time. So in finding bugs you become a better coder.

Chapter 16

Exercise 1

You are now developer and maintainer of the Wrox United web site. What else would you add to the Wrox United site? Make a list of possible add-ons, and prioritize them with the simplest to do first. Implement some of these add-ons.

Solution

There is no hard and fast solution to this exercise, but to get some ideas for add-ons to your site, or to compare notes with other developers and the authors of this book, head over to `http://p2p.wrox.com` and look for this book's discussion board. Note that this forum is purely for this topic and not for customer feedback or book problems.

B

Setup

The ASP.NET 2.0 runtime comes as part of the Visual Web Developer Express download. ASP has undergone an evolution in terms of setup, each version being simpler (although often larger and lengthier) to install than the previous one. In classic ASP 2.0, ASP was separate even from the IIS web server itself, both of which had to be downloaded and attached manually to IIS. By version 3.0 of classic ASP, ASP had been integrated with the web server. With ASP.NET 1.x you had to download the .NET Framework separately to get ASP, and enable IIS, which by then was part of the operating system. However, throughout each of these iterations you still had to download and install a database solution separately.

With ASP.NET 2.0, all four parts come together in one easy-to-install package — Visual Web Developer Express 2005. ASP.NET 2.0, web server, development tools, and database are all installed at the same time. The web server is a test-development server nicknamed Cassini (after the discoverer of the gaps and particular matter in the rings of Saturn) and can run without IIS, alongside IIS, or you can choose to use IIS in place of Cassini instead.

System Requirements

Before you install VWD Express, you should check that your system meets the minimum requirements. We have taken the requirements from the Microsoft web site. They are as follows:

Processor

- **Minimum:** 600 megahertz (MHz) Pentium processor.
- **Recommended:** 1 gigahertz (GHz) Pentium processor.

Operating System

VWD Express can be installed on any of the following systems:

- Microsoft Windows 2003 Server.
- Windows XP (Home Edition and Professional), Service Pack 2.
- Windows 2000 (Professional and Server), Service Pack 4.

RAM

- **Minimum:** 128 megabytes (MB).
- **Recommended:** 256 MB.

Hard Disk

Up to 1.3 GB of available space may be required.

CD or DVD Drive

Not required.

Display

- **Minimum:** 800×600 256 colors.
- **Recommended:** 1024×768 High Color — 16-bit.

Mouse

Microsoft mouse or compatible pointing device.

As with plenty of Microsoft technologies, you'll find that it may well work on other older setups; however, we cannot recommend this and we won't answer questions about it either.

Visual Web Developer Express Installation

1. Go to the following URL: `http://lab.msdn.microsoft.com/express/vwd/`.
2. Click the link to download from here, and you will see the page shown in Figure B-1 asking you whether you want to run or save the file.

If you're using a dialup connection, please remain connected after you have downloaded this file, because you will still need an active connection later during the installation process.

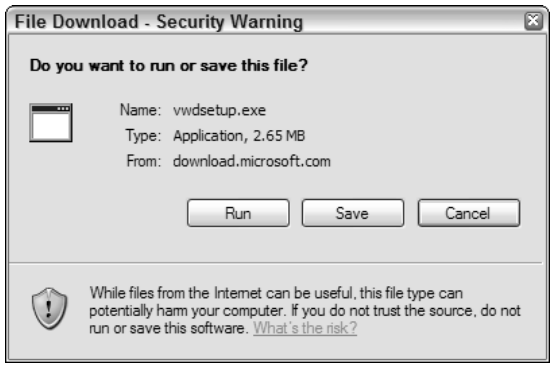


Figure B-1

3. Click Run and you will see the dialog shown in Figure B-2 once the `vwdsetup.exe` file has fully downloaded.

Figure B-2

4. Next, you will be asked whether you want to submit anonymous information about your setup experiences (see Figure B-3). If you want to send information about your setup experience, check the box. If not, click Next.

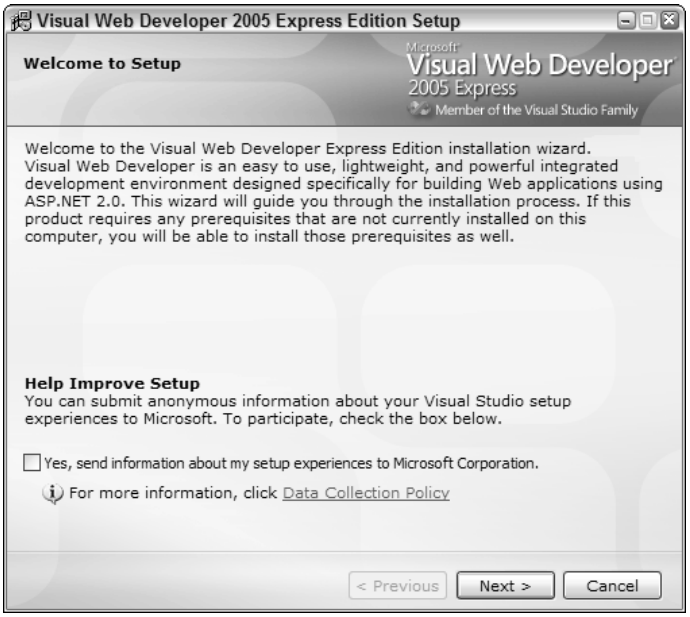


Figure B-3

5. In the next screen, shown in Figure B-4, you will see the end-user license agreement (EULA). You have to agree to this to continue, so check the box and click Next:

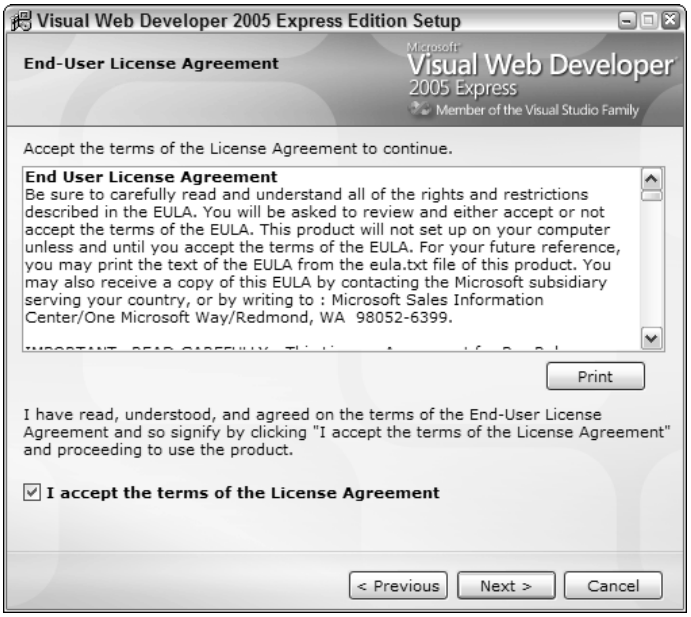


Figure B-4

6. After accepting the terms of the EULA, you then specify which installation options you want to install in addition to .NET 2.0 and Visual Web Developer Express. The only compulsory option for this book is SQL Server 2005 Express. As shown in Figure B-5, select that option and click Next.

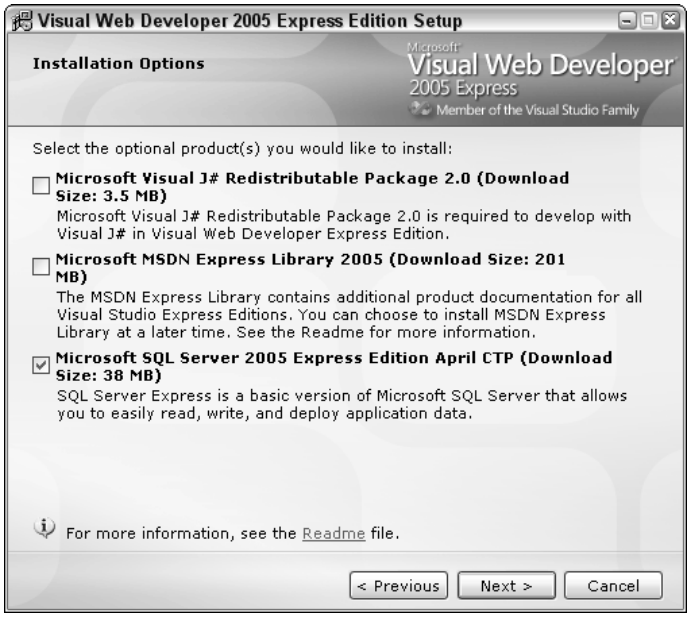


Figure B-5

7. Next, you have to specify where to install VWD (see Figure B-6). I suggest selecting the default, which is C:\Program Files\Microsoft Visual Studio 8, and clicking Install to begin the setup.

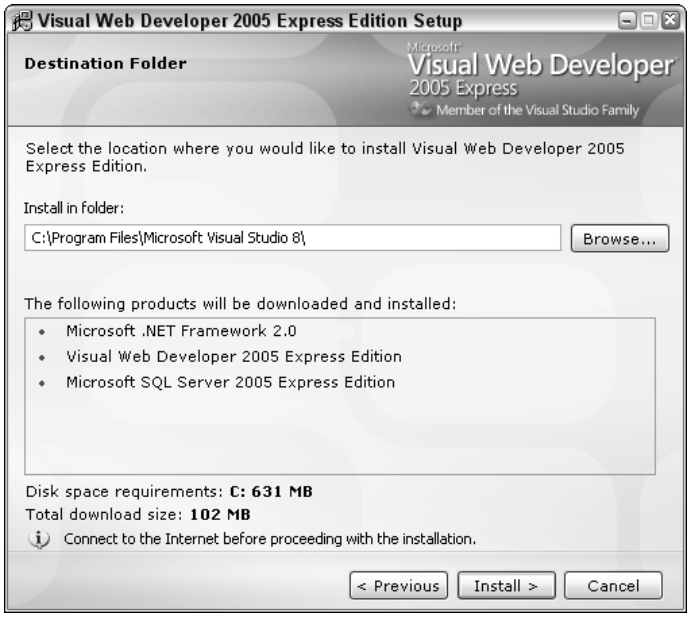


Figure B-6

Unfortunately, downloading of all the components must now commence (see Figure B-7), and with 102MB this can take quite a while.

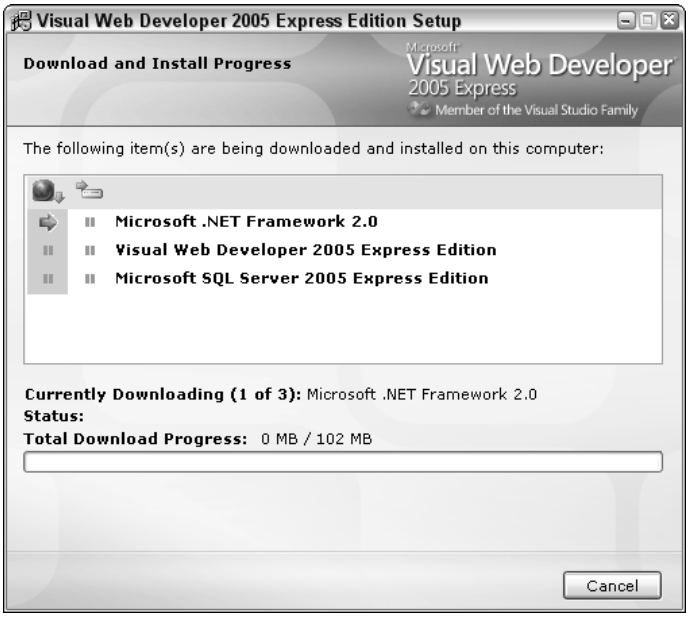


Figure B-7

Don't be surprised to see Microsoft .NET Framework 2.0 continue to download for quite a while after reaching the 102MB; this isn't unusual. Once it has completed this stage, it will begin installation of the downloaded components, shown in Figure B-8.

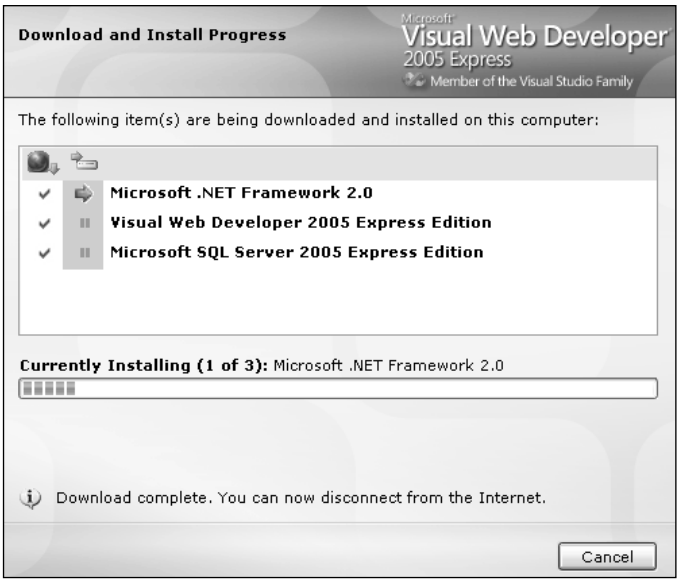


Figure B-8

SQL Server needs Internet access during installation, so please make sure it can access the Internet. Otherwise the installation will fail.

8. At the end of this installation, you should see the screen shown in Figure B-9, asking you to restart your machine. You should oblige by clicking Restart Now.

By chance, you may not see this screen. As a general rule, you shouldn't restart more often than necessary, so if you're not prompted to restart, don't do it.

Figure B-9

9. After your machine has restarted, the dialog depicted in Figure B-10 will be displayed, notifying you of a successful install (or any problems that were encountered) and reminding you to register the software within 30 days.

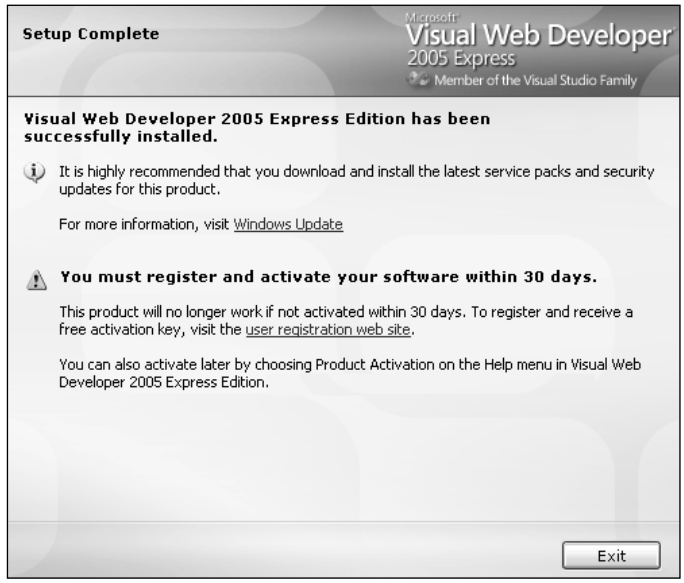


Figure B-10

10. Click Exit and you will now be able to start up both Visual Web Developer and SQL Express.

Web Site Folder Setup

Next, set up the Websites folder with Windows Explorer, and create the folders C:\Websites\WroxUnited (or use whichever drive is appropriate to your setup).

> **To create a folder in Windows Explorer, select File ➪ New Folder and type in the name Websites.**

IIS Setup (Optional)

As we've already mentioned, Visual Web Developer Express comes with its own web server, nicknamed Cassini. However, some of you might want to use IIS anyway. To use IIS, you must have Windows XP Professional, Windows 2000, or Windows 2003 Server installed. Windows XP Home Edition comes without IIS, and it isn't possible to install it on Home Edition if you do manage to get a copy of IIS. To begin the install, follow these steps:

1. To install IIS go to the Start menu, navigate to Settings ➪ Control Panel, and click Add or Remove Programs. From the left-hand menu of the dialog (shown in Figure B-11), select the Add/Remove Windows Components icon.

Figure B-11

2. This will bring up the Windows Components Wizard. Make sure the Internet Information Services option is selected, as shown in Figure B-12.

Figure B-12

3. Click Details and you can select which of the options to install (see Figure B-13). You won't need all of the options, though you can install them separately at a later point. However, you *must* make sure that you select the Common Files, the IIS snap-in, the Front Page Extensions, and the World Wide Web Services options, because these are necessary to work with ASP.NET 2.0 and Visual Web Developer Express.

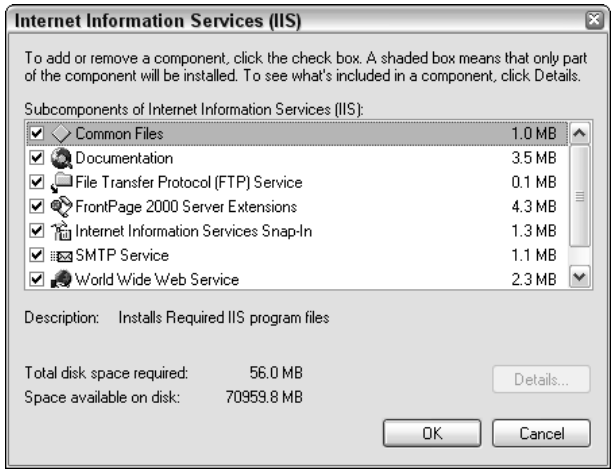


Figure B-13

4. Click OK and make sure you have the Windows CD handy for the installation.

Create Alias

If you choose to install IIS and want to use the Wrox United sample web site on IIS, you will need to an alias so that IIS can recognize which application you mean and serve it accordingly. The following steps walk you through creating an alias:

1. From the Start menu, select Run, and type **MMC** in the text box and click OK. In the MMC dialog that appears, select File➪ Add/Remove Snap In. Click the Add button and select IIS Virtual Directory Management from the dialog that appears, as depicted in Figure B-14.

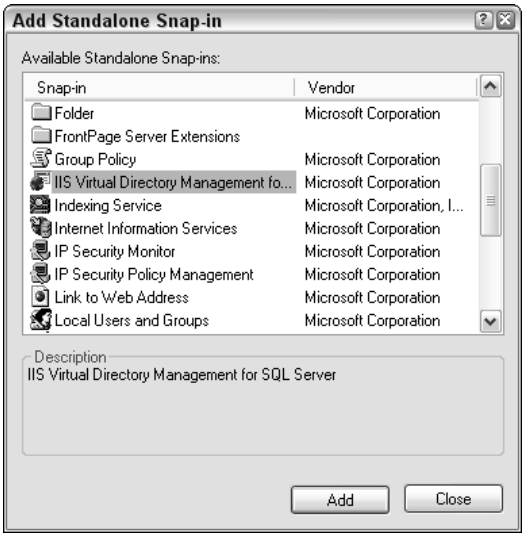


Figure B-14

2. Next, as shown in Figure B-15, expand the IIS Virtual Directory Management. Underneath that will be your computer's name; expand that as well.

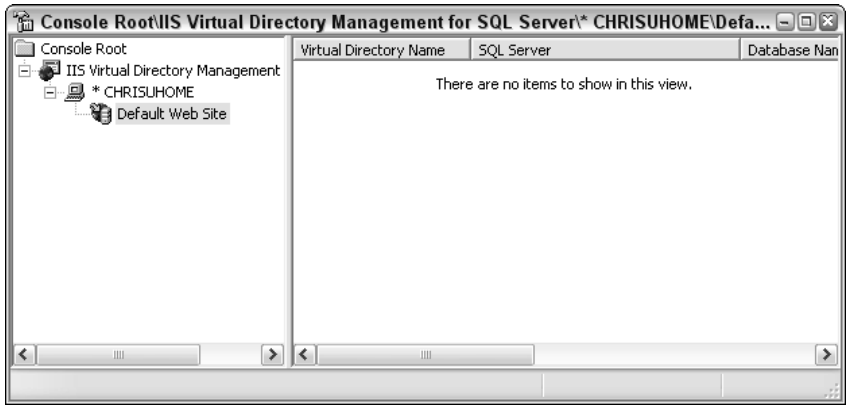


Figure B-15

3. Right-click Default Web Site, and select New ➪ Virtual Directory from the menu to start the wizard. Type in **WroxUnited** as the Virtual Directory Name and **C:\Websites\WroxUnited** as the local path, as in Figure B-16.

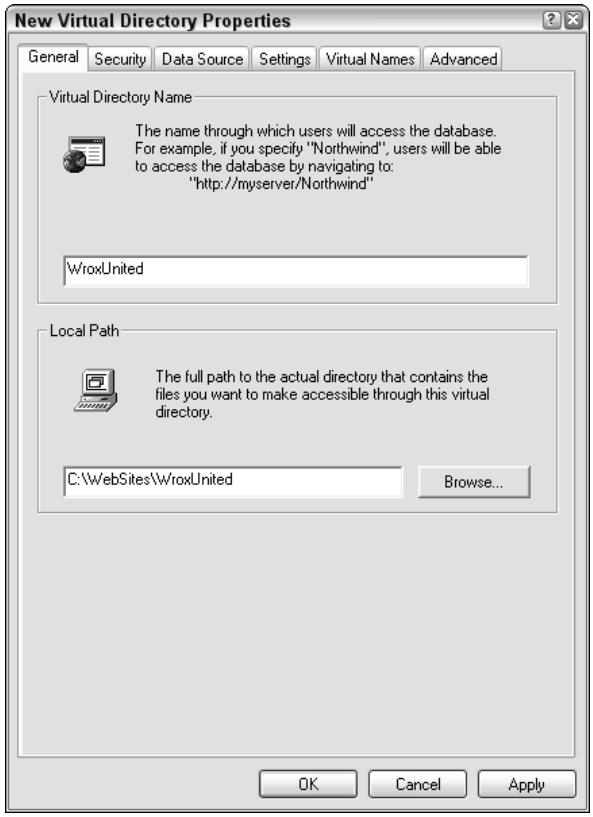


Figure B-16

4. Click Apply and then OK, which will finish the wizard. Close the MMC Console. A save is optional; you can supply a name if you so want.

Wrox United Installation

Go to `www.wrox.com` and search for the dedicated page for Beginning ASP.NET 2.0. Once there, you can download the Wrox United code, which comes as a single downloadable zip file containing the database and application. Download the file `WroxUnited.zip` and save to the C:\Website\WroxUnited folder you created earlier. Next, unzip this file to C:\Website\WroxUnited. After extraction, you should have 146 files and 5632kb total size. Check with Windows Explorer that inside your C:\WebSites\WroxUnited is an `App_Data` folder and that it has four files.

In particular, make sure that the following file names are present:

- `WroxUnited.mdf`
- `ASPNET.mdf`
- `WroxUnited_log.mdf`
- `ASPNET_log.mdf`

If not, go back and try downloading the zip file again.

Network Service Enabling

The last step before you can test the application is that you might need to add Write permissions to the Network Service account. This will allow ASP.NET to use the database and to read data from it and write data to it, as routinely required throughout the course of this book. You can skip this step if you are using Windows Server 2003, because the Network Service account has these permissions already enabled by default. If not, then you will almost certainly have to enable Write permissions first. Let's begin, shall we?

1. To enable Write permissions, go to Windows Explorer and select the C:\WebSites\WroxUnited\App_Data folder. Right-click it and select Sharing and Security. Select the Security tab, shown in Figure B-17.

Figure B-17

If you can't see the Security tab this is because you have Simple File Sharing switched on. To disable it select Tools ➪ Folder Options from Windows Explorer, and select the View tab. Scroll to the bottom and uncheck the Use Simple File Sharing option (see Figure B-18). If you can't see the Simple File Sharing option, this is because you have Windows XP Home Edition installed and it has Simple File Sharing switched on permanently, and you cannot change it. Instead, you will have to take another course as outlined in the next section.

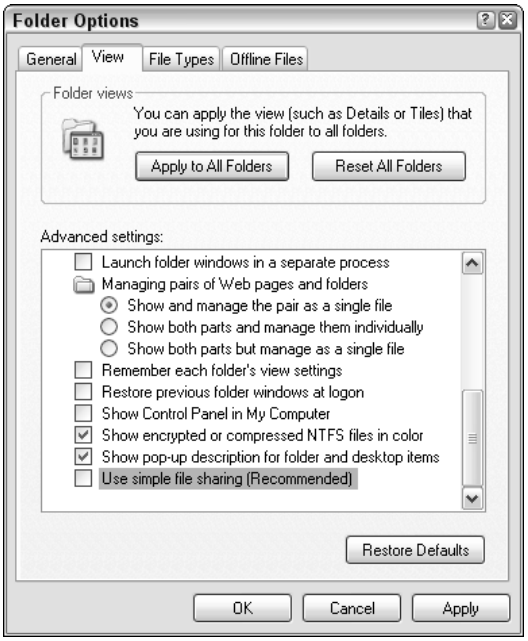


Figure B-18

2. Click the Add button in the Wrox United Properties dialog and in the Select Users or Groups dialog that appears. Type **NETWORK SERVICE** into the text box and click Check Names. NETWORK SERVICE will become underlined, as shown in Figure B-19.

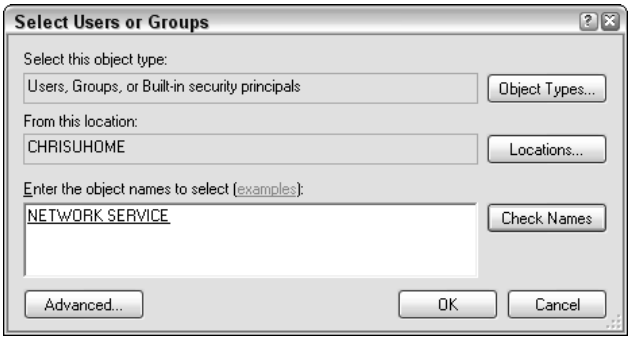


Figure B-19

If the machine is joined to a domain, the user must select the Locations button first and pick the current machine, rather than the domain. That's because NETWORK SERVICE is an account on your machine. By default the dialog will attempt to add the domain name, rather than the machine name.

3. Click OK. You are returned to the Wrox United Properties dialog once more. This time select the new NETWORK SERVICE option. Scroll down and check the box next to Write (see Figure B-20). Click Apply, and then click OK.

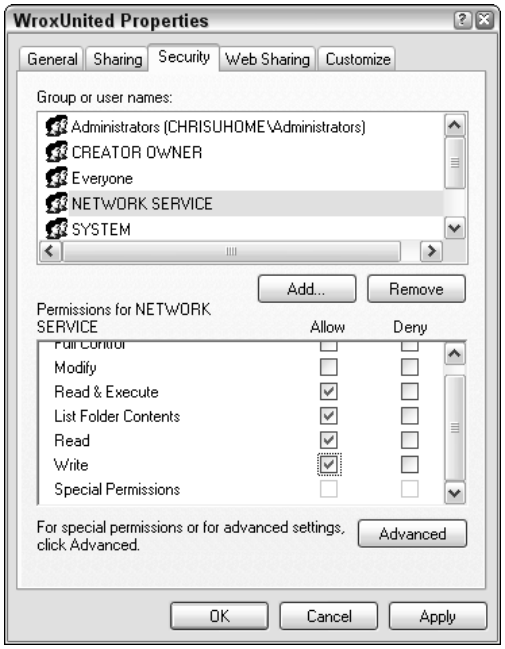


Figure B-20

This will enable your account to access the database.

Windows XP Home Edition Users Only

If, when you come to browse for a Security tab in Windows Explorer, you can't find one, this is because you have Windows XP Home Edition installed and you have a slightly more complex route to enable the correct permissions. Apparently, Windows XP Home Edition users just aren't allowed to have the same kind of power as their XP Professional counterparts. To get around it, restart your computer in Safe Mode.

To do this, restart your machine, and before the Windows XP logo appears, hold down the F8 key and select Safe Mode. Let XP continue and then log in as Administrator. You'll receive a warning about running in Safe Mode, but click Yes anyway. Locate the C:\WebSites\WroxUnited folder in Windows Explorer and right-click the `App_Data` folder. Select Properties and select the Security tab that has now appeared. Now go back to Step 1 in the previous section and follow the instructions from there on. At the end, though, shut down and restart your machine in normal mode before you continue to the next step.

Checking the Installation with VWD and Cassini (the Default Web Server)

Once you have successfully downloaded the Wrox United zip file, unzipped it, and enabled the Network Service, you are ready to check your installation:

1. Select the Start menu and navigate to All Programs. Select the Visual Web Developer 2005 Express Edition Icon at the bottom of the menu.
2. VWD will open. Select File ➪ Open Web Site, and browse to C:\Websites\WroxUnited and click OK. When the website has loaded into Solution Explorer, Double-click `default.aspx` to open the file. Last, press the F5 key to run the page and observe in a browser. You should see what appears in Figure B-21 in your browser.

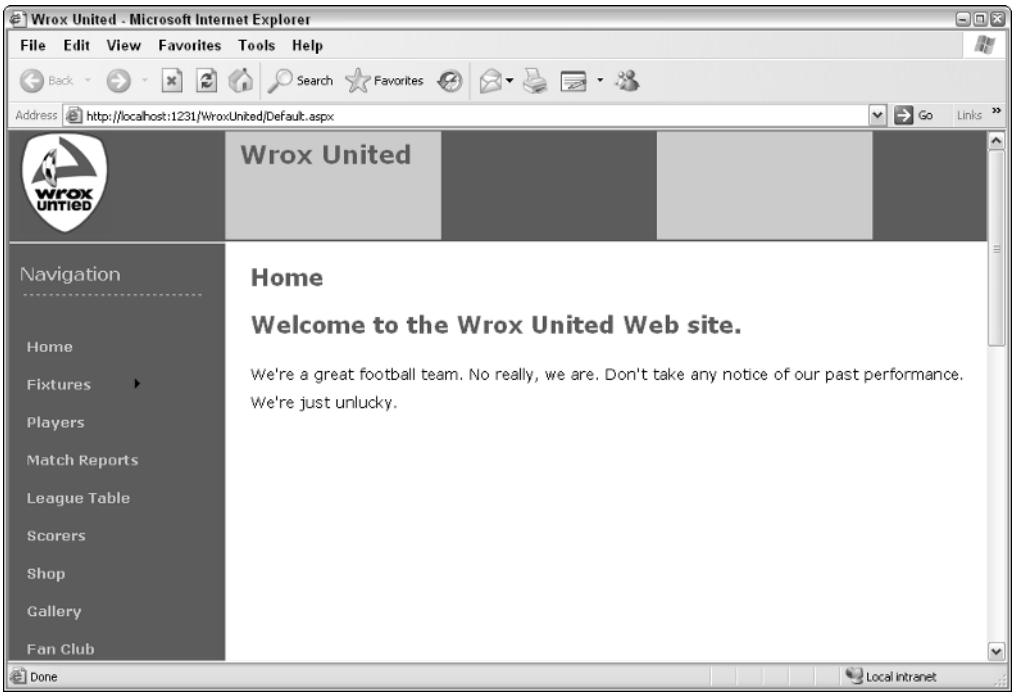


Figure B-21

Checking the Installation with IIS

Follow this step only if you have installed IIS and intend to use it as your main web server. To open WroxUnited with IIS, start Internet Explorer and type `http://localhost/WroxUnited` into the Address line. The web site should start and display what's shown in Figure B-22.

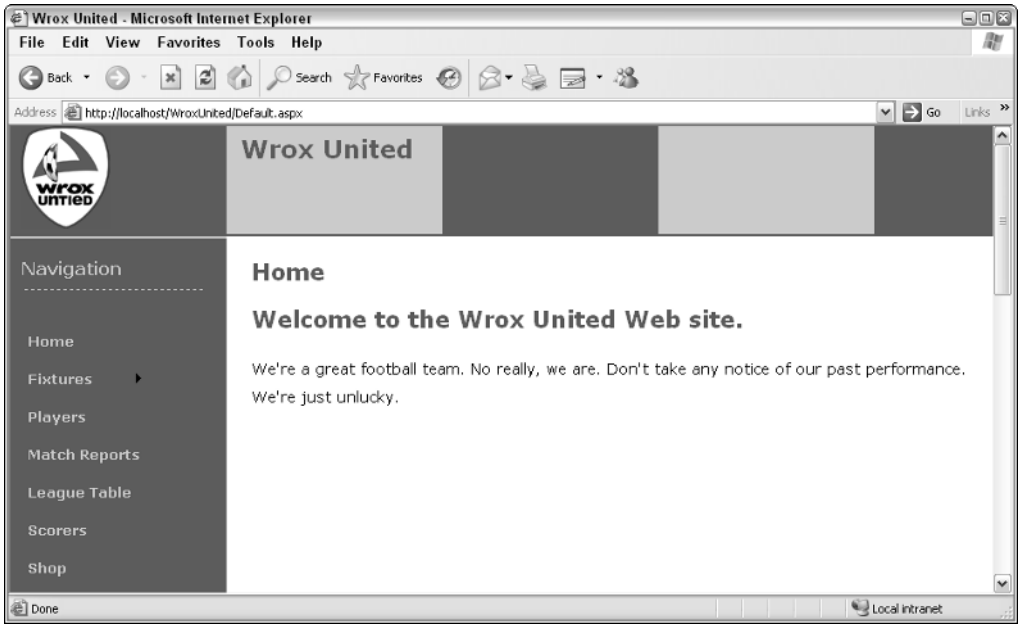


Figure B-22

Please note that while Figure B-22 is seemingly identical to Figure B-21, the Address lines reveals a small difference. If you are running your site on Cassini (the free web server with VWD), you will get the following line (potentially with a different number): `http://localhost:1231/WroxUnited`.

This indicates that the web server is running on port 1231. Cassini will arbitrarily assign a port number in the URL. If you are running the web site on IIS, then you see the following line: `http://localhost/WroxUnited`.

IIS by default runs on port 80, and this doesn't need to be specified in the URL.

Occasionally, if port 80 is taken by another process, IIS will default to `http://localhost:8080`, or you might have to specify it yourself if you get an error message saying `Unexpected error 0x8ffe2740 occurred`.

This means that another application is using port 80. To alter this, you need to start the IIS manager from Administrative Tools in the Control Panel, right-click the Default Web site in the left panel, and select Properties. From the Web Site tab, change the number there from 80 to 8080, or if 8080 is taken then 8081 or the first one free above that number.

Troubleshooting

Unlike with previous versions of ASP and ASP.NET there are no specific *gotchas* in the installation process. If you encounter a problem go to `http://forums.asp.net` and check to see if your problem is answered there.

C

Wrox United Database Design

Throughout this book we've presented examples based on the fictional Wrox United soccer team web site. The application relies on a SQL Server database, supplied with the code downloads for this book (available at `www.wrox.com`). This database stores details of the players in the team, fixtures and results, news items, orders from the shop, and so on.

This appendix is not intended to provide a thorough overview of database design principles, and as such, I recommend reading Wrox's *Beginning Database Design*.

The database schema looks like Figure C-1.

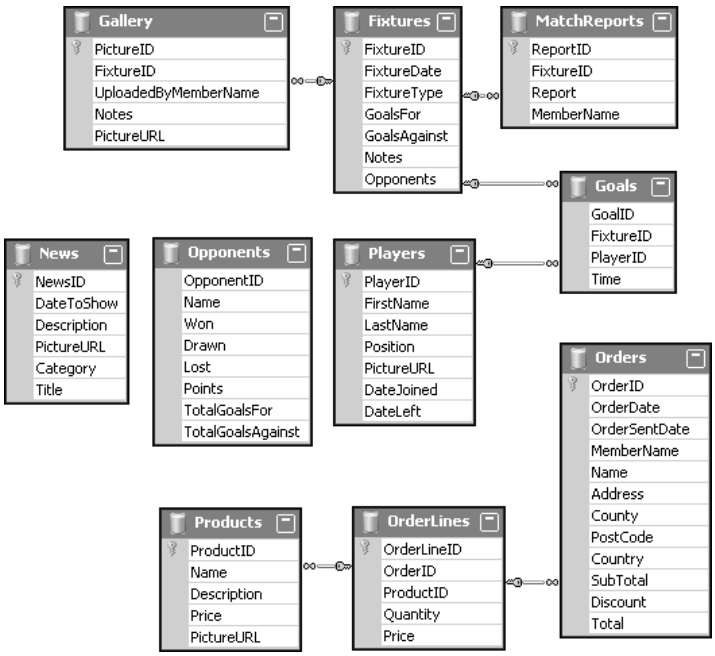


Figure C-1

This diagram illustrates the tables that exist within the database, and the relationships between those tables. For example, players score goals, goals are scored at fixtures, match reports are written about specific fixtures, and so on. Many tables relate to other tables in the database, but equally, there are some tables that stand on their own; for example, the News table, which stores news articles. This table doesn't link to data stored in any other table. Notice also that the Orders, Products, and OrderLines tables are separate from the rest of the database — these tables are used to store data relating to orders from the Wrox United shop.

This appendix walks through the structure of each of the tables in the database and describes the relationships between them.

Players and Matches

The players on the Wrox United team are involved in many fixtures, and several related tables in the database store related data for matches. Take a look at these tables first.

The Players Table

The structure of the Players table is as follows:

Field	Data Type	Allow Nulls
PlayerID (Primary Key)	`int`	No
FirstName	`varchar(25)`	No
LastName	`varchar(25)`	No
Position	`varchar(50)`	Yes
PictureURL	`varchar(255)`	Yes
DateJoined	`datetime`	Yes
DateLeft	`datetime`	Yes

This table is typical of all database tables in that it has the following:

- A *primary key* field that uniquely identifies each row in the database.
- Fields designed to store textual data about each player (in `varchar` fields).
- Fields that store date and time information.
- Flags indicating whether or not different fields require values.

In this table, the primary key is the PlayerID field, which stores numeric values (integers) that are unique to each player in the database. This field, along with the FirstName and LastName fields, is marked as not allowing null values; in other words, if you enter a row of data in the table, you must

enter values for each of these fields. However, the PlayerID field will be filled with an auto-generated number for you automatically (due to the way it is configured), so the only data you must enter when you create a new row is the full name of the new player. The remaining information describing the player is optional. You don't have to specify which position the player occupies, and you don't have to specify when he or she joined.

> *Note that a* `varchar` *field is a field that stores character data of varying length. The number in brackets is the maximum number of characters that can be stored in that field. If the field contains less than the maximum length, it occupies less space in the database. A* `char` *field, by comparison, always takes up the same size in the database, no matter how much of the available space is filled with data.*

Figure C-2 shows an example of some data from the Players table.

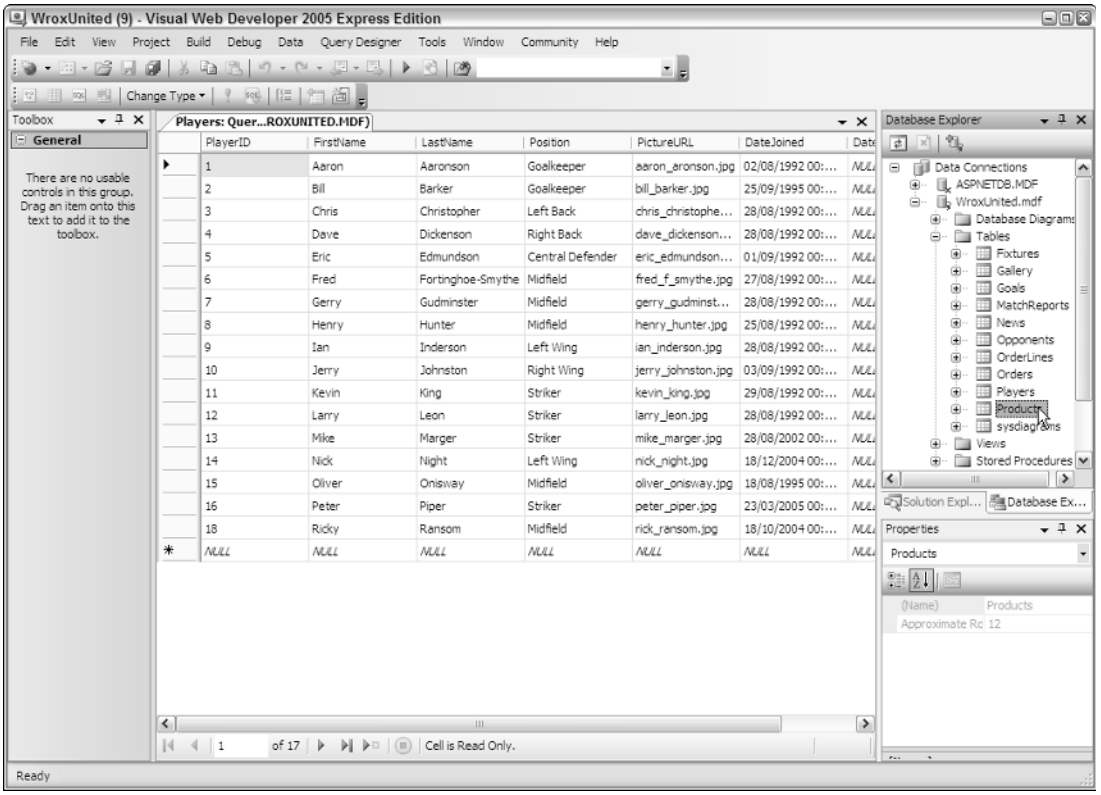


Figure C-2

This screenshot comes straight from Visual Web Developer; you can right-click any database table in the Database Explorer and select Show Table Data to try this out for yourself.

The Goals Table

The Goals table relates directly to the Players table, because players score goals during a match. Here's the structure of the Goals table:

Field	Data Type	Allow Nulls
GoalID (Primary Key)	`int`	No
FixtureID (Foreign Key)	`int`	Yes
PlayerID (Foreign Key)	`int`	Yes
Time	`int`	Yes

Notice that one of the fields in this table is the PlayerID field, which will store an integer value corresponding to the ID of one of the players in the Players table, so if Dave Dickenson scored the first-ever goal for Wrox United, the goal in the table with GoalID of 1 will have a PlayerID of 4. Dave could later score another goal for Wrox United, so another record in the Goal table would be created with another unique value for GoalID, but with the same PlayerID. This type of field is called a *foreign key* because it relates directly to a primary key in another table.

There is another field in the Goals table for storing ID values, which is the FixtureID field. This links each goal to a particular fixture. Because players could score many goals at a single fixture, the relationship between the Fixtures table and the Goals table is similar to that of the Players table and the Goals table.

> **This sort of relationship — where one fixture can contain many goals, or where one player could score many goals — is known as a one-to-many relationship.**

The Fixtures Table

The Fixtures table is structured as follows:

Field	Data Type	Allow Nulls
FixtureID (Primary Key)	`int`	No
FixtureDate	`datetime`	No
FixtureType	`varchar(10)`	Yes
GoalsFor	`smallint`	Yes
GoalsAgainst	`smallint`	Yes
Notes	`text`	Yes
Opponents	`varchar(50)`	No

For each match played by the Wrox United team, there is an entry in the Fixtures table. Because fixtures can be arranged several months in advance, the fixture date has to be entered as soon as the fixture is arranged, and the opponents have to be entered. The number of goals scored can be entered later once the match has been played.

The MatchReports Table

After each match has taken place, it's up to the reporters to write up the details of the match so that fans can read all about it later. These reports are stored in the MatchReports table, which is structured like this:

Field	Data Type	Allow Nulls
ReportID (Primary Key)	`int`	No
FixtureID (Foreign Key)	`int`	No
Report	`text`	Yes
MemberName	`varchar(50)`	No

This table also links to the Fixtures table by including a FixtureID field in this table, linking a match report to a specific fixture. The MemberName field stores the name of the reporter.

The Gallery Table

The Gallery table is used to store details of pictures uploaded by fan club members. Here are the fields defined in this table:

Field	Data Type	Allow Nulls
PictureID (Primary Key)	`int`	No
FixtureID (Foreign Key)	`int`	Yes
UploadedByMemberName	`varchar(50)`	Yes
Notes	`text`	Yes
PictureURL	`varchar(50)`	No

Each picture can relate to a specific fixture (notice the FixtureID field); however, because this field allows the use of null values, this implies that pictures do not necessarily have to relate to fixtures.

Standalone Tables

The two standalone tables in the database are the Opponents table and the News table.

The Opponents Table

The Opponents table stands on its own in the database, and is defined as follows:

The reason the Opponents table is on its own is a bit unfortunate, but the opposing team may decide to change its name at some point in the future, which would change the name of all fixtures that Wrox United played against them in the past if they were related. By keeping the tables separate, and only using a name for each team, the name of the opponent in any particular match is preserved.

Field	Data Type	Allow Nulls
OpponentID (Primary Key)	`int`	No
Name	`varchar(50)`	Yes
Won	`int`	Yes
Drawn	`int`	Yes
Lost	`int`	Yes
Points	`int`	Yes
TotalGoalsFor	`int`	Yes
TotalGoalsAgainst	`int`	Yes

This table can be updated with results of matches to maintain a tally of how well the Wrox United team is performing in the league.

The News Table

The News table contains all of the stories from the front page of the Wrox United site:

Field	Data Type	Allow Nulls
NewsID (Primary Key)	`int`	No
DateToShow	`datetime`	No
Description	`text`	Yes
PictureURL	`varchar(50)`	Yes
Category	`varchar(50)`	Yes
Title	`varchar(50)`	Yes

Notice that each news item requires that a date be entered for each story, so that a story can remain hidden until a certain date has passed.

Wrox United Store Tables

The online shopping experience on the Wrox United site relies on data stored in three tables: the Orders table, the Products table, and the OrderLines table. These tables are heavily reliant on each other, so this section considers these now.

The Orders Table

The Orders table contains a unique ID containing the main order details for an order:

Field	Data Type	Allow Nulls
OrderID (Primary Key)	`int`	No
OrderDate	`datetime`	No
OrderSentDate	`datetime`	Yes
MemberName	`varchar(50)`	No
Name	`varchar(50)`	No
Address	`varchar(255)`	No
County	`varchar(50)`	No
PostCode	`varchar(15)`	No
Country	`nchar(10)`	No
SubTotal	`money`	Yes
Discount	`money`	Yes
Total	`money`	Yes

In this table, you'll notice that most of the fields are marked as mandatory (not allowing null values). This highlights the fact that orders must have full address details before an order can be fulfilled. A couple of less familiar field types are in here too. The `nchar` data type will always take up 10 characters space in the database, and the `n` in the name indicates that the data stored could contain Unicode characters. The other unfamiliar data type is `money`, which (as the name implies) can be used to store monetary values.

Notice that there are no details in this table about which products have been bought in a particular order; this information is stored in the OrderLines table.

The OrderLines Table

This table links the Products table to the Orders table, indicating which items have been bought in a particular order:

Field	Data Type	Allow Nulls
OrderLineID (Primary Key)	`int`	No
OrderID (Foreign Key)	`int`	No
ProductID (Foreign Key)	`int`	No
Quantity	`smallint`	No
Price	`money`	No

Because an order can contain one or many products, there is a foreign key link here to the Products table. However, because many different orders can be for the same product, there is also a foreign key link here to the Orders table. This means that an individual line in this table stores details of one item, and one order number. If you order more than one of a specific product, the Quantity is increased for the order line, but you won't end up with a new OrderLineID.

> **The relationship between the Orders table and the Products table is a many-to-many relationship. In this situation, there has to be a central table that has one-to-many relationships to both tables, and this is called the Join table.**

The Products Table

The Products table contains details of all of the products that can be bought from the shop:

Field	Data Type	Allow Nulls
ProductID (Primary Key)	`int`	No
Name	`varchar(50)`	No
Description	`varchar(255)`	Yes
Price	`money`	No
PictureURL	`varchar(255)`	Yes

This simple table provides data about products, and is used both when browsing the shop and when buying items from the shop.

D

VWD Database Explorer

When designing pages that work with data you frequently need to check the metadata, for example, to confirm the data type of a field. You also want to test your pages by quickly modifying the data in tables. Furthermore, in some cases you want to add a small and simple table to a database, such as a list of shippers. In the past these database tasks required leaving your web editor to open a second window with a database management tool. Visual Web Developer offers a built-in tool named the Database Explorer that can perform these tasks without the need for a separate management tool. Some functions are performed directly and others invoke a wizard to step you through the task.

This appendix covers the various techniques for working with the Database Explorer.

Open the Database Explorer

The Database Explorer can be viewed either by choosing Menu ➪ View or by pressing Ctrl+Alt+S. Once open, the Database Explorer by default stacks on top of the Solution Explorer on the right side of the screen. You can move it to a new dock location by dragging its title bar.

> **If you mess up the layout you can return to the default by choosing Menu ➪ Windows ➪ Reset Windows Layout.**

Add an Existing Database to the Database Explorer

The technique to connect the Database Explorer to a database depends on the type of database. The following three sections cover the Microsoft databases. Most other databases (such as Oracle or MySQL) will be the same as connecting to a SQL Server.

Access Files

1. On the Database Explorer toolbar, click Connect to Database, and from the first page of the wizard select Microsoft Access Database File, as shown in Figure D-1.

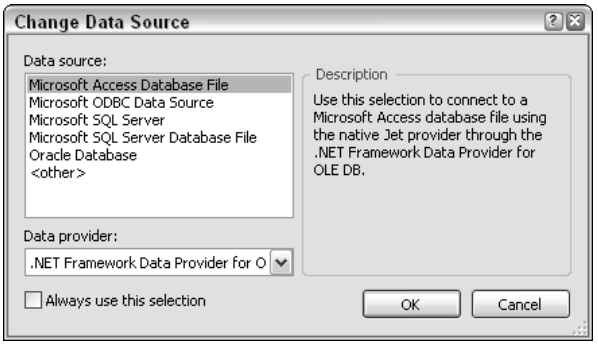


Figure D-1

2. Browse to the file, then add logon information if needed (see Figure D-2).

Figure D-2

3. You have the option to test the connection and then it is added to your list in the Database Explorer.

SQL Databases on a SQL Server (Including SQL Server Express)

1. On the Database Explorer toolbar, click Connect to Database, and in the first page of the wizard (shown in Figure D-3) select Microsoft SQL Server.

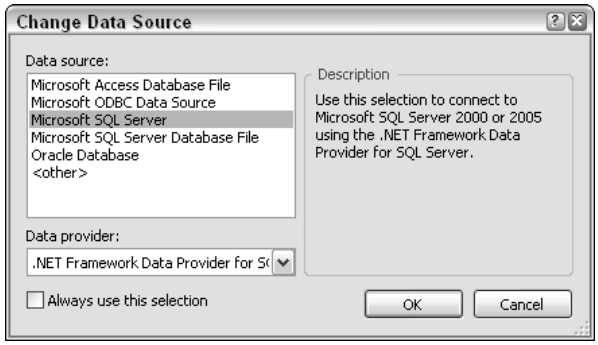


Figure D-3

2. In the next dialog box the Data Source section is locked — it actually means the kind of data source, not the name of the database.

3. Continuing on the Add Connections screen, for the Server Name text box there are two options. If you are using a full install of SQL Server, select the server name. If you are using SQL Server Express (as we do in this book), type the following syntax exactly: `(local)\SQLExpress`, as shown in Figure D-4.

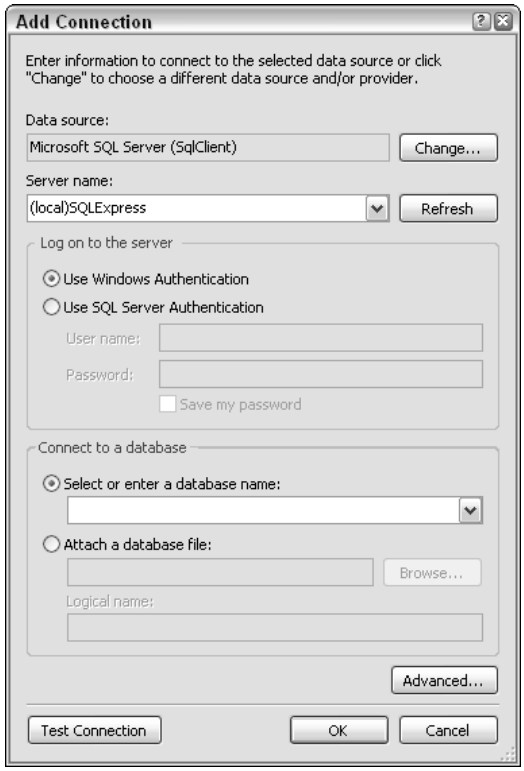


Figure D-4

Note the potential confusion when using SQL Server Express. Your PC name will be listed in the drop-down box of servers, but that is not the server you want to specify. You must type into the server name box the specific syntax to point to your local machine's instance of SQL Server Express.

4. Keep the choice for logon information set to Windows (see Figure D-5) unless you have developed an authentication table in SQL Server.

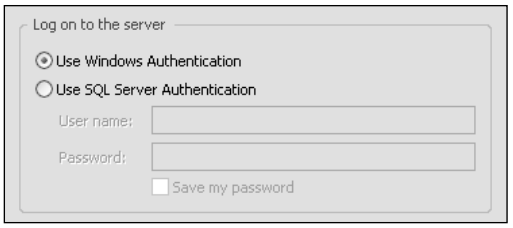


Figure D-5

5. Once you have selected the server name, you can drop-down the list of databases. Test the connection and then click Finish to see your new data connection.

SQL Databases Saved as an MDF File

For highest performance, data is kept in SQL Server without an external file structure. But for portability, a database can be configured to save its data in a Windows file that can be copied to a new server. The file will have an extension of .mdf. We use an .mdf file to distribute data in this book. (The alternative would be to have you download a long SQL script that would build the entire database internally in your server and populate its data.) Connections to an .mdf file are very similar to connecting to Access Files, as explained here:

1. On the Database Explorer toolbar, click Connect to Database, and select Microsoft Access Database File, as shown in Figure D-6.

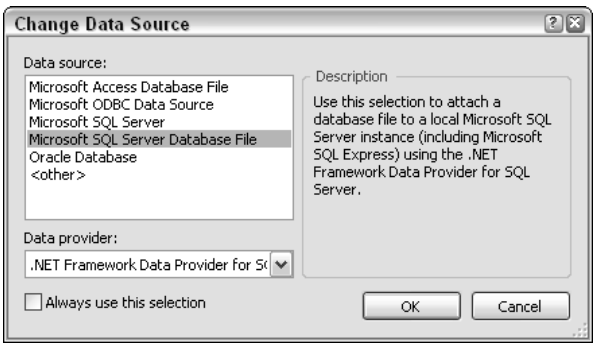


Figure D-6

2. Browse to the file and add logon information if needed (see Figure D-7).

Figure D-7

3. You have the option to test the connection and then it is added to your list in the Database Explorer.

Database Diagrams for an Overview

The VWD Database Explorer provides a visual presentation of your database's objects along with the capability to drill down into each object's properties. Follow these steps to walk through a diagram of your database:

1. Within the Database Explorer, expand your Data Connections and then expand your database. When you expand the Database Diagrams (see Figure D-8) the first time you may be asked to establish yourself as the dbo (database owner). Click Yes. Right-click the Database Diagram object and add a new diagram. If asked, accept the creation of elements needed to build the diagram.

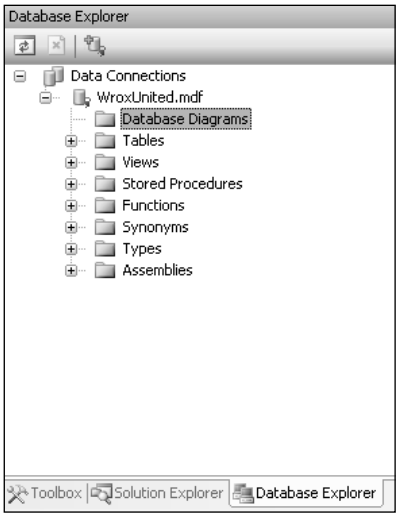


Figure D-8

2. Add tables as desired and close the Add Table dialog (see Figure D-9).

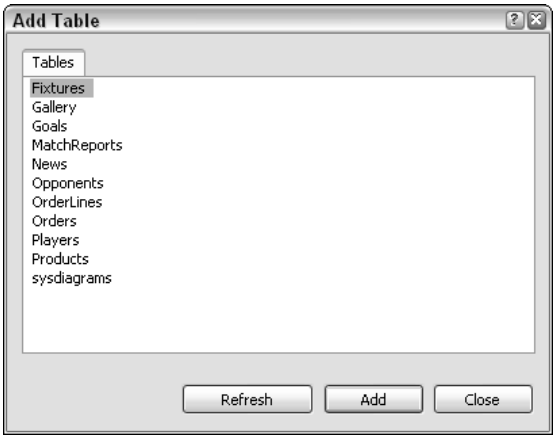


Figure D-9

The diagram can be so large that it is easy to miss tables. Note the Windows-standard horizontal and vertical scroll bars to navigate the diagram. See Figure D-10.

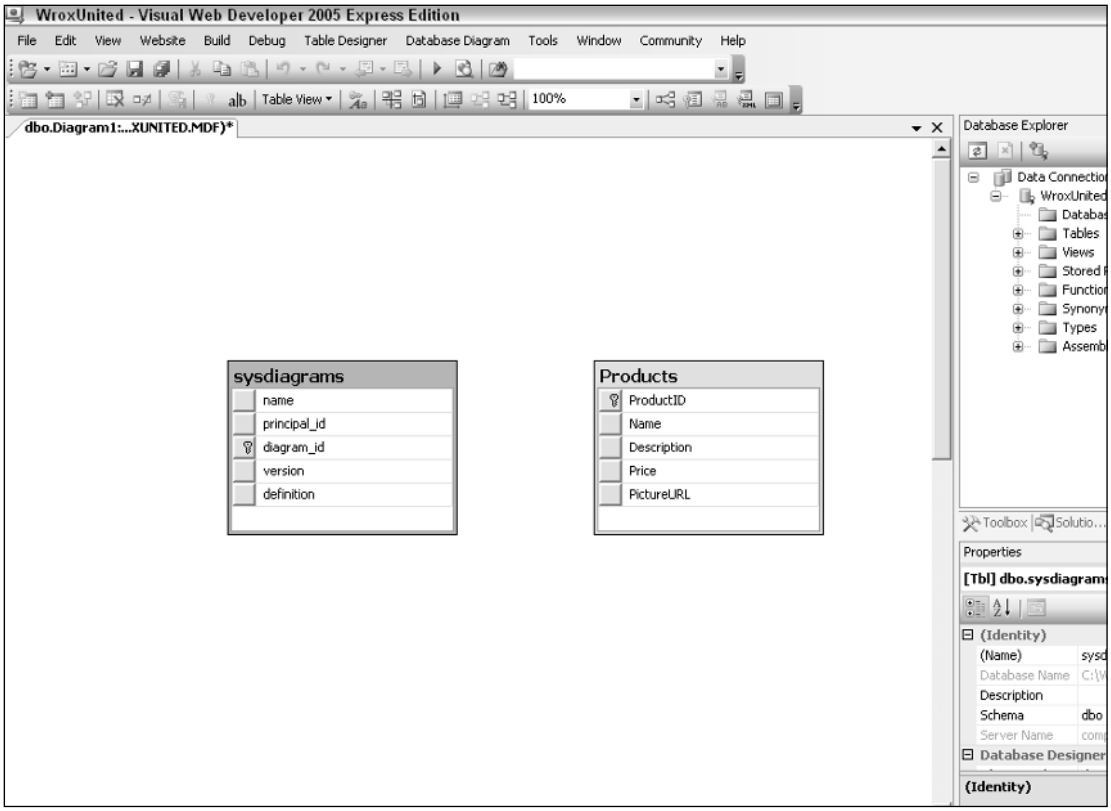


Figure D-10

3. Once you see the tables, you can rearrange them (the relationship lines will automatically adjust). Start by changing the zoom size to 30% or so to be sure you see all of the tables and then do some rearranging. The zoom window can be found on the diagram toolbar, shown in Figure D-11 set to 30%.

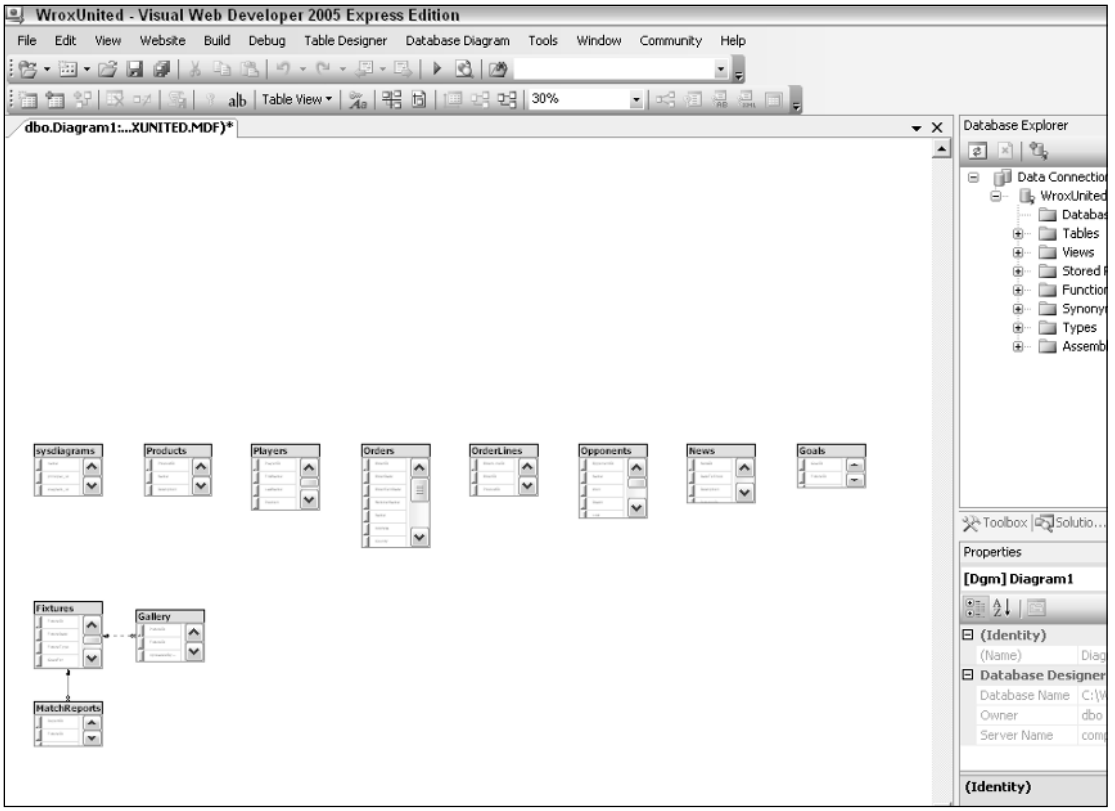


Figure D-11

4. Next, increase the zoom size to be able to read the data. For example, after rearrangement, 70% shows all the tables for Wrox United, as shown in Figure D-12.

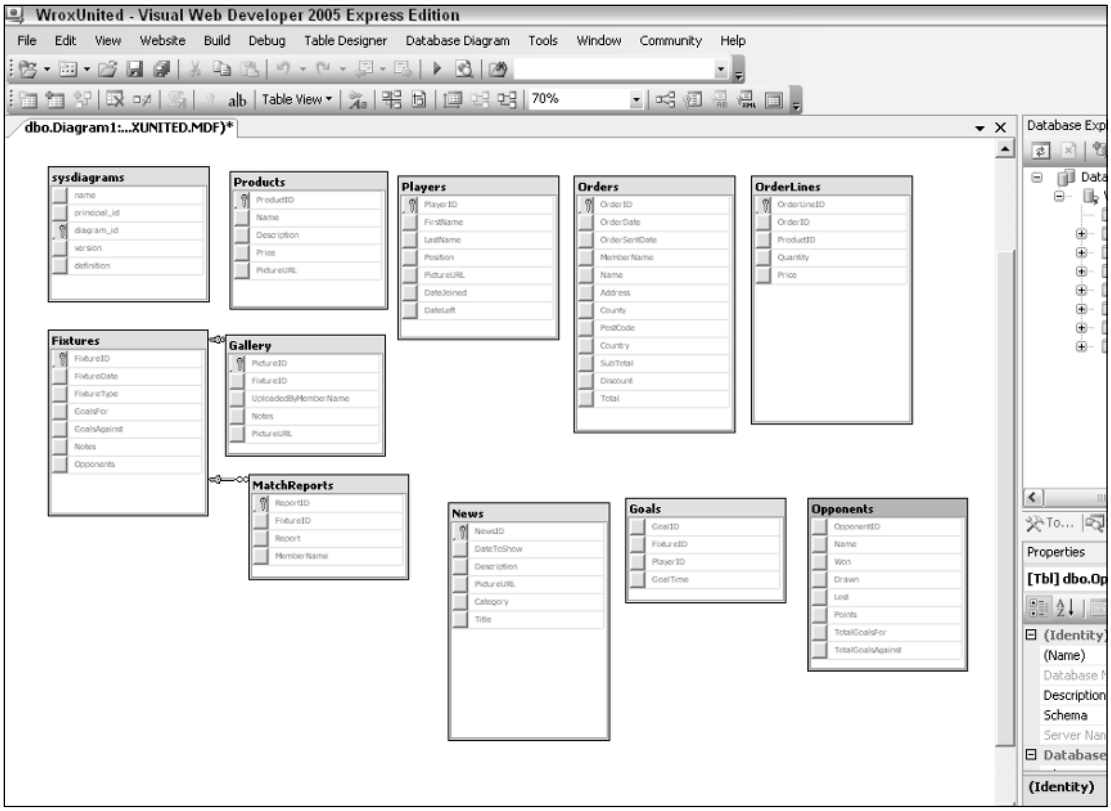


Figure D-12

5. Right-click the title bar of a *table* (for example Players) and select Properties from the menu. In the Properties box (lower right of the monitor), you can view parameters such as the Identity column. Right-click *one field* (see Figure D-13) of a table and select Properties to see how that column has been configured, including the data type and length.

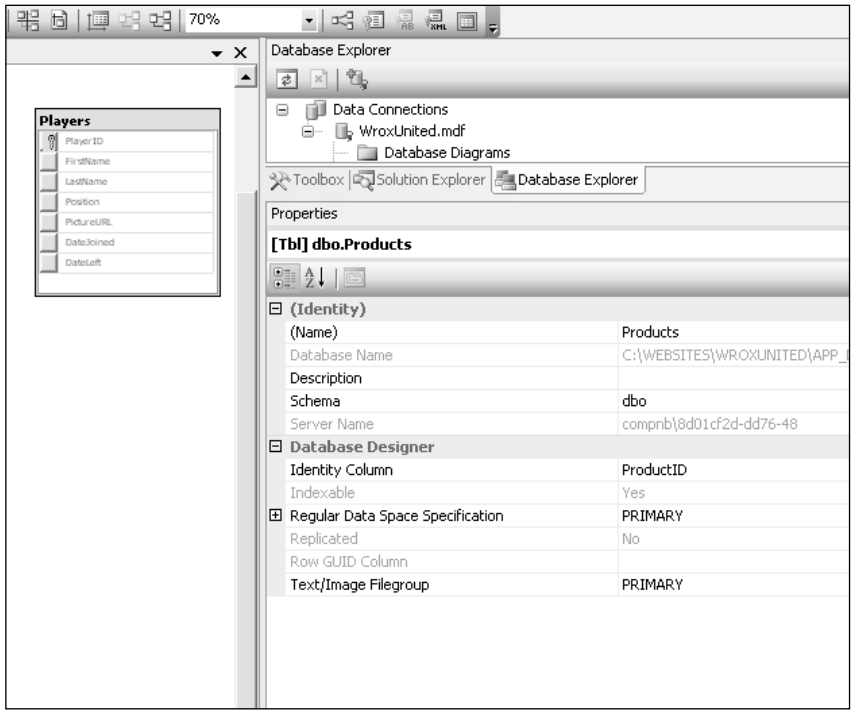


Figure D-13

6. Last, carefully place the tip of the mouse arrow on a relationship line (for example between Fixtures and MatchReports) so that the mouse arrow changes to a horizontal double-ended arrow. Right-click this *relationship* and select Properties to view data on the relationship, including enforcement rules, as shown in Figure D-14.

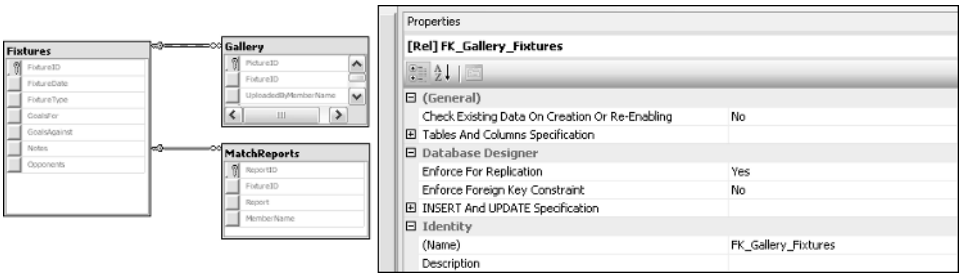


Figure D-14

The Database Diagram can also be printed or saved to include in documentation for the site. Note that there are tools to position page breaks at specific axes of the diagram, as well as a tool that allows you to add a text box of notes.

Explore a Table's Structure

In addition to the Database Diagram, you can look at tables through the Table node of the Database Explorer:

1. Starting in Database Explorer, expand the list of databases and then the database of interest. Expand the Tables node and select a table name (for example MatchReports). In the Properties window, shown in Figure D-15, you will see the approximate number of records.

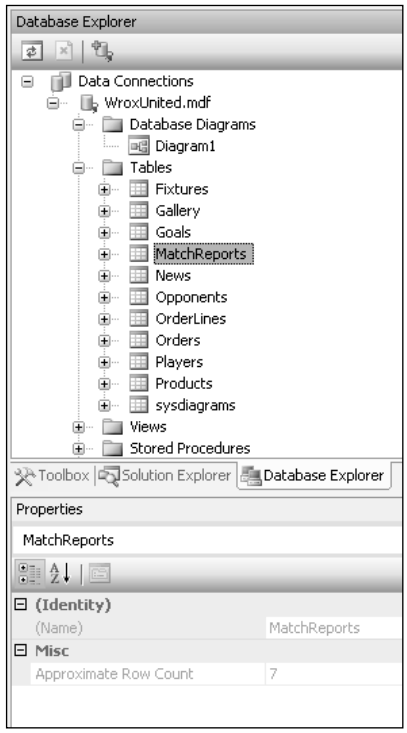


Figure D-15

2. Double-click a table name to open a list of the columns (fields) and populate the Properties windows with data on the table as a whole, as shown in Figure D-16.

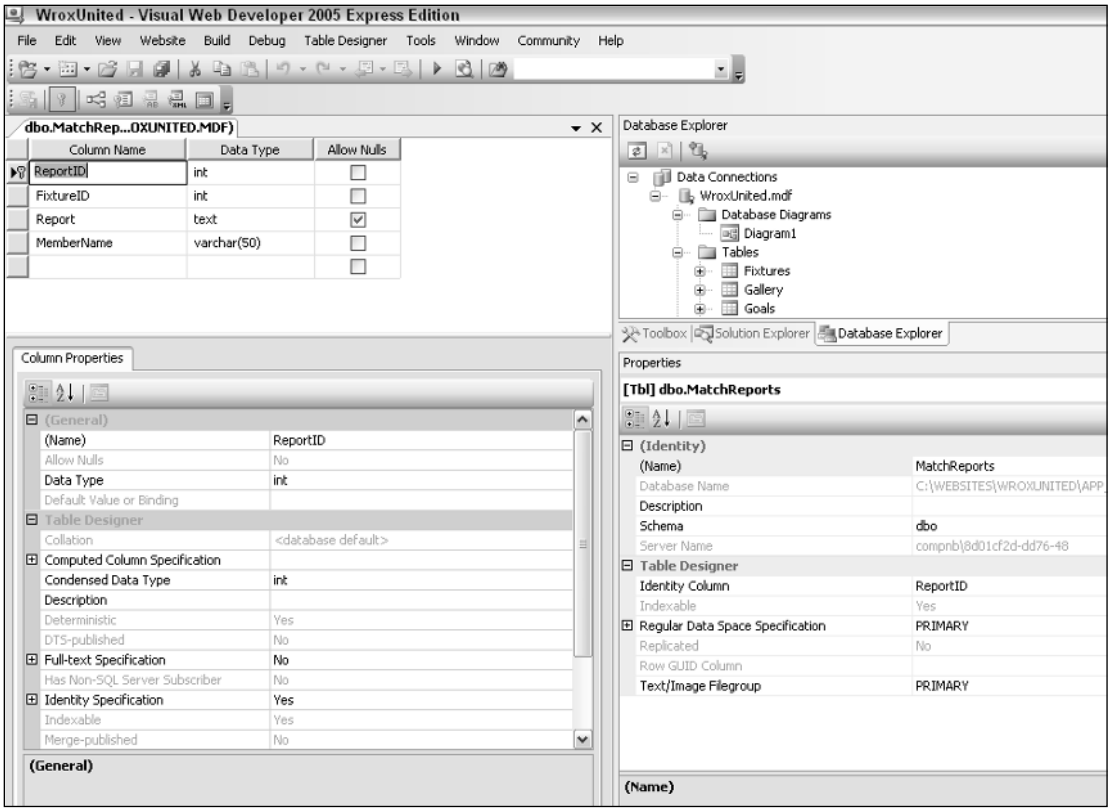


Figure D-16

These metadata can be changed in this view, assuming that you have the rights to make changes to the database structure.

Observe and Edit Data of Existing Tables

If you right-click a table name in the Tables node of Database Explorer, you'll see an option to Show Table Data. This is a quick way to find out if your data-enabled web pages are actually carrying out their tasks. You can also add, modify, or delete records by hand to test results in data-reading pages.

Be extremely careful about changing data in the Show Table Data tool. For example, deletions or changes of customers may divorce them from their orders. In some databases, the addition of a record may require the addition of a partner record in another table. A simple correction to a spelling mistake may cause a failure to properly look up data that is based on the old spelling. If you thoroughly understand the schema and are changing independent data, you may avoid trouble. But in most cases it is better to make revisions based on the interface that ensconces proper validation, limits, and controls.

Create a New Database

It is rare that you will use VWD to create a database from scratch. Good databases require the kind of planning and implementation tools that are strongest in the tools that come with your database management system. However, in the case of a small and simple database, VWD does offer the necessary planning and implementation tools. You can add a new database in two ways: directly in the Database Explorer or by adding a SQL Database through the Add New Item menu in Solution Explorer.

1. In the Database Explorer, right-click Data Connections and select Create New SQL Server Database.
2. Select a server. If using SQL Server Express, use this exact syntax for the server name: `(local)\SQLExpress`. Use Windows authentication unless you have created an authentication scheme internal to SQL Server Express. Type the name of the new database into the bottom text box.
3. Database Explorer will automatically add the database to its list and you are ready to create tables and add data.

You can also create a new database directly in the Solution Explorer. This technique is very similar to the preceding except for the first few steps:

1. Start in the Solution Explorer and right-click the root of the web site. Select Add New Item and select the template of type SQL Database.
2. When prompted, agree to add to the `App_Data` folder.
3. VWD will now roll you over to the Database Explorer where you will see the new database and folders for its objects (albeit empty). You can now create tables, add data, and perform other tasks.

Create a New Table and Add Data

Tables can be added and populated in the Database Explorer:

1. Expand the database, right-click the Tables node, and select Add New Table from the menu shown in Figure D-17.

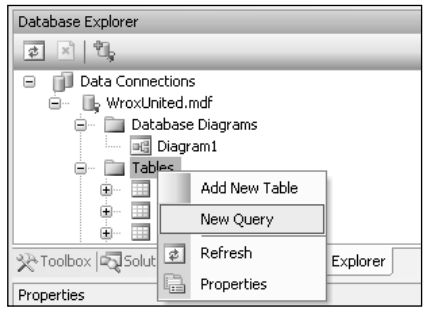


Figure D-17

2. In the resulting list of columns, enter the names and data types. For example, as shown in Figure D-18, a new table that holds a schedule of reporter's interviews with the players would start with a column (field) for InterviewID.

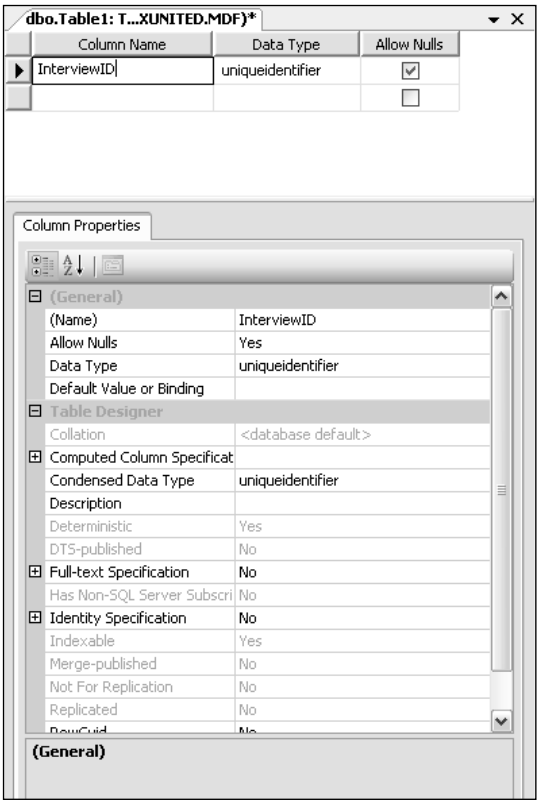


Figure D-18

Note that under Data Type you can scroll down to find the UniqueIdentifier type, which is similar to AutoNumber in Access.

3. In the panel below the columns list you will find additional properties for the current column such as default value and length.
4. Set the primary key by selecting a field and clicking the key tool in the table's toolbar.
5. Finish by choosing Menu ➪ File ➪ Save Table.

Examine and Create Views

Views provide a set of data. Instead of returning information directly from a table, a view returns only certain fields or modified fields, or only certain records. In many databases the security rules will allow a web site to request a view but not directly request data from a table; this provides a level of control for

the database administrator. For example, a table of employees may hold a field for salary level. A view that is authorized for the accounting department would include that field, but other users only have access to views that do not include the salary data. Views are also useful for creating hybrid data, such as combining a NameFirst field and a NameLast field to show both names in a single field of a list box.

You can do a basic exercise where you create a view that would support a selection ListBox of Players. You want the view to create two fields; the first is the player's ID and the second is a combination of the player's last and first names, separated by a comma.

1. In Database Explorer, expand your database, right-click the Views node, and select Add a New View. This opens the designer for a new view in the background, and in the foreground the Add Table dialog (see Figure D-19) will open.

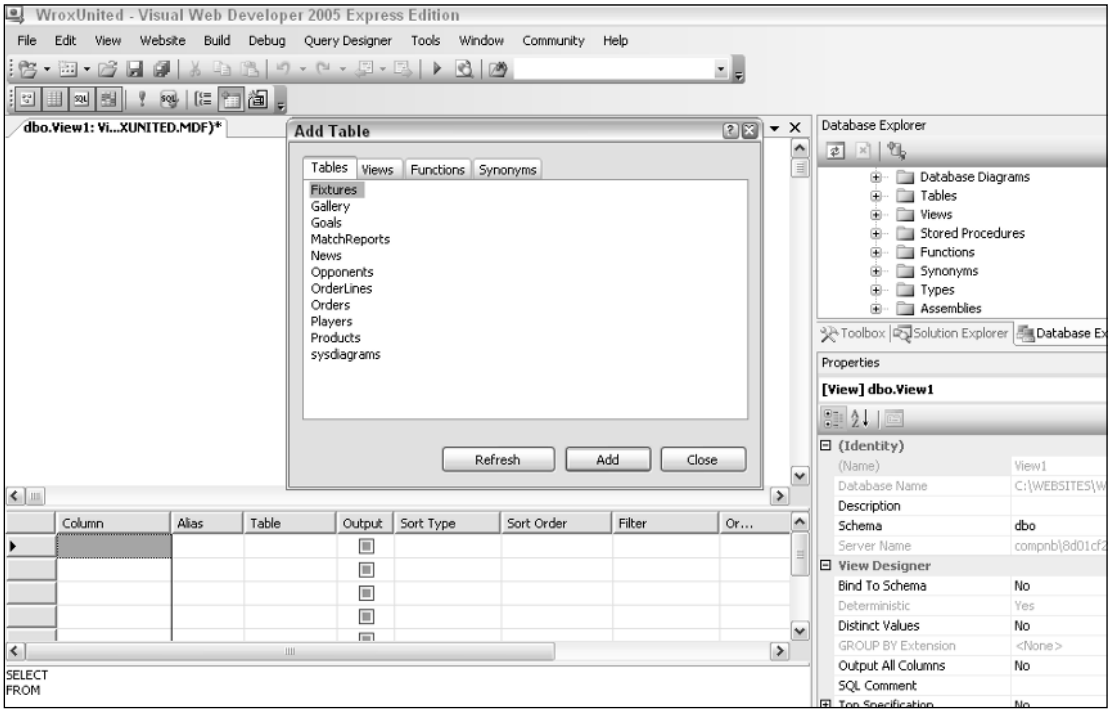


Figure D-19

2. In the Add Table dialog box, select Players and click Add. Close the dialog.
3. Before you go on, play with turning on and off the panels to display a view. From left to right, they are the Diagram, Query, SQL Statement, and Results. Because you are making a small view you can display all four. Figure D-20 shows the four panels. Topmost is the pane of tables, showing just the Players table with the single field of PlayerID selected. The next panel down is the query designer showing the single field selected. The next panel below shows the very simple SQL statement: `SELECT PlayerID FROM dbo.Players`. The bottom panel shows the results of choosing Query Designer ➪ Run to produce the results table.

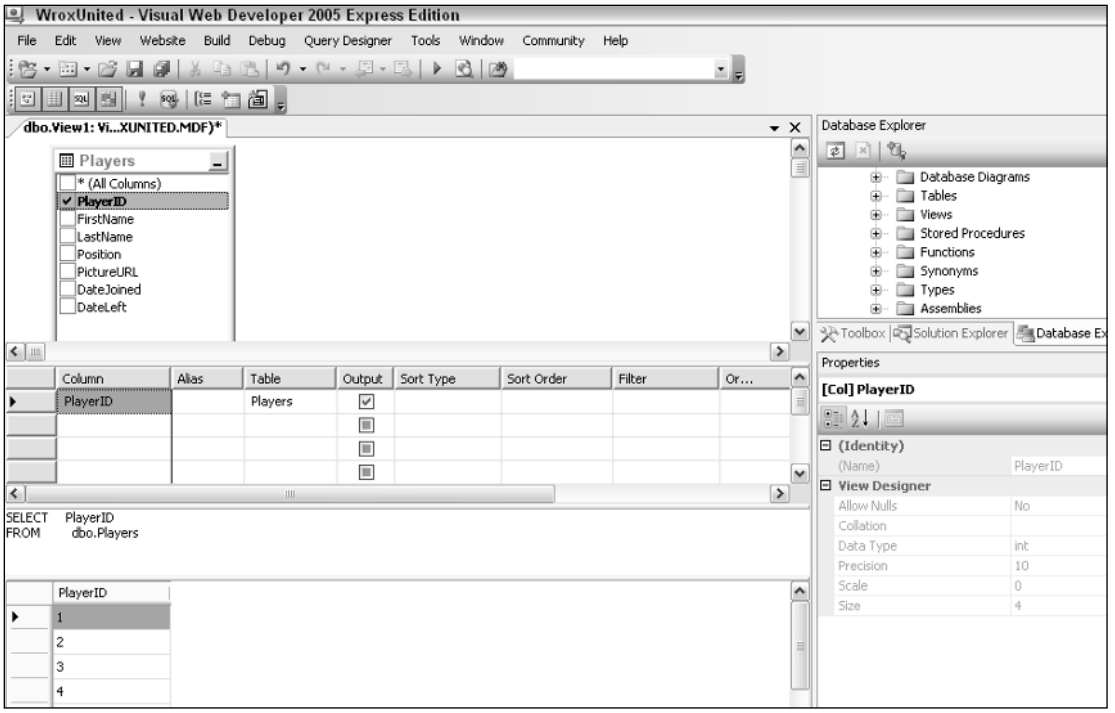


Figure D-20

4. Click the checkbox next to the PlayerID field in the Player table of the Diagram View (the top-most panel) and note that the field is added to the Query and SQL Statement panels.

5. In the Query panel, go to the second row and type **FullName** into the alias cell. In the leftmost column, type in `LastName + ', ' + FirstName`.

6. Click the execute SQL tool (the red exclamation point) to see the results, displayed in Figure D-21.

7. To finish, order the players' names by last name. SQL does not like to order on a created (or alias) field, so go to the third row of the Query panel and add the LastName field. Turn off its Output option. Set the Sort Order column to 1, meaning this is the first criterion for sorting. In the Sort Type VWD will automatically set the order to Ascending. These four changes are shown in figure D-22 below. This step tells SQL to sort according to the last name, but not to output the LastName as its own field. Execute the SQL.

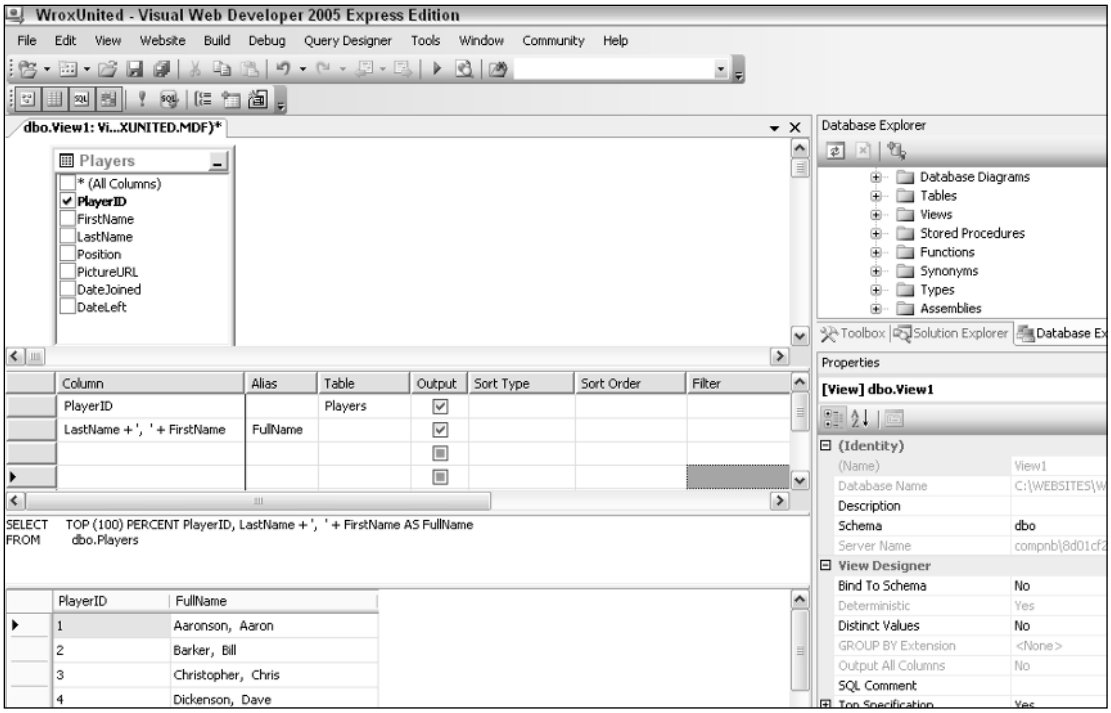


Figure D-21

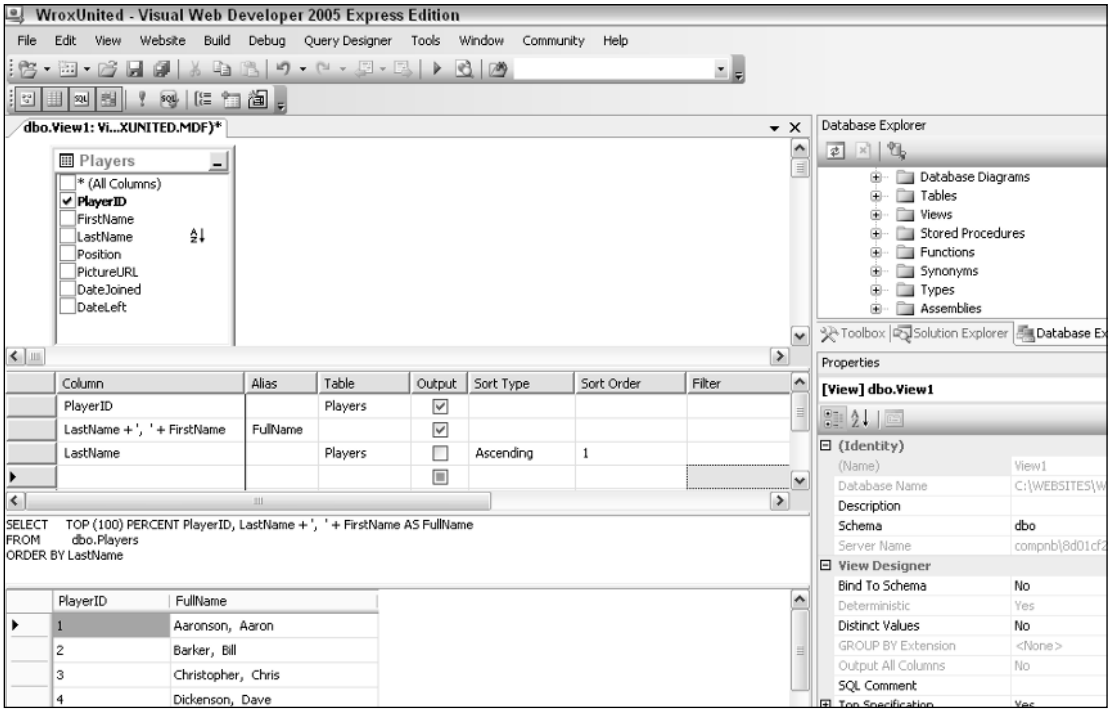


Figure D-22

8. Press Ctrl+S to save the view as PlayersForSelectionList. You now have a new view that can be used in a selection list of a web page; for example, `PlayerDetails.aspx`, for which the data controls follow. Note that in the `DataSource1` (supporting the list box), you are not reading from the Players table. Rather, you read from the PlayerSelection view. That view includes your new field FullName, which you can set as the `DataTextField` in `ListBox1`:

```
<asp:ListBox ID="ListBox1" runat="server"
 DataSourceID="SqlDataSource1"
 DataTextField="FullName"
 DataValueField="PlayerID"
 AutoPostBack=true>
</asp:ListBox>

<asp:SqlDataSource ID="SqlDataSource1" runat="server"
ConnectionString="<%$ ConnectionStrings:WroxUnitedConnectionString1 %>"
SelectCommand="SELECT [PlayerID], [FullName] FROM [PlayerSelection]">
</asp:SqlDataSource>
<br />
<asp:DetailsView ID="DetailsView1" runat="server"
DataSourceID="SqlDataSource2"
 ...
</asp:DetailsView>

<asp:SqlDataSource ID="SqlDataSource2" runat="server"
 ConnectionString="<%$ ConnectionStrings:WroxUnitedConnectionString1 %>"
 SelectCommand="SELECT * FROM [Players] WHERE ([PlayerID] = @PlayerID)">
        <SelectParameters>
                <asp:ControlParameter ControlID="ListBox1"
                DefaultValue="1"
                Name="PlayerID"
                PropertyName="SelectedValue"
                Type="Int32" />
        </SelectParameters>
</asp:SqlDataSource>
</asp:Content>
```

Examine a Stored Procedure (SPROC)

Like the other objects explored in this appendix, you can examine, edit, and create stored procedures, or SPROCs. SPROCs are a set of one or more SQL commands that, as a group, carry out a task. The Database Explorer offers a node for SPROCs, which can be expanded. A single click selects a SPROC and shows, in the Properties window, if it is encrypted. A double-click opens the SPROC, which can then be edited (assuming you have the rights to change the object).

The design of SPROCs is beyond the scope of this text, but you can take a quick look at one. For example, in the Database Explorer you can expand the WroxUnited database and then expand Stored Procedures. Then you can double-click usp_OrderAdd to open it and view the following code. In this simple SPROC, only one actual SQL statement gets executed.

```
ALTER PROCEDURE dbo.usp_OrderAdd
(
 @MemberName varchar(5),
 @Name varchar(50),
 @Address varchar(255),
 @PostCode varchar(15),
 @County varchar(50),
 @country varchar(50),
 @SubTotal money,
 @Discount money,
 @Total money
)
AS
 INSERT INTO Orders(MemberName, OrderDate, Name, Address, County, PostCode,
Country, SubTotal, Discount, Total)
 VALUES (@MemberName, GETDATE(), @Name, @Address, @County, @PostCode, @Country,
@SubTotal, @Discount, @Total)

RETURN SCOPE_IDENTITY()
```

This SPROC has three parts. The first and last lines establish the frame of the procedure and declare its name. The second section, within parentheses, names the parameters that will be used to carry out the procedure. The third part, the `INSERT INTO` statement following the `AS` command, describes the one SQL statement to actually execute.

In summary, VWD provides the Database Explorer for the creation, modification, and examination of databases. Generally, a web site will use an existing database, so the examination features are most useful. However, when testing a new site you can hop to the VWD Database Explorer to see if your pages are updating data correctly, or you can modify data to see how the pages handle the rendering. In addition to introducing the Database Explorer, this appendix discussed the following topics:

- You can examine both data and metadata. The latter includes the list of fields in a table and details about how those fields are structured, including their exact spelling, data type, size, and other parameters that will be important when designing a page to use the fields.
- When creating a database, table or view, or SPROC, the Database Explorer will kick off a wizard to guide you through the process. Keep in mind that when referring to your SQL Server Express install, you must use the syntax of `(local)\SQLExpress`.
- For two reasons, use particular caution when modifying data or metadata for existing databases. First, others may be expecting the database to be in its original state for their Web Forms or Windows forms. Second, you may not be aware of the constraints and relationships that can be ruined by incorrect changes in the data or structure.

E

CSS and HTML Quick Reference

This appendix provides a quick reference to CSS and HTML. It's not meant to be an exhaustive and complete list of all HTML controls, their properties and the CSS properties, but rather to give the most common uses.

Styling Pages and Controls

You can style controls, or change their look and feel, in two ways: with properties of the control or with Cascading Style Sheets (CSS). Ultimately, both achieve the same thing, making the control look how you want it to, but in practice they are very different. Both Visual Web Developer and Visual Studio 2005 use properties when setting the style for controls. For example, if you drop a `GridView` onto your page and autoformat it with the Autumn format you get:

```
<asp:GridView ID="GridView1" runat="server" BackColor="White"
  BorderColor="#CC9966" BorderStyle="None" BorderWidth="1px" CellPadding="4">
  <FooterStyle BackColor="#FFFFCC" ForeColor="#330099" />
  <RowStyle BackColor="White" ForeColor="#330099" />
  <PagerStyle BackColor="#FFFFCC" ForeColor="#330099"
    HorizontalAlign="Center" />
  <SelectedRowStyle BackColor="#FFCC66" Font-Bold="True" ForeColor="#663399"
/>
  <HeaderStyle BackColor="#990000" Font-Bold="True" ForeColor="#FFFFCC" />
</asp:GridView>
```

Here the `BackColor` sets the background color, and `BorderColor` sets the color of the border. The same sort of thing applies to the style for parts of the control, such as the `FooterStyle` and `RowStyle`.

Although the approach of including the individual style attributes works fine, there are some issues:

- It makes the code hard to read. Not only is it more text to read through, but the properties aren't always in a logical order. For example, on `FooterStyle` and `RowStyle` the `BackColor` and `ForeColor` are next to each other, but on the `HeaderStyle` there is a `Font-Bold` attribute between them.
- There is extra text, bulking out the page. With lots of styling applied to lots of controls, the page size can increase, which can lead to performance degradation.
- It's hard to amend if you decide to change colors. AutoFormat works fine, but if you want custom colors you have to change each property individually.

CSS solves this problem by abstracting the actual styling away from the control, leaving the control with just a simple reference to the styles being used; this is the `CssClass` property for web controls or the `class` property for HTML controls. The `GridView` could now be as follows:

```
<asp:GridView ID="GridView1" runat="server" CssClass="MyGrid">
  <FooterStyle CssClass="MyGridFooter" />
  <RowStyle CssClass="MyGridRow" />
  <PagerStyle CssClass="MyGridPager" />
  <SelectedRowStyle CssClass="MyGridSelectedRow" />
  <HeaderStyle CssClass="MyGridHeader" />
</asp:GridView>
```

Immediately you can see that this is easier to read. The class names can be anything you want, and it is best not to be control-specific, because CSS classes can be used across controls. For example, if the `FooterStyle` and `RowStyle` needed the same styling you could do the following:

```
  <FooterStyle CssClass="MyGridStandard" />
  <RowStyle CssClass="MyGridStandard" />
```

Here the same style name has been used, allowing the centralization of the styling. Style names should also not contain things like color names. For example, don't call a style TextRed just because it outputs text in red. What happens if you want to change that text from red to blue? You can simply change the style, but the class name would be misleading. Calling it TextHighlight is acceptable.

Creating Inline Styles

To create inline styles you use the `<style>` element, which is usually placed within the `<head>` element. For example:

```
<head>
  <title>My Styled Page</title>
  <style>
    styling goes here
  </style>
</head>
```

When using Master pages you have to put the styling in the Master page, because Content pages don't allow a `<head>` element. Adding the style to the Master page is sensible though, because if all pages use the Master page, they automatically get the styles.

Linking Style Sheets to a Page

Another, and better, way to add styles is to use linked style sheets. In these cases the style sheet is created as a separate file (with a .css suffix) and linked to the page like so:

```
<head>
  <title>My Styled Page</title>
  <link rel="stylesheet" type="text/css" href="site.css" />
</head>
```

The CSS is stored in `site.css` and the `<link>` element links this style sheet into the page at runtime. Another great advantage of linked style sheets is that they can be cached by the browser, so the first time a page is requested the style sheet is loaded and cached. Subsequent pages that use the same style sheet won't need to reload it from the server because it's already loaded.

CSS Inheritance

One of the core concepts of CSS is that inheritance is implicit in the styles. In many ways the concept is the same as inheritance in classes, in which a child class can inherit features from its parent. CSS works the same way. This allows styling to be applied at the top level and inherited by contained controls. For example, if you defined the paragraph tag (`<p>`) to have blue text like so:

```
p {
  color: blue;
}
```

Any child tags would inherit that style, so:

```
<p>Hello everyone. I'm a paragraph with a <b>bold</b> word.</p>
```

The paragraph would appear in blue, including the bold word, because it inherits styles from the parent. A bold tag not inside a paragraph would not be blue, so:

```
<b>this is bold</b>
<p>this is blue <b>and bold</b></p>
```

The first line would be bold only, whereas the second line would be blue, including the bold word. The `<b>` tag changes its style depending upon context.

The technique of inherited styles reduces the amount of styling that needs to be done, and is especially useful for setting default fonts and font sizes.

CSS Styles

Whichever method you use to add CSS styles, the styles themselves are the same, and are best seen by an example. Take the example of blue text on a paragraph. The style could be as follows:

```
p {
  color: blue;
  font-weight: bold;
}
```

Every paragraph would now appear in bold blue because this style sets the style for the <p> element. Only the element name is used, and the angled brackets aren't included. So p defines the element for which the style applies, and the styling is surrounded by curly braces. Styles appear as a list separated by semicolons — styles are context independent, so they can be all on one line or on separate lines. Likewise, the curly braces can be on separate lines.

In this example two style properties are set, and the style is separated from the value by a colon. The first, color, defines the color of the text, and its value is set to blue. The second, font-weight, defines the weight of the font — how heavy it looks — and this is set to bold.

This technique allows styles to be set for HTML elements, and is typically used for the base elements. For example, the Wrox United style sheet defines the following:

```
html, body {
  background-color: #fff;
  color: #000;
  font: normal 90%/1.8em 'Lucida Grande', Verdana, Geneva, Lucida, Helvetica,
Arial, sans-serif;
  margin: 0;
}
h1 {
  font-size: 1.8em;
  font-weight: bold;
  margin-top: 0em;
  margin-bottom: 0em;
  color: #a83930;
}
h2 {
  font-size: 1.6em;
  margin: 1.0em 0em 1.0em 0em;
  font-weight: bold;
  color: #a83930;
}
h3 {
  font-size: 1.2em;
  margin: 1.0em 0em 1.0em 0em;
  font-weight: bold;
  color: #a83930;
}
p {
  font-size: 1.1em;
  line-height: 1.8em;
  margin: 1.1em 0em 1.1em 0em;
  text-align: left;
}
```

This defines the styles for the html and body elements, which due to inheritance become the default for the rest of the page. Next are the headings and then the paragraph. The colors are described in the "Colors" section later in the appendix.

CSS Sizes

One thing you'll have noticed in the previous style sheet is the use of `em` as a size, for both fonts and margins. There are many ways of sizing things, including points, pixels, inches, and percentages or for fonts, predefined sizes. One of the problems with defining sizes is that they mean *different* things to *different* people, especially if they use *different* browsers or *different* platforms (get used to that word; I'm going to use it a lot!). The sizings you can use are as follows:

- Points (`pt`), which are a unit of print rather than a unit of the screen. Different browsers render the same point size differently, giving different font sizes.
- Pixels (`px`), which represent an individual pixel on the screen. This again depends on the platform and screen, because they define how many pixels per inch there are. The biggest drawback with pixels is that they are not user scalable. For example, in Internet Explorer you can select Text Size from the View menu and change the size of the text being browsed, but if the page designer used pixels, you have no way to resize the text.
- Physical units (`in`, `cm`, `mm`), which is a physical size. This again gives different results on different sized screens.
- Named sizes, such as `small`, `medium`, `large`, `x-large`. These provide relative sizes, with `small` being smaller than `medium`, and so on.
- Percentages (`%`), which define the size as a percentage of the default size (`medium`). So a font size of `200%` is twice the size of the default size.
- Ems (`em`), which represent the default font setting. `Ems` are user resizable. `1 em` represents one unit of the default font size.

In the Wrox United application, `ems` have been used because they provide the best flexibility, and are suitable for user resizing, which allows users with visual impairments to change the size of the text. You may read much on the pros and cons of setting sizes for fonts, but as Frog Box Design (who did the CSS and images for the Wrox United site) says:

> *We use relative sizes and* `em` *units because they scale better for people using larger fonts, but we do set a relative percentage size, too.*

Percentages are particularly useful when defining the width of block elements. For example, a width of 100% means the element will be the full width of its parent element. This is useful for things like grids where you want them to be the full width of the screen.

Oh, and I've now finished with all the *difference* stuff, so you can relax again.

Fonts

Deciding on which fonts to use can make a big difference to the readability of your site, because certain fonts are easier to read on the screen than others. You can define many different aspects of the font including the style (normal, bold, and so forth), the size, and the family. In the Wrox United style sheet the main font is defined as follows:

```
font: normal 90%/1.8em 'Lucida Grande', Verdana, Geneva, Lucida, Helvetica, Arial,
sans-serif;
```

This has three parts:

- The style, which is `normal`.
- The size, which is `90%/1.8em`. This means a font size of 90% and a line height of 1.8em (1.8 times the normal font size), giving us nice spacing between the lines. The size of the font isn't directly related to the line height, and this declaration is a shortcut that allows us to specify the two at the same time.
- The family, which defines the fonts to be used, if they are available. If a font is not available on the browser, the next in line is tried. Here `Lucida Grande` will be tried first, `Verdana` next, and so on. Fonts that have spaces in their names must have quotes around them.

These three parts could also have been defined like this:

```
font-style: normal;
font-size: 90%;
font-family: 'Lucida Grande', Verdana, Geneva, Lucida, Helvetica, Arial, sans-
serif;
line-height: 1.8em;
```

The single-line form is just a shortcut.

Colors

Colors can be predefined or you can specify the red, green, and blue values. For example, for blue text any of the following could be used:

```
color: blue;
color: #0000ff;
color: rgb(0, 0, 255)
color: rgb(0%, 0%, 100%);
```

They all produce the same result. The first uses a defined name, whereas the second uses a hexadecimal notation where `00` represents no color and `ff` represents full colors. There are two digits for the red component, two for green, and two for blue. So `0000ff` means:

- `00` for red, so no red
- `00` for green, so no green
- `ff` for blue, so full blue

Using `rgb` allows you to specify this either in decimal (`0` is no color and `255` is full color), or as percentages.

You might also see a shortcut form of the hexadecimal notation consisting of only three digits. This can be used if the two digits for a color part are the same. So blue could be `00f`.

CSS Selectors

Earlier you saw how a paragraph could be styled:

```
p {
  color: blue;
  font-weight: bold;
}
```

The `p` part is defined as the *selector*, and this can be an element, an element ID, or a class name, and they way they are defined is different. To define an element ID you place a hash sign (#) before the selector:

```
#header {
  height: 100px;
  padding: 0 10px 0 10px;
  . . .
}
```

This would then correspond to an element with that ID:

```
<div id="header">
```

ID-based selectors can only be used by a single element because IDs have to be unique, so this should be reserved for things that will only ever appear once. In the Wrox United style sheet this is used for items such as the header, sidebar, and so on.

To use a class name, you precede the selector with a period:

```
.title {
  color: #a83930;
  text-align: center;
  . . .
}
```

This matches a `CssClass` property for a web server control, or the `class` property for an HTML control:

```
<asp:Label id="Label1" runat="server" CssClass="title">My Page</asp:Label>
<div class="title>My Page</div>
```

Because the class name can be used by multiple controls, you should use it for common styling across elements. The named selector can be designed to apply to all elements (as in the previous code), or just selected elements:

```
div.title {
  color: #a83930;
}
```

Here the selector only applies if a `div` element is given a class of `title`; any other element would not get the style. The following line will be styled:

```
<div class="title">This will be styled</div>
```

Whereas this line will not be styled:

```
<span class="title">While this will not be styled</span>
```

Selector names are case sensitive.

Multiple Selectors

You can also define multiple selectors to have the same style by having them as a comma-separated list at their definition:

```
span, div {
  color: #a83930;
}
```

This defines both the `span` and `div` elements to have the same style. Multiple selectors work with elements, ID-based and class-named forms.

Contextual Selectors

Selectors can also be contextual, meaning that they can be defined to only apply depending on the context in which the element appears. For example, what if you wanted to style list elements (`li` and `ul`), but only if they appear within the navigation bar at the left of the screen (`#nav`)? Your style could be

```
#nav li {
  color: #a83930;
}
#nav ul {
  color: #a83930;
}
```

With these rules the `li` and `ul` elements will only be styled if they are within a control with an ID of `#nav`. Outside of the `#nav` control no style will be applied.

Floating Elements

Sometimes you want to position elements to the left or right of others, and can't achieve this with placing them one after another, because HTML is a flow-based layout, and elements are placed in their declaration order. One way around this is fixed position, which positions elements directly, but this has problems with users resizing their browser window, because the positioned elements may be outside the new window size.

An easy way is to use floating elements, and although they are restricted in what they do, they can often provide the solution. For example, on the Wrox United home page there are news items, and the date of the item is shown at the right of the page. Resizing the browser keeps this at the right, because we have floated it to the right. The style for this is as follows:

```
.newsDate {
  font: normal 0.9em/0.9em 'Lucida Grande', Verdana,  Geneva, Lucida, Helvetica,
Arial, sans-serif;
  float: right;
  color: #666666;
}
```

Ignore the font and color; the important point is the `float` element:

```
float: right;
```

This states that the element should be placed at the right of its containing control. So however wide the parent control is, the news date will always appear at its right. Elements can also be floated to the left of others, and if you want to learn more about floating elements it's best to consult a specialized CSS book, but details of some are included at the end of this appendix.

Pseudo Classes

In addition to standard classes, some special classes (called *pseudo classes*) apply to actions rather than the anchor element. These allow specific classes to be applied to links. For example, consider the following:

```
a:hover {
  text-decoration: none;
}
#nav a:hover {
  text-decoration: none;
  color: #a83930;
  background-color: #fdea12;
}
```

Here the `hover` pseudo class is used, which indicates the style to be applied when the cursor is hovering over a link. The first class sets the `text-decoration` to `none`, which removes the underline from links, but only when they are hovered over. For links in the navigation area though, additional styling is done.

In addition to `hover`, three pseudo classes exist for links:

- `link` defines how an unclicked and unvisited link should be styled.
- `visited` defines how a link that has been visited should be styled.
- `active` defines how a currently active line should be styled.

Other pseudo classes exist, but support for these in Internet Explorer is limited, so coding to use them always requires a lot of effort. For that reason we haven't described them here.

CSS Reference

The following table describes the CSS properties, but does not include the aural properties for screen readers. These should be supported on most modern browsers.

Property	Description
background	Changes the background color and image.
background-attachment	Determines how background images should scroll. background-attachment supports three values: scroll, fixed, and inherit. The default value is scroll, which indicates that images scroll. Specifying fixed means that images are fixed. Specifying inherit indicates that images inherit behavior from their parent.
background-color	Defines the background color.
background-image	Defines the image to show in the background of the element.
background-position	Defines the position of a background image. Defined as two values to specify the horizontal and vertical positioning. These can be top, center, or bottom for vertical alignment; left, center, or right for horizontal alignment; percentages; or fixed values.
background-repeat	Indicates whether a background image is repeated and can be repeat, repeat-x, repeat-y, no-repeat, or inherit.
border	Defines the properties of the border of an element.
border-color	Defines the color of a border.
border-collapse	Indicates whether borders in tables collapse onto each other. Can be one of collapse, separate, or inherit.
border-spacing	Defines the amount of space between borders in a table.
border-style	Defines the style of a border, and can be one of none, dotted, dashed, solid, double, groove, ridge, inset, outset, or inherit.
border-top border-bottom border-left border-right	Define the properties of a single border of an element.
border-top-color border-bottom-color border-left-color border-right-color	Define the color for an individual border of an element.

Property	Description

`border-top-style`
`border-bottom-style`
`border-left-style`
`border-right-style`
	Define the style for an individual border of an element.

`border-top-width`
`border-bottom-width`
`border-left-width`
`border-right-width`
	Define the width for an individual border of an element.

`border-width`	Defines the width of the border for an element.
`bottom`	Defines the distance to offset an element from the bottom edge of its parent element.
`caption-side`	Defines where a caption is placed in relation to a table, and can be one of `top`, `bottom`, `left`, `right`, or `inherit`.
`clear`	Clears any floating in action, and can be one of `none`, `left`, `right`, `both`, or `inherit`.
`clip`	Defines how much of an element is visible and can be a rectangle `rect[n,n,n,n]`, `auto`, or `inherit`.
`color`	Defines the foreground color of an element.
`content`	Defines the type of content and how it is to be displayed.
`counter-increment`	Defines the property and amount for auto-incrementing lists.
`counter-reset`	Resets the numerical value of auto-incrementing lists.
`cursor`	Sets the shape of the cursor when over the element. Can be one of `auto`, `crosshair`, `default`, `pointer`, `move`, `e-resize`, `ne-resize`, `nw-resize`, `n-resize`, `se-resize`, `sw-resize`, `s-resize`, `w-resize`, `text`, `wait`, `help`, `inherit`, or a URL to an image.
`direction`	Indicates the direction for letters, and can be one of `ltr` (left to right, the default), `rtl` (right to left), or `inherit`.
`display`	Determines how to display an element, and can be one of: `block`, `inline`, `list-item`, `none`, or `inherit`.
`empty-cells`	Defines how empty table cells are shown, and can be one of `hide`, `show`, or `inherit`.

Table continued on following page

Property	Description
`float`	Indicates how this element floats within the parent element, and can be one of `left`, `right`, `none`, or `inherit`.
`font`	Defines the attributes of the font for the element.
`font-family`	Defines the font family for text.
`font-size`	Defines the size of the font for text.
`font-size-adjust`	Defines the aspect value for a font element.
`font-stretch`	Defines how expanded or condensed a font is.
`font-style`	Defines the style of the font, and can be one of `italic`, `normal`, `oblique`, or `inherit`.
`font-variant`	Defines whether the font is displayed in capital letters, and can be `normal`, `small-caps`, or `inherit`.
`font-weight`	Defines the thickness of the font, and can be absolute weight values (`100` to `900` in steps of 100), `bold` or `normal`, `bolder` or `lighter`, or `inherit`.
`height`	Defines the height of an element.
`left`	When using absolute positioning, this defines how far from the left edge of the parent the element is placed.
`letter-spacing`	Defines the amount of space between letters.
`line-height`	Defines the height between lines.
`list-style`	Defines the properties for list elements.
`list-style-image`	Defines the image to be used as the marker for a list element.
`list-style-position`	Defines the positioning of the list relative to the list itself, and can be one of `inside`, `outside`, or `inherit`.
`list-style-type`	Defines the type of marker for the list, and can be one of `circle`, `decimal`, `disc`, `square`, `lower-roman`, `upper-roman`, `lower-alpha`, `upper-alpha`, `none`, or `inherit`.
`margin`	Defines the amount of space between the border and the parent element.

`margin-top`
`margin-bottom`
`margin-left`
`margin-right`
	Define the amount of space between the border and the parent element for an individual side of an element.

Property	Description
marker-offset	Defines the distance between the border of a list marker and the list itself.
marks	Defines whether crop marks are shown, and can be one of crop, cross, both, none, or inherit.
max-height max-width	Define the maximum height and width of an element.
min-height min-width	Define the minimum height and width of an element.
orphans	Defines the minimum number of lines or paragraph that must be left at the bottom of a page.
outline	Defines the properties of a button or form field that has focus.
outline-color	Defines the color of a button or form field that has focus.
outline-style	Defines the border style of a button or form field that has focus.
outline-width	Defines the border width of a button or form field that has focus.
overflow	Defines the visibility of content if it doesn't fit within the element, and can be one of auto, hidden, scroll, visible, or inherit.
padding	Defines the distance between one or more sides of the content area and its border.
padding-top padding-bottom padding-left padding-right	Define the distance between a side of the content area and its border.
page	Defines the page type (such as regular or landscape) for printed content.
page-break-after page-break-before	Define how the browser should insert page breaks, and can be one of always, auto, avoid, left, right or inherit.
page-break-inside	Defines whether page breaks split an element across pages, and can be auto, avoid, or inherit.
position	Defines how an element is positioned relative to the flow of the document, and can be absolute, fixed, relative, static, or inherit.
quotes	Defines the type of quotation mark to be used within embedded quotes.

Property	Description
right	Defines the distance an element should be from its parent's right edge.
size	Defines the size of the printing area in a page.
table-layout	Defines how the width of table cells is calculated, and can be auto, fixed, or inherit.
text-align	Defines the alignment of text, and can be one of center, justify, left, right, or inherit.
text-decoration	Defines the decoration on text, and can be one of blink, line-through, none, overline, underline, or inherit.
text-indent	Defines the amount of space to indent the first line of a paragraph.
text-shadow	Defines the amount of shadow to apply to text.
text-transform	Defines the casing to use on text, and can be one of capitalize, lowercase, none, uppercase, or inherit.
top	Defines the distance between an element and its parent's top edge.
Unicode-bidi	Defines Unicode text as having bidirectional characteristics.
vertical-align	Defines the vertical alignment of the element.
visibility	Defines how, or if, the element is shown, and can be one of collapse, hidden, visible, or inherit.
white-space	Defines how white space should be treated, and can be one of normal, nowrap, pre, or inherit.
widows	Defines the minimum number of lines that must be left at the top of a page.
width	Defines the width of the element.
word-spacing	Defines the distance between words.
z-index	Defines the depth of an element to allow overlapping elements.

Common HTML Tags by Category

Following is a list of some of the most commonly used HTML tags by category. When you know what you want to do, but you're not sure which tag will achieve the desired effect, use the following reference tables to put you on the right track.

Document Structure

Tag	Meaning
<! >	Allows authors to add comments to code.
<!DOCTYPE>	Defines the document type. This is required by all HTML documents.
<base>	Specifies the document's base URL — its original location. It's not normally necessary to include this tag. It can only be used in <HEAD> section.
<body>	Contains the main part of the HTML document.
<comment>	Allows authors to add comments to code.
	Defines a block division of the <BODY> section of the document.
<head>	Contains information about the document itself.
<html>	Signals the beginning and end of an HTML document.
<link>	Defines the current document's relationship with other resources. Used in <HEAD> section only.
<meta>	Describes the content of a document.
<nextid>	Defines a parameter in the <HEAD> section of the document.
	Defines an area for reference by a style sheet.
<style>	Specifies the style sheet for the page.

Titles and Headings

Tag	Meaning
<h1>	Heading level 1.
<h2>	Heading level 2.
<h3>	Heading level 3.
<h4>	Heading level 4.
<h5>	Heading level 5.
<h6>	Heading level 6.
<title>	Defines the title of the document.

Paragraphs and Lines

Tag	Meaning
 	Line break.
	Centers subsequent text/images.
<hr>	Draws a horizontal rule.
<nobr>	Prevents a line of text breaking.
<p>	Defines a paragraph.
<wbr>	Inserts a soft line break in a block of <NOBR> text.

Text Styles

Tag	Meaning
<address>	Indicates an address. The address is typically displayed in italics.
<b>	Emboldens text.
<basefont>	Sets font size to be used as default.
<big>	Changes the physical rendering of the font to one size larger.
<blockquote>	Formats a quote — typically by indentation.
<cite>	Renders text in italics.
<code>	Renders text in a font resembling computer code.
<dfn>	Indicates the first instance of a term or important word.
	Emphasized text — usually italic.
<font>	Changes font properties.
<i>	Defines italic text.
<kbd>	Indicates typed text. Useful for instruction manuals and the like.
<listing>	Renders text in a fixed-width font.
<plaintext>	Renders text in a fixed-width font without processing any other tags it may contain.
<pre>	Preformatted text. Renders text exactly how it is typed — carriage returns, styles, and so forth, will be recognized.

Tag	Meaning
<s> or <strike>	Strikethrough. Renders the text as deleted (crossed out).
<samp>	Specifies sample code.
<small>	Changes the physical rendering of a font to one size smaller.
	Strong emphasis — usually bold.
<style>	Specifies the style sheet for the page.
<sub>	Subscript.
<sup>	Superscript.
<tt>	Renders text in fixed width, typewriter-style font.
<u>	Underlines text. Not widely supported at present, and not recommended, because it can cause confusion with hyperlinks, which also normally appear underlined.
<var>	Indicates a variable.
<xmp>	Renders text in fixed-width type, used for example text.

Lists

Tag	Meaning
<dd>	Definition description. Used in definition lists with <DT> to define the term.
<dir>	Denotes a directory list by indenting the text.
<dl>	Defines a definition list.
<dt>	Defines a definition term. Used with definition lists.
	Defines a list item in any type of list other than a definition list.
<menu>	Defines a menu list.
	Defines an ordered (numbered) list.
	Defines an unordered (bulleted) list.

Tables

Tag	Meaning
`<caption>`	Puts a title above a table.
`<col>`	Defines column width and properties for a table.
`<colgroup>`	Defines properties for a group of columns in a table.
`<table>`	Defines a series of columns and rows to form a table.
`<tbody>`	Defines the table body.
`<td>`	Specifies a cell in a table.
`<tfoot>`	Defines table footer.
`<th>`	Specifies a header column. Text will be centered and bold.
`<thead>`	Used to designate rows as the table's header.
`<tr>`	Defines the start of a table row.

Links

Tag	Meaning
`<a>`	Used to insert an anchor, which can be either a local reference point or a hyperlink to another URL.
`<a href="url">`	Hyperlink to another document, the location of which is specified by the `url`.
`<a name="name">`	Link to a local reference point, the location of which is specified by the `name`.

Graphics, Objects, Multimedia, and Scripts

Tag	Meaning
`<applet>`	Inserts an applet.
`<area>`	Specifies the shape of a hot spot in a client-side image map.
`<bgsound>`	Plays a background sound.

Tag	Meaning
<embed>	Defines an embedded object in an HTML document.
<img>	Embeds an image or a video clip in a document.
<map>	Specifies a collection of hot spots for a client-side image map.
<marquee>	Sets a scrolling marquee.
<noscript>	Specifies HTML to be displayed in browsers that don't support scripting.
<object>	Inserts an object.
<param>	Defines parameters for a Java applet.
<script>	Inserts a script.

Forms

Tag	Meaning
<button>	Creates an HTML-style button.
<fieldset>	Draws a box around a group of controls.
<form>	Defines part of the document as a user fill-out form.
<input>	Defines a user input box.
<label>	Defines a label for a control.
<legend>	Defines the text label to use in box created by a <FIELDSET> tag.
<option>	Used within the <SELECT> tag to present the user with a number of options.
<select>	Denotes a list box or drop-down list.
<textarea>	Defines a text area inside a <FORM> element.

Frames

Tag	Meaning
<frame>	Defines a single frame in a frameset.
<frameset>	Defines the main container for a frame.

Table continued on following page

Tag	Meaning
<iframe>	Defines a floating frame within a document.
<noframes>	Allows for backward compatibility with non-frame-compliant browsers.

HTML Common Attributes to CSS Property Cross Reference

Attribute	CSS Values	Description
align	text-align	Specifies how the element is aligned with respect to its containing element, or to the rest of the page.
alink	:link pseudo class	The color for active links in the page. A link is active while the mouse button is held down over the link.
background	background:	Specifies a background picture that is tiled behind text and graphics.
bgcolor	background-color	Specifies the background color to be used for an element.
bgproperties	background-attachment	Specifies a background picture as a watermark, which does not scroll.
border	border	Specifies if a border is to be drawn around the element, and sets its thickness.
bordercolor	border-color	The color of all or some of the borders for an element.
clear	clear	Causes the next element or text to be displayed below left-aligned or right-aligned images.
color	color	The text or foreground color of an element.
face	font-family	Sets the font family or typeface of the current font or base font.
height	height	Specifies the height of the element that is to be drawn on the page.
hidden	visibility	Forces the embedded object to be invisible in an <EMBED> tag.

Attribute	CSS Values	Description
hspace	margin	Specifies the horizontal spacing or margin between an element and its neighbors.
link	:link pseudo class	The color for links.
left	left	Position in pixels of the left-hand side of the object in relation to its container.
leftmargin	margin-left	Specifies the left margin for the entire body of the page, overriding the default margin.
marginheight	margin-top	Specifies the top and bottom margins for displaying text in a frame.
marginwidth margin-right	margin-left	Specifies the left and right margins for displaying text in a frame.
nowrap	white-space	Indicates that the browser should not perform automatic word wrapping of the text.
rightmargin	margin-right	Specifies the right margin for the entire body of the page, overriding the default margin.
size	size	Specifies the size of the element.
top	top	Position of the top of the element. Also returns topmost window object.
topmargin	margin-top	Specifies the margin for the top of the page, overriding the default top margin.
valign	vertical-align	Specifies how the contents should be aligned vertically within the element.
visibility	{visibility: visible | hidden}	Defines whether the element should be displayed on the page.
vlink	:visited pseudo class	The color for visited links in the page.
vspace	margin	Specifies the vertical spacing or margin between an element and its neighbors.

Table continued on following page

Attribute	CSS Values	Description
`weight`	`font-weight`	Defines the weight of the font used to render the text.
`width`	`width`	Specifies the width of the element that will be drawn in the page.
`z-index`	`z-index`	Position in the z-order or stacking order of the page — the z coordinate.

Recommended Reading

If you'd like to learn more about CSS, and we recommend you do, the following books will be useful:

Title	Beginning CSS: Cascading Style Sheets for Web Design
Author	Richard York
Publisher	Wrox Press
ISBN	0-7645-7642-9
Description	As part of the Beginning series this is a natural companion to this book, covering all aspects of how to use CSS for web site design.
Author	Jon Duckett
Publisher	Wrox Press
ISBN	0-7645-8306-9
Description	This book is aimed more at how to make your web site accessible to people with visual impairments or who use screen readers rather than standard browsers. It's something we should all aim to do when creating web sites.

Title	Core CSS Second Edition
Author	Keith Schengili-Roberts
Publisher	Prentice Hall
ISBN	0-13-009278-9
Description	This is a pure reference book to the whole of CSS, including some of the future enhancements. It's definitely not a learning book, but does provide good examples as well as being an excellent reference.

Title	Designing with Web Standards
Author	Jeffrey Zeldman
Publisher	New Riders
ISBN	0-7357-1201-8
Description	A book for the more advanced user, but this contains a wealth of information, especially around the practicalities of CSS and their use in the real world. It includes lots of material on cross-browser issues, such as sizes.

Another good resource is the Web, and there are plenty of CSS tutorials. A good place to start is `www.w3schools.com/css/`.

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