2ND EDITION

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BUILD YOUR OWN ASP.NET 2.0 WEB SITE USING C# & VB

BY CRISTIAN DARIE
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THE ULTIMATE ASP.NET BEGINNER'S GUIDE

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Acknowledgements

First and foremost, I'd like to thank the SitePoint team for doing such a great job in making this book possible, for being understanding as deadlines inevitably slipped past, and for the team's personal touch, which made it a pleasure to work on this project.

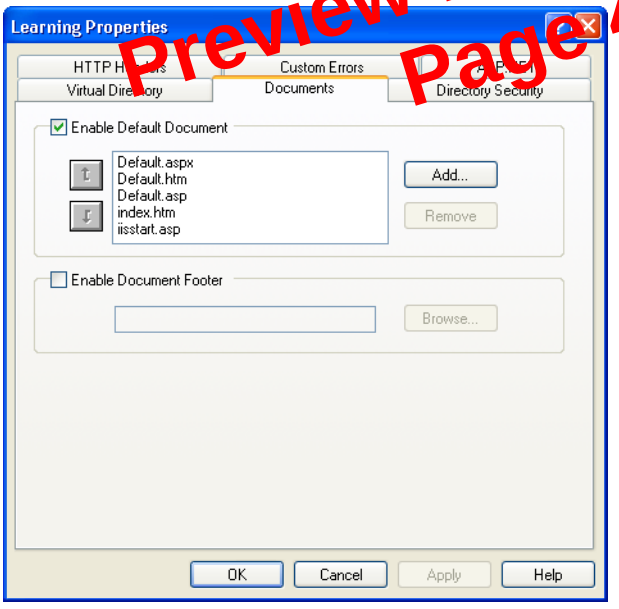
[2] http://www.sitepoint.com/forums/
[3] http://www.sitepoint.com/forums/forumdisplay.php?f=141

won't be the case with the ASP.NET scripts you'll see through the rest of this book.

Once your new virtual directory has been created, you can see and configure it through the Internet Information Services management console shown in Figure 1.8. You can see the folder's contents in the right-hand panel.

As `index.htm` is one of the default document names, you can access that page just by entering **`http://localhost/Learning/`** into your browser's address bar. To see and edit the default document names for a virtual directory (or any directory, for that matter), you can right-click the directory's name in the IIS management console, click Properties, and select the Documents tab. You'll see the dialog displayed in Figure 1.10.

Figure 1.10. Default document types for the Learning virtual directory



By default, when we request a directory without specifying a filename, IIS looks for a page with the name of one of the default documents, such as `index.htm` or `default.htm`. If there is no index page, IIS assumes we want to see the contents of the requested location. This operation is allowed only if the Directory Browsing

Custom Errors — This option allows you to define your own custom error pages. Rather than presenting the standard error messages that appear within Internet Explorer, you can customize error messages with your company's logo and messages of your choice.

ASP.NET — This tab allows you to configure the options for the ASP.NET applications stored in that folder.

One thing to note at this point is that we can set properties for the Default Web Site node, and choose to have them "propagate" down to all the virtual directories we've created.

Using Cassini

If you're stuck using a version of Windows that doesn't support IIS, you'll need to make use of Cassini to get your simple ASP.NET web applications up and running. Cassini doesn't support virtual directories, security settings, or any of IIS's other fancy features; it's just a very simple web server that gives you the basics you need to get up and running.

To get started using Cassini:

1. Create a directory called `C:\WebDocs\Learning`, just like the one we created in the section called "Virtual Directories".

2. Copy `index.htm` into this folder. We first saw `index.htm` in the section called "Using localhost".

3. Start Cassini by opening `C:\Cassini` (or, if you chose to install Cassini somewhere else, open that folder), then double-click on the file `CassiniWebServer.exe`.

4. Cassini has just three configuration options:

   Application Directory
   It's here that your application's files are stored. Enter **`C:\WebDocs\Learning`** into this field.

   Server Port
   Web servers almost always operate on port 80, so we won't touch this setting.

Server Management Studio Express is a free tool provided by Microsoft to allow you to manage your installation of SQL Server 2005.

To install SQL Server Management Studio Express, follow these steps:

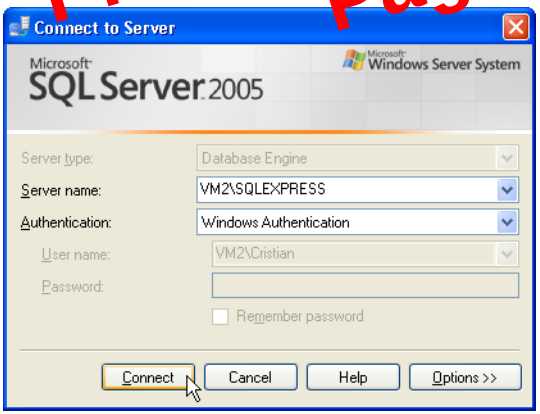
1. Navigate again to http://msdn.microsoft.com/vstudio/express/sql/, and click the Download Now link.

2. This time, download the SQL Server Management Studio Express edition that corresponds to the SQL Server 2005 version that you installed previously.

3. After the download completes, execute the file and follow the steps to install the product.

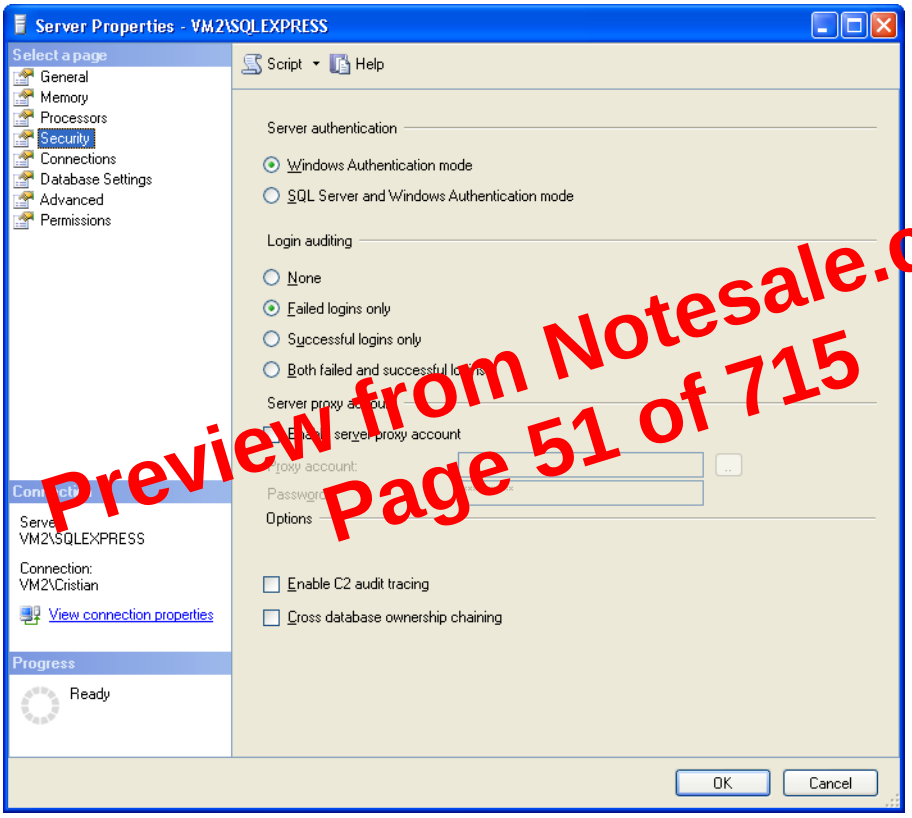
Once it's installed, SQL Server Manager Express can be accessed from Start > All Programs > Microsoft SQL Server 2005 > SQL Server Management Studio Express. When executed, it will first ask for your credentials, as Figure 1.12 illustrates.

Figure 1.12. Connecting to SQL Server



By default, when installed, SQL Server 2005 Express Edition will only accept connections that use Windows Authentication, which means that you'll use your Windows user account to log in to the SQL Server. Because you're the user that installed SQL Server 2005, you'll already have full privileges to the SQL Server. Click Connect to connect to your SQL Server 2005 instance.

Figure 1.14. Changing server settings with SQL Server Management Studio



database server, you must specify both the name of the computer and the name of the SQL Server instance in the form *ComputerName*`\`*InstanceName*. You can see this specification back in Figure 1.12 and Figure 1.13, where we're connecting to an instance called `SQLEXPRESS` on a computer called `VM2`.

Installing Visual Web Developer 2005

Visual Web Developer automates many of the tasks that you'd need to complete yourself in other environments, and includes many powerful features. For the first exercises in this book, we'll recommend you use a simple text editor such as

The `runat="server"` attribute identifies the tag as something that needs to be handled on the server. In other words, the web browser will never see the `<asp:Label/>` tag; when the page is requested by the client, ASP.NET sees it and converts it to regular HTML tags before the page is sent to the browser. It's up to us to write the code that will tell ASP.NET to replace this particular tag with the current time.

To do this, we must add some script to our page. ASP.NET gives you the choice of a number of different languages to use in your scripts. The two most common languages are VB and C#. Let's take a look at examples using both. Here's a version of the page in VB:

Visual Basic — File: **FirstPage.aspx (excerpt)**

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html>
  <head>
    <title>My First ASP.NET Page</title>
    <script runat="server" language="VB">
      Sub Page_Load(sender As Object, e As EventArgs)
        timeLabel.Text = DateTime.Now.ToString()
      End Sub
    </script>
  </head>
  <body>
    <p>Hello there!</p>
    <p>The time is now:
       <asp:Label runat="server" id="timeLabel" /></p>
  </body>
</html>
```

Here's the same page written in C#:

C# — File: **FirstPage.aspx (excerpt)**

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html>
  <head>
    <title>My First ASP.NET Page</title>
    <script runat="server" language="C#">
      protected void Page_Load(object sender, EventArgs e)
      {
        timeLabel.Text = DateTime.Now.ToString();
      }
    </script>
```

2

ASP.NET Basics

So far, you've learned what ASP.NET is, and what it can do. You've installed the software you need to get going, and, having been introduced to some very simple form processing techniques, you even know how to create a simple ASP.NET page. Don't worry if it all seems a little bewildering right now, because, as this book progresses, you'll learn how to use ASP.NET at more advanced levels.

As the next few chapters unfold, we'll explore some more advanced topics, including the use of controls, and various programming techniques. But before you can begin to develop applications with ASP.NET, you'll need to understand the inner workings of a typical ASP.NET page—with this knowledge, you'll be able to identify the parts of the ASP.NET page referenced in the examples we'll discuss throughout this book. So, in this chapter, we'll talk about some key mechanisms of an ASP.NET page, specifically:

- page structure
- view state
- namespaces
- directives

Figure 2.1. The life cycle of the ASP.NET page

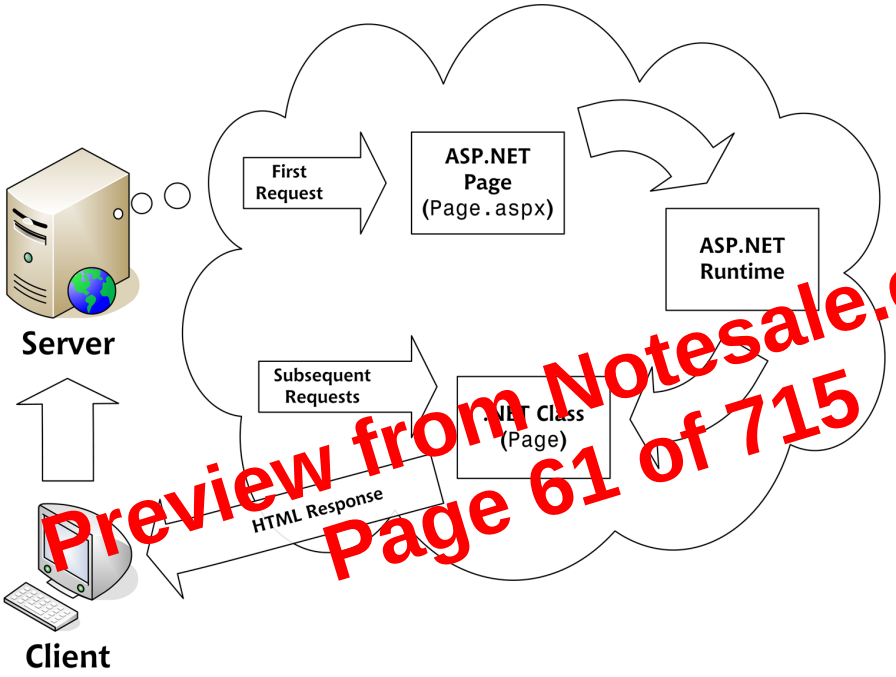
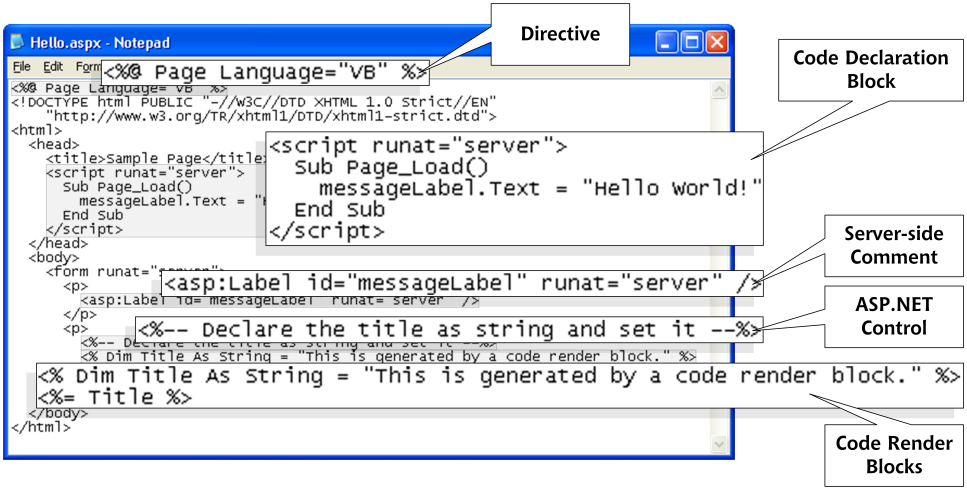


Figure 2.2. The parts of an ASP.NET page



In VB code, a single quote or apostrophe (') indicates that the remainder of the line is to be ignored as a comment.

In C# code, two slashes (//) achieve the same end. C# code also lets us span a comment over multiple lines if we begin it with /* and end it with */, as in this example:

C#

```
<script runat="server">
  void mySub()
  {
    /* Multi-line
       comment    */
  }
</script>
```


Before .NET emerged, ASP also supported such script tags using a runat="server" attribute. However, they could only ever contain VBScript and, for a variety of reasons, they failed to find favor among developers.

Code declaration blocks are generally placed inside the head of your ASP.NET page. The sample ASP.NET page shown in Figure 2.2, for instance, contains the following code declaration block:

Visual Basic File: **Hello.aspx (excerpt)**

```
<script runat="server">
  Sub Page_Load()
    messageLabel.Text = "Hello World"
  End Sub
</script>
```

Perhaps you can work out what the equivalent C# code would be:

C# File: **Hello.aspx (excerpt)**

```
<script runat="server">
  void Page_Load()
  {
    messageLabel.Text = "Hello World";
  }
</script>
```

The <script runat="server"> tag also accepts two other attributes. We can set the language that's used in this code declaration block via the language attribute:

These code blocks simply declare a String variable called `Title`, and assign it the value `This is generated by a code render block`.

Inline expression render blocks can be compared to `Response.Write` in classic ASP. They start with `<%=` and end with `%>`, and are used to display the values of variables and methods on a page. In our example, an inline expression appears immediately after our inline code block:

File: **Hello.aspx (excerpt)**

```
<%= Title %>
```

If you're familiar with classic ASP, you'll know what this code does: it simply outputs the value of the variable `Title` that we declared in the previous inline code block.

ASP.NET Server Controls

At the heart of any ASP.NET page lie server controls, which represent dynamic elements with which your users can interact. There are three basic types of server control: ASP.NET controls, HTML controls, and web user controls.

Usually, an ASP.NET control must reside within a `<form runat="server">` tag in order to function correctly. Controls offer the following advantages to ASP.NET developers:

- They give us the ability to access HTML elements easily from within our code: we can change these elements' characteristics, check their values, or even update them dynamically from our server-side programming language of choice.
- ASP.NET controls retain their properties thanks to a mechanism called **view state**. We'll be covering view state later in this chapter. For now, you need to know that view state prevents users from losing the data they've entered into a form once that form has been sent to the server for processing. When the response comes back to the client, text box entries, drop-down list selections, and so on, are all retained through view state.
- With ASP.NET controls, developers are able to separate a page's presentational elements (everything the user sees) from its application logic (the dynamic portions of the ASP.NET page), so that each can be considered separately.
- Many ASP.NET controls can be "bound" to the data sources from which they will extract data for display with minimal (if any) coding effort.

3 VB and C# Programming Basics

As you learned at the end of the last chapter, one of the great things about using ASP.NET is that we can pick and choose which of the various .NET languages we like. In this chapter, we'll look at the key programming principles that will underpin our use of Visual Basic and C#. We'll start by discussing some basic concepts of programming ASP.NET web applications using these two languages. We'll explore programming fundamentals such as variables, arrays, functions, operators, conditionals, loops, and events, and work through a quick introduction to object oriented programming (OOP). Next, we'll dive into namespaces and address the topic of classes—seeing how they're exposed through namespaces, and which ones you'll use most often.

The final sections of the chapter cover some of the ideas underlying modern, effective ASP.NET design, including code-behind and the value it provides by helping us separate code from presentation. We finish with an examination of how object oriented programming techniques impact the ASP.NET developer.

Programming Basics

One of the building blocks of an ASP.NET page is the application logic: the actual programming code that allows the page to function. To get anywhere with ASP.NET, you need to grasp the concept of **events**. All ASP.NET pages will contain controls such as text boxes, checkboxes, and lists. Each of these controls

Visual Basic
```
Dim carType As String = "BMW"
```

C#
```
string carType = "BMW";
```

We can also declare and/or initialize a group of variables of the same type simultaneously. This practice isn't recommended, though, as it makes the code more difficult to read.

Visual Basic
```
Dim carType As String, carColor As String = "blue"
```

C#
```
string carType, carColor = "blue";
```

Table 3.1 lists the most useful data types available in VB and C#.

Table 3.1. A list of commonly used data types

VB	C#	Description
`Integer`	`int`	whole numbers in the range -2,147,483,648 to 2,147,483,647
`Decimal`	`decimal`	numbers up to 28 decimal places; this command is used most often when dealing with costs of items
`String`	`string`	any text value
`Char`	`char`	a single character (letter, number, or symbol)
`Boolean`	`bool`	true or false
`Object`	object	a generic type that can be used to refer to objects of any type

You'll encounter many other data types as you progress, but this list provides an overview of the ones you'll use most often.

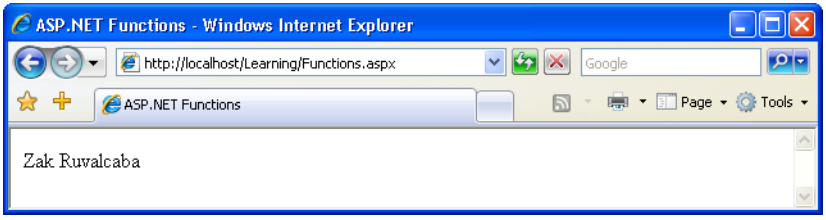
Many Aliases are Available

These data types are the VB- and C#-specific aliases for types of the .NET Framework. For example, instead of Integer or int, you could use `System.Int32` in any .NET language; likewise, instead of Boolean or bool, you could use `System.Boolean`, and so on.

```
      string getName()
      {
        return "Zak Ruvalcaba";
      }
      // And now we'll use it in the Page_Load handler
      void Page_Load()
      {
        messageLabel.Text = getName();
      }
    </script>
  </head>
  <body>
    <form runat="server">
      <asp:Label id="messageLabel" runat="server" />
    </form>
  </body>
</html>
```


When the page above is loaded in the browser, the Load event will be raised which will cause the Page_Load event handler to be called, which in turn will call the getName function. Figure 3.4 shows the result in the browser.

Figure 3.4. Executing an ASP.NET function



Here's what's happening: the line in our Page_Load subroutine calls our function, which returns a simple string that we can assign to our label. In this simple example, we're merely returning a fixed string, but the function could just as easily retrieve the name from a database (or somewhere else). The point is that, regardless of how the function gets its data, we call it in just the same way.

When we're declaring our function, we must remember to specify the correct return type. Take a look at the following code:

Visual Basic

```
' Here's our function
Function addUp(x As Integer, y As Integer) As Integer
  Return x + y
```

call which will return an integer during execution. Converting numbers to strings is a very common task in ASP.NET, so it's good to get a handle on it early.

Converting Numbers to Strings

There are more ways to convert numbers to strings in .NET, as the following lines of VB code illustrate:

```
messageLabel.Text = addUp(5, 2).ToString()
messageLabel.Text = Convert.ToString(addUp(5, 2))
```

If you prefer C#, these lines of code perform the same operations as the VB code above:

```
messageLabel.Text = addUp(5, 2).ToString();
messageLabel.Text = Convert.ToString(addUp(5, 2));
```

Don't be concerned if you're a little confused by how these conversions work, though—the syntax will become clear once we discuss object oriented concepts later in this chapter.

Operators

Throwing around values with variables and functions isn't of much use unless you can use them in some meaningful way, and to do so, we need operators. An **operator** is a symbol that has a certain meaning when it's applied to a value. Don't worry—operators are nowhere near as scary as they sound! In fact, in the last example, where our function added two numbers, we were using an operator: the addition operator, or + symbol. Most of the other operators are just as well known, although there are one or two that will probably be new to you. Table 3.2 outlines the operators that you'll use most often in your ASP.NET development.

Operators Abound!

The list of operators in Table 3.2 is far from complete. You can find detailed (though poorly written) lists of the differences between VB and C# operators on the Code Project web site.[3]

[3] http://www.codeproject.com/dotnet/vbnet_c__difference.asp

This demonstrates that the loop repeats until the condition is no longer met. Try changing the code so that the counter variable is initialized to `20` instead of `0`. When you open the page now, you won't see anything on the screen, because the loop condition was never met.

The other form of the `While` loop, called a `Do While` loop, checks whether or not the condition has been met at the end of the code block, rather than at the beginning:

Visual Basic — File: **Loops.aspx (excerpt)**

```
Sub Page_Load(s As Object, e As EventArgs)
  ' Initialize counter
  Dim counter As Integer = 0
  ' Loop
  Do
    ' Update the label
    messageLabel.Text = counter.ToString()
    ' We use the += operator to increase variable by 1
    counter += 1
  Loop While counter <= 10
End Sub
```

C# — File: **Loops.aspx (excerpt)**

```
void Page_Load()
{
  // initialize counter
  int counter = 0;
  // loop
  do
  {
    // Update the label
    messageLabel.Text = counter.ToString();
    // C# has the operator ++ to increase a variable by 1
    counter++;
  }
  while (counter <= 10);
}
```


If you run this code, you'll see it provides the exact same output we saw when we tested the condition before the code block. However, we can see the crucial difference if we change the code so that the counter variable is initialized to `20`. In this case, we will, in fact, see 20 displayed, because the loop code is executed once before the condition is even checked! There are some instances when this

is just what we want, so being able to place the condition at the end of the loop can be very handy.

A `For` loop is similar to a `While` loop, but we typically use it when we know beforehand how many times we need it to execute. The following example displays the count of items within a `DropDownList` control called `productList`:

Visual Basic

```
Dim i As Integer
For i = 1 To productList.Items.Count
  messageLabel.Text = i.ToString()
Next
```

C#

```
int i;
for (i = 1; i <= productList.Items.Count; i++)
{
  messageLabel.Text = i.ToString();
}
```


In VB, the loop syntax specifies the starting and ending values for our counter variable within the `For` statement itself.

In C#, we assign a starting value (`i = 1`) along with a condition that will be tested each time we move through the loop (`i <= productList.Items.Count`), and identify how the counter variable should be incremented after each loop (`i++`). While this allows for some powerful variations on the theme in our C# code, it can be confusing at first. In VB, the syntax is considerably simpler, but it can be a bit limiting in exceptional cases.

The other type of `For` loop is `For Each`, which loops through every item within a collection. The following example loops through an array called `arrayName`:

Visual Basic

```
For Each item In arrayName
  messageLabel.Text = item
Next
```

C#

```
foreach (string item in arrayName)
{
  messageLabel.Text = item;
}
```

This is just a simple example to help you visualize what OOP is all about. In the next few sections, we'll cover properties and methods in greater detail, and talk about classes and class instances, scope, events, and inheritance.

Properties

As we've seen, properties are characteristics shared by all objects of a particular class. In the case of our example, the following properties might be used to describe any given dog:

- color
- height
- length

In the same way, the more-or-less ASP.NET `Button` class exposes properties including:

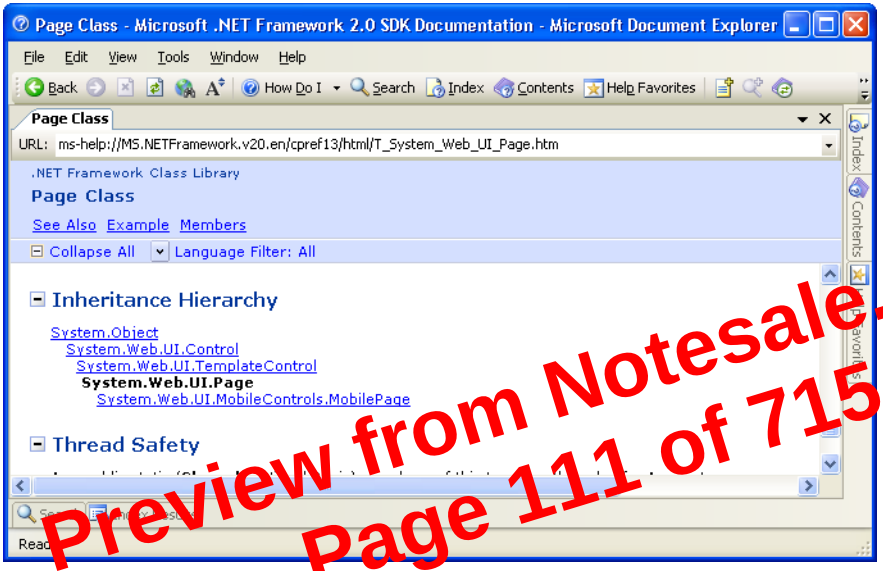
- `Width`
- `Height`
- `ID`
- `Text`
- `ForeColor`
- `BackColor`

Unfortunately for me, if I get sick of Rayne's color, I can't change it in real life. However, if Rayne was a .NET object, we could change any of his properties in the same way that we set variables (although a property can be read-only or write-only). For instance, we could make him brown very easily:

Visual Basic
```
rayne.Color = "Brown"
```

C#
```
rayne.Color = "Brown";
```

Figure 3.7. The `Page` class's documentation



You'll remember from the last section that we said our hypothetical `AustralianShepherd` class would inherit from the more general `Dog` class, which, in turn, would inherit from the even more general `Animal` class. This is exactly the kind of relationship that's being shown in Figure 3.7—`Page` inherits methods and properties from the `TemplateControl` class, which in turn inherits from a more general class called `Control`. In the same way that we say that an Australian Shepherd is an Animal, we say that a `Page` is a `Control`. `Control`, like all .NET classes, inherits from `Object`.

Since `Object` is so important that every other class derives from it, either directly or indirectly, it deserves a closer look. `Object` contains the basic functionality that the designers of .NET felt should be available in any object. The `Object` class contains these public members:

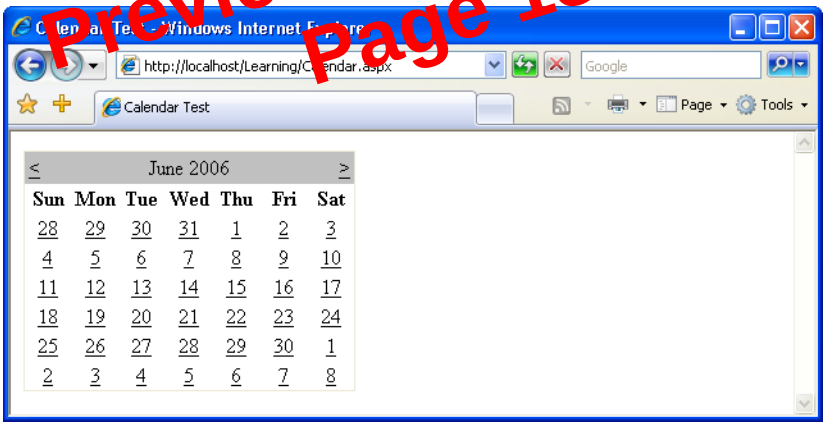
- `Equals`
- `ReferenceEquals`
- `GetHashCode`
- `GetType`

File: **Calendar.aspx (excerpt)**

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01//EN"
    "http://www.w3.org/TR/html4/strict.dtd">
<html>
  <head>
    <title>Calendar Test</title>
  </head>
  <body>
    <form runat="server">
      <asp:Calendar id="myCalendar" runat="server" />
    </form>
  </body>
</html>
```

If you save this page in the `Learning` folder and load it, you'd get the output shown in Figure 4.4.

Figure 4.4. Displaying the default calendar



The `Calendar` control contains a wide range of properties, methods, and events, including those listed in Table 4.3.

Table 4.3. Some of the `Calendar` control's properties

Property	Description
`DayNameFormat`	This property sets the format of the day names. Its possible values are `FirstLetter`, `FirstTwoLetters`, `Full`, and `Short`. The default is `Short`, which displays the three-letter abbreviation.
`FirstDayOfWeek`	This property sets the day of the week that begins each week in the calendar. By default, the value of this property is determined by your server's region settings, but you can set this to `Sunday` or `Monday` if you want to control it.
`NextPrevFormat`	Set to `CustomText` by default, this property can be set to `ShortMonth` or `FullMonth` to control the format of the next and previous month links.
`SelectedDate`	This property contains a DateTime value that specifies the highlighted day. You'll use this property a lot to determine which day the user has selected.
`SelectionMode`	This property determines whether days, weeks, or months can be selected; its possible values are `Day`, `DayWeek`, `DayWeekMonth`, and `None`, and the default is `Day`. When `Day` is selected, a user can only select a day; when `DayWeek` is selected, a user can select a day or an entire week; and so on.
`SelectMonthText`	This property controls the text of the link that's displayed to allow users to select an entire month from the calendar.
`SelectWeekText`	This property controls the text of the link that's displayed to allow users to select an entire week from the calendar.
`ShowDayHeader`	If `True`, this property displays the names of the days of the week. The default is `True`.
`ShowGridLines`	If `True`, this property renders the calendar with grid lines. The default is `True`.
`ShowNextPrevMonth`	If `True`, this property displays next/previous month links. The default is `True`.
`ShowTitle`	If `True`, this property displays the calendar's title. The default is `False`.

As you've probably noticed by now, the `.xml` file enables you to specify properties for each banner advertisement by inserting appropriate elements inside each of the `Ad` elements. These elements include:

`ImageURL`
: the URL of the image to display for the banner ad

`NavigateURL`
: the web page to which your users will navigate when they click the banner ad

`AlternateText`
: the alternative text to display for browsers that do not support images

`Keyword`
: the keyword to use to categorize your banner ad

  If you use the `KeywordFilter` property of the `AdRotator` control, you can specify the categories of banner ads to display.

`Impressions`
: the relative frequency that a particular banner ad should be shown in relation to other banner advertisements

  The higher this number, the more frequently that specific banner will display in the browser. The number provided for this element can be as low as one, but cannot exceed 2,048,000,000; if it does, the page throws an exception.

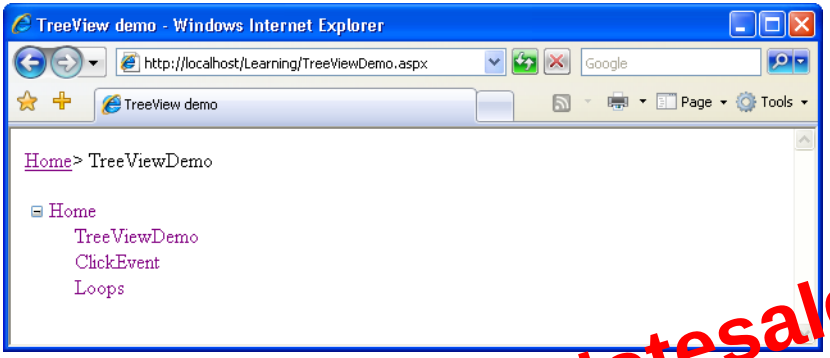
Except for `ImageURL`, all these elements are optional. Also, if you specify an `Ad` without a `NavigateURL`, the banner ad will display without a hyperlink.

To make use of this `Ads.xml` file, create a new ASP.NET page, called `AdRotator.aspx`, with the following code:

File: **`AdRotator.aspx` (excerpt)**

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html>
  <head>
    <title>AdRotator Control</title>
  </head>
  <body>
    <form runat="server">
      <asp:AdRotator ID="adRotator" runat="server"
```

Figure 4.8. A breadcrumb created using the `SiteMapPath` control



File: **TreeViewDemo.aspx (excerpt)**

```
<asp:SiteMapPath id="mySiteMapPath" runat="server"
    PathSeparator=" : ">
</asp:SiteMapPath>
```

If you run the example now, you'll see the breadcrumb appear exactly as it's shown in Figure 4.8.

Note that the `SiteMapPath` control shows only the nodes that correspond to existing pages of your site, so if you don't have a file named `Default.aspx`, the root node link won't show up. Similarly, if the page you're loading isn't named `TreeViewDemo.aspx`, the `SiteMapPath` control won't generate any output.

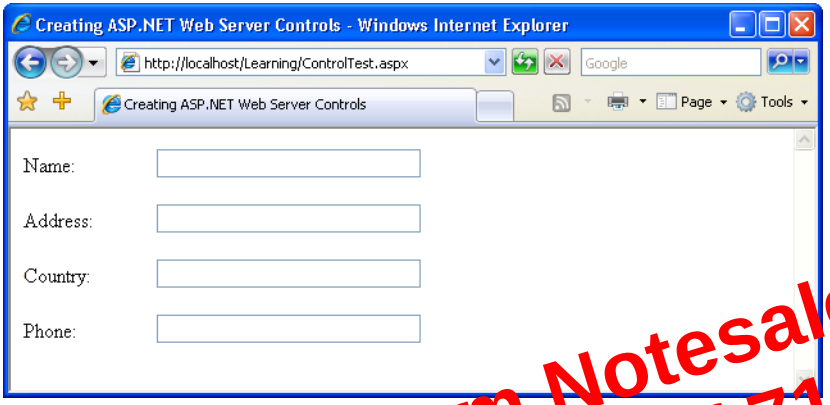
`Menu`

The `Menu` control is similar to `TreeView` in that it displays hierarchical data from a data source; the ways in which we work with both controls are also very similar. The most important differences between the two lie in their appearances, and the fact that `Menu` supports templates for better customization and displays only two levels of items (menu and submenu items).

`MultiView`

The `MultiView` control is similar to `Panel` in that it doesn't generate interface elements itself, but contains other controls. A `MultiView` can store more pages of data (called **views**), and lets you show one page at a time. You can change the active view (the one being presented to the visitor) by setting the value of the

Figure 4.10. A simple form



includes a `Label` of the specified width, and a `TextBox` that accepts 20 characters; you'll then be able to use the web user control wherever it's needed in your project.

In your `Learning` folder, create a new file named `SmartBox.ascx`. Then, add the control's constituent controls—a `Label` control and a `TextBox` control—as shown below:

File: **`SmartBox.ascx` (excerpt)**

```
<p>
  <asp:Label ID="myLabel" runat="server" Text="" Width="100" />
  <asp:TextBox ID="myTextBox" runat="server" Text="" Width="200"
      MaxLength="20" />
</p>
```

Label Widths in Firefox

Unfortunately, setting the `Width` property of the `Label` control doesn't guarantee that the label will appear at that width in all browsers. The current version of Firefox, for example, will not display the above label in the way it appears in Internet Explorer.

To get around this, you should use a CSS style sheet and the `CssClass` property, which we'll take a look at later in this chapter.

In Chapter 3 we discussed properties briefly, but we didn't explain how you could create your own properties within your own classes. So far, you've worked with

```
      return myTextBox.Text;
    }
  }
</script>
```

Just like web forms, web user controls can work with code-behind files, but, in an effort to keep our examples simple, we aren't using them here. You'll meet more complex web user controls in the chapters that follow.

When you use the `SmartBox` control in a form, you can set its label and have the text entered by the user, like this:

Visual Basic

```
mySmartBox.LabelText = "Address:"
userAddress = mySmartBox.Text
```

C#

```
mySmartBox.LabelText = "Address:";
userAddress = mySmartBox.Text;
```


Let's see how we implemented this functionality. In .NET, properties can be read-only, write-only, or read-write. In many cases, you'll want to have properties that can be both read and write, but in this case, we want to be able to set the text of the inner `Label`, and to read the text from the `TextBox`.

To define a write-only property in VB, you need to use the `WriteOnly` modifier. Write-only properties need only define a special block of code that starts with the keyword `Set`. This block of code, called an **accessor**, is just like a subroutine that takes as a parameter the value that needs to be set. The block of code uses this value to perform the desired action—in the case of the `LabelText` property, that action sets the `Text` property of our `Label` control, as shown below:

Visual Basic — File: **`SmartBox.ascx` (excerpt)**

```
Public WriteOnly Property LabelText() As String
  Set(ByVal value As String)
    myLabel.Text = value
  End Set
End Property
```

Assuming that a form uses a `SmartBox` object called `mySmartBox`, we could set the `Text` property of the `Label` like this:

Visual Basic

```
mySmartBox.LabelText = "Address:"
```

```
  </body>
</html>
```

Loading this page will produce the output we saw in Figure 4.10.

Now, this is a very simple example indeed, but we can easily extend it for other purposes. You can see in the code snippet that we set the `LabelText` property directly in the control's tag; we could have accessed the properties from our code instead. Here's an example:

Visual Basic — File: **ControlTest.aspx (excerpt)**

```
<script runat="server" language="VB">
  Protected Sub Page_Load()
    nameSb.LabelText = "Name:"
    addressSb.LabelText = "Address:"
    countrySb.LabelText = "Country:"
    phoneSb.LabelText = "Phone:"
  End Sub
</script>
```


C# — File: **ControlTest.aspx (excerpt)**

```
<script runat="server" language="C#">
  protected void Page_Load()
  {
    nameSb.LabelText = "Name:";
    addressSb.LabelText = "Address:";
    countrySb.LabelText = "Country:";
    phoneSb.LabelText = "Phone:";
  }
</script>
```

Master Pages

Master pages are a new feature of ASP.NET 2.0 that can make an important difference in the way we compose web forms. Master pages are similar to web user controls in that they are also composed of HTML and other controls; they can be extended with the addition of events, methods, or properties; and they can't be loaded directly by users—instead, they're used as building blocks to design the structure of your web forms.

A master page is a page template that can be applied to give many web forms a consistent appearance. For example, a master page can set out a standard structure

If all the pages in the site have the same header, footer, and navigation menu, it makes sense to include these components in a master page, and to build several web forms that customize only the content areas on each page. We'll begin to create such a site in Chapter 5, but let's work through a quick example here.

To keep this example simple, we won't include a menu here: we'll include just the header, the footer, and the content placeholder. In your `Learning` folder, create a new file named `FrontPages.master`, and write the following code into it:

File: **FrontPages.master (excerpt)**

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html>
  <head>
    <title>Front Page</title>
  </head>
  <body>
    <form id="myForm" runat="server">
      <h1>Welcome to SuperSite.com!</h1>
      <asp:ContentPlaceHolder id="FrontPageContent"
          runat="server" />
      <p>Copyright 2006</p>
    </form>
  </body>
</html>
```

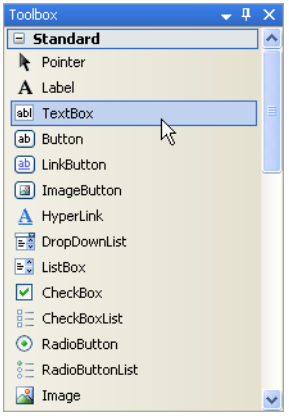

The master page looks almost like a web form, except for one important detail: it has an empty `ContentPlaceHolder` control. If you want to build a web form based on this master page, you just need to reference the master page using the `Page` directive in the web form, and add a `Content` control that includes the content you want to insert.

Let's try it. Create a web form called `FrontPage.aspx`, and add this code to it:

File: **FrontPage.aspx (excerpt)**

```
<%@ Page MasterPageFile="FrontPages.master" %>
<asp:Content id="myContent" runat="server"
    ContentPlaceHolderID="FrontPageContent">
  <p>
    Welcome to our web site! We hope you'll enjoy your visit.
  </p>
</asp:Content>
```

Figure 5.12. The Toolbox



server controls we discussed in Chapter 4. In the other tabs, you'll find other controls, including the validation controls we'll discuss in Chapter 6, which can be found in the Validation tab. Figure 5.13 shows the toolbox with all its tabs in the collapsed state.

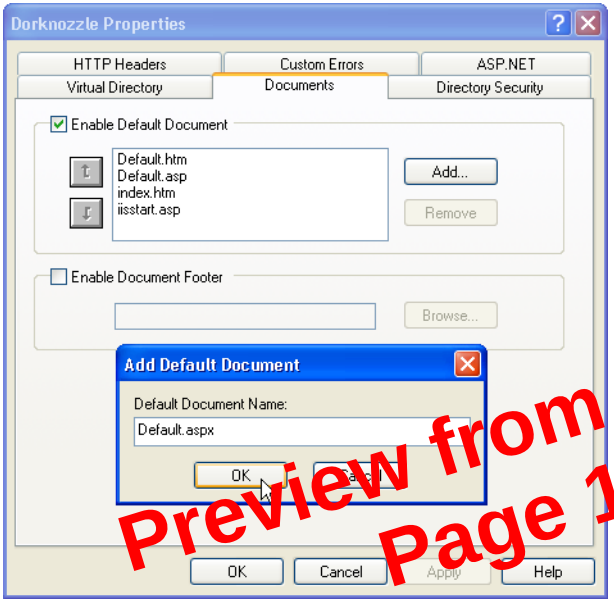
Figure 5.13. The collapsed Toolbox tabs

The Properties Window

When you select a control in the web forms designer, its properties are displayed automatically in the Properties window. For example, if you select the `TextBox` control we added to the form earlier, the properties of that `TextBox` will display in the Properties window. If it's not visible, you can make it appear by selecting View > Properties Window.

The Properties window doesn't just allow you to see the properties—it also lets you set them. Many properties—such as the colors that can be chosen from a palette—can be set visually, but in other cases, complex dialogs are available to

Figure 5.22. Adding a default name for the document



While you're here, it's a good idea to check that `Default.aspx` is included as a default file. If it is, then requesting `http://localhost/Dorknozzle` will load `http://localhost/Dorknozzle/Default.aspx` by default. To check this, click the Documents tab. If `Default.aspx` isn't in the list, add it by clicking the Add... button and entering the filename, as shown in Figure 5.22.

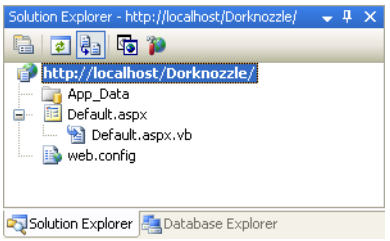
Finally, click OK to close the Dorknozzle Properties window.

If no default document exists in the `Dorknozzle` folder, the web server will attempt to return a list of the files and folders inside the `Dorknozzle` folder—an operation that will only succeed if the Directory Browsing option shown in Figure 5.21 is enabled. If this option is left in its default, disabled state, this operation will result in an error.

Now, if you load `http://localhost/Dorknozzle/` using any web browser, you should see a little magic (as Figure 5.23 reveals)!

The project will open. This time, the root entry in Solution Explorer will be `http://localhost/Dorknozzle/` instead of `c:\WebDocs\Dorknozzle\`, as Figure 5.25 indicates.

Figure 5.25. Solution Explorer displaying an HTTP location



Visual Web Developer knows how to investigate your IIS location and display its contents automatically in the Solution Explorer. If the folder contents are changed outside of Visual Web Developer, you'll need to right-click the root node and select Refresh Folder to refresh Visual Web Developer's display of the directory's contents.

Core Web Application Features

Let's continue our exploration of the key topics related to developing ASP.NET web applications. We'll put them into practice as we move through the book, but in this quick introduction, we'll discuss:

- `Web.config`
- `Global.asax`
- user sessions
- caching
- cookies

`Web.config`

Almost every ASP.NET web application contains a file named `Web.config`, which stores various application settings. By default, all ASP.NET web applications are

configured in the `Machine.config` file, which contains machine-wide settings, and lives in the `C:\WINDOWS\Microsoft.NET\Framework\`*`version`*`\CONFIG` directory.

For the most part, you won't want to make any modifications to this file. However, you can override certain settings of the `Machine.config` file by adding a `Web.config` file to the root directory of your application. You may already have this file in your project; if you don't, you can add one by accessing File > New File..., then selecting Web Configuration File from the dialog that appears.

The `Web.config` file is an XML file that can hold configuration settings for the application in which the file resides. One of the most useful settings that `Web.config` controls is ASP.NET's debug mode. If you're using VB, you can enable debug mode by opening `Web.config` and editing the `compilation` element, which looks like this:

File: **`Web.config` (excerpt)**

```
<!--
    Set compilation debug="true" to insert debugging
    symbols into the compiled page. Because this
    affects performance, set this value to true only
    during development.

    Visual Basic options:
    Set strict="true" to disallow all data type conversions
    where data loss can occur.
    Set explicit="true" to force declaration of all variables.
-->
<compilation debug="false" strict="false" explicit="true" />
```

Enabling debug mode is as simple as changing the value of the `debug` attribute to `true`. The other attributes listed here were added by Visual Web Developer to offer a helping hand to VB developers migrating from older versions. For example, `strict="false"` makes the compiler forgive some of the mistakes we might make, such as using the wrong case in variable names.

If you're using C#, you'll need to create the `Web.config` file yourself. Go to File > New File..., then select Web Configuration File from the dialog that appears, and click Add. This will create the default `Web.config` file, which will contain the following section:

File: **`Web.config` (excerpt)**

```
<!--
    Set compilation debug="true" to insert debugging
```

```
    <add namespace="System.Web.UI.WebControls"/>
    <add namespace="System.Web.UI.WebControls.WebParts"/>
    <add namespace="System.Web.UI.HtmlControls"/>
  </namespaces>
</pages>
```

We can use classes from these namespaces in our code without needing to reference them in every file in which they're used. As you can see, Visual Web Developer tries to offer an extra level of assistance for VB developers, but users of C# (or any other language) could also add these namespace references to `Web.config`.

You'll learn more about working with `Web.config` as you progress through this book, so if you wish, you can skip the rest of these details for now and come back to them later as you need them.

The `Web.config` file's root element is always `configuration`, which can contain three different types of element:

configuration section groups
: As ASP.NET and the .NET framework are so configurable, configuration files could easily become jumbled if we didn't have a way to break the files into groups of related settings. A number of predefined section grouping tags let you do just that. For example, settings specific to ASP.NET must be placed inside a `system.web` section grouping element, while settings that are relevant to .NET's networking classes belong inside a `system.net` element.

  General settings, like the `appSettings` element we saw above, stand on their own, outside the section grouping tags. In this book, though, our configuration files will also contain a number of ASP.NET-specific settings, which live inside the `system.web` element.

configuration sections
: These are the actual setting tags in our configuration file. Since a single element can contain a number of settings (e.g. the `appSettings` element we saw earlier could contain a number of different strings for use by the application), Microsoft calls each of these tags a "configuration section." ASP.NET provides a wide range of built-in configuration sections to control the various aspects of your web applications.

  The following list outlines some of the commonly used ASP.NET configuration sections, all of which must appear within the `system.web` section grouping element:

`authentication`
outlines configuration settings for user authentication, and is covered in detail in Chapter 14

`authorization`
specifies users and roles, and controls their access to particular files within an application; discussed more in Chapter 14.

`compilation`
contains settings that are related to page compilation, and lets you specify the default language that's used to compile pages

`customErrors`
used to customize the way errors display

`globalization`
used to customize character encoding for requests and responses

`pages`
handles the configuration options for specific ASP.NET pages; allows you to disable session state, buffering, and view state, for example

`sessionState`
contains configuration information for modifying session state (i.e. variables associated with a particular user's visit to your site)

`trace`
contains information related to page and application tracing

configuration section handler declarations
ASP.NET's configuration file system is so flexible that it allows you to define your own configuration sections. For most purposes, the built-in configuration sections will do nicely, but if we wanted to include some custom configuration sections, we'd need to tell ASP.NET how to handle them. To do so, we'd declare a configuration section handler for each custom configuration section we wanted to create. This is pretty advanced stuff, so we won't worry about it in this book.

Global.asax

`Global.asax` is another special file that can be added to the root of an application. It defines subroutines that are executed in response to application-wide events.

C#
```
Application.Remove("SiteName");
```

If you find you have multiple objects and application variables lingering in application state, you can remove them all at once using the `RemoveAll` method:

Visual Basic
```
Application.RemoveAll()
```

C#
```
Application.RemoveAll();
```

It's important to be cautious when using application variables. Objects remain in application state until you remove them using the `Remove` or `RemoveAll` methods, or shut down the application in IIS. If you continue to save objects into the application state without removing them, you can place a heavy demand on server resources and dramatically decrease the performance of your applications.

Let's take a look at application state in action. Application state is very commonly used to maintain hit counters, so our first task in this example will be to build one! Let's modify the `Default.aspx` page that Visual Web Developer created for us. Double-click `Default.aspx` in Solution Explorer, and add a `Label` control inside the `form` element. You could drag the control from the Toolbox (in either Design View or Source View) and modify the generated code, or you could simply enter the new code by hand. We'll also add a bit of text to the page, and change the `Label`'s ID to `myLabel`, as shown below:

File: **`Default.aspx` (excerpt)**
```
<form id="form1" runat="server">
  <div>
    The page has been requested
    <asp:Label ID="myLabel" runat="server" />
    times!
  </div>
</form>
```

In Design View, you should see your label appear inside the text, as shown in Figure 5.27.

Now, let's modify the code-behind file to use an application variable that will keep track of the number of hits our page receives. Double-click in any empty space on your form; Visual Web Developer will create a `Page_Load` subroutine automatically, and display it in the code editor.

```
  End If
  ' Display page counter
  myLabel.Text = Application("PageCounter")
End Sub
```

C# File: **Default.aspx.cs (excerpt)**

```
protected void Page_Load(object sender, EventArgs e)
{
  // Reset counter when it reaches 10
  if (Application["PageCounter"] != null &&
      (int)Application["PageCounter"] >= 10)
  {
    Application.Remove("PageCounter");
  }
  // Initialize or increment page counter each time the page loads
  if (Application["PageCounter"] == null)
  {
    Application["PageCounter"] = 1;
  }
  else
  {
    Application["PageCounter"] =
        (int)Application["PageCounter"] + 1;
  }
  // Display page counter
  myLabel.Text = Convert.ToString(Application["PageCounter"]);
}
```


Before analyzing the code, press **F5** to run the site and ensure that everything works properly. Every time you refresh the page, the hit counter should increase by one until it reaches ten, when it starts over. Now, shut down your browser altogether, and open the page in another browser. We've stored the value within application state, so when you restart the application, the page hit counter will remember the value it reached in the original browser, as Figure 5.28 shows.

If you play with the page, reloading it over and over again, you'll see that the code increments `PageCounter` every time the page is loaded. First, though, the code verifies that the counter hasn't reached or exceeded ten requests. If it has, the counter variable is removed from the application state:

Visual Basic File: **Default.aspx.vb (excerpt)**

```
' Reset counter when it reaches 10
If Application("PageCounter") >= 10 Then
  Application.Remove("PageCounter")
End If
```

C# File: **Global.asax (excerpt)**

```
void Session_Start(Object sender, EventArgs e)
{
  Session.Timeout = 1560;
}
```

Using the Cache Object

In traditional ASP, developers used application state to cache data. Although there's nothing to prevent you from doing the same thing here, ASP.NET provides a new object, `Cache`, specifically for that purpose. `Cache` is also a collection, and we access its contents similarly to the way we accessed the contents of `Application`. Another similarity is that both have application-wide visibility, being shared between all users who access a web application.

Let's assume that there's a list of employees that you'd normally read from the database. To spare the database server's resources after you read the table from the database the first time, you might save it into the cache using a command like this:

Visual Basic

```
Cache("Employees") = employeesTable
```

C#

```
Cache["Employees"] = employeesTable;
```

By default, objects stay in the cache until we remove them, or server resources become low, at which point objects begin to be removed from the cache in the order in which they were added. The `Cache` object also lets us control expiration—if, for example, we want to add an object to the cache for a period of ten minutes, we can use the `Insert` method. Here's an example:

Visual Basic

```
Cache.Insert("Employees", employeesTable, Nothing,
    DateTime.MaxValue, TimeSpan.FromMinutes(10))
```

C#

```
Cache.Insert("Employees", employeesTable, null,
    DateTime.MaxValue, TimeSpan.FromMinutes(10));
```

The third parameter, which in this case is `Nothing` or `null`, can be used to add cache dependencies. We could use such dependencies to invalidate cached items

We'll keep all the files related to the default appearance of Dorknozzle in this `Blue` folder.

Creating a New Style Sheet

We'll start by adding a new CSS file to the Blue theme. CSS files can be created independently of themes, but it's easier in the long term to save them to themes—this way, your solution becomes more manageable, and you can save different versions of your CSS files under different themes. Any files with the `.css` extension in a theme's folder will be automatically linked to any web form that uses that theme.

Right-click the `Blue` folder, and select Add New Item.... Select the Style Sheet template to create a new file named `Dorknozzle.css`, and click Add. By default, `Dorknozzle.css` will be almost empty:

File: **Dorknozzle.css (excerpt)**

```
body {
}
```


Let's make this file more useful by adding more styles to it. We'll use these styles soon, when we build the first page of Dorknozzle.

File: **Dorknozzle.css (excerpt)**

```
body
{
  font-family: Tahoma, Helvetica, Arial, sans-serif;
  font-size: 12px;
}
h1
{
  font-size: 25px;
}
a:link, a:visited
{
  text-decoration: none;
  color: Blue;
}
a:hover
{
  color: Red;
}
.Header
{
```

```
  </namespaces>
</pages>
```

If you're using C#, you'll need to add the `pages` element to the `system.web` element yourself:

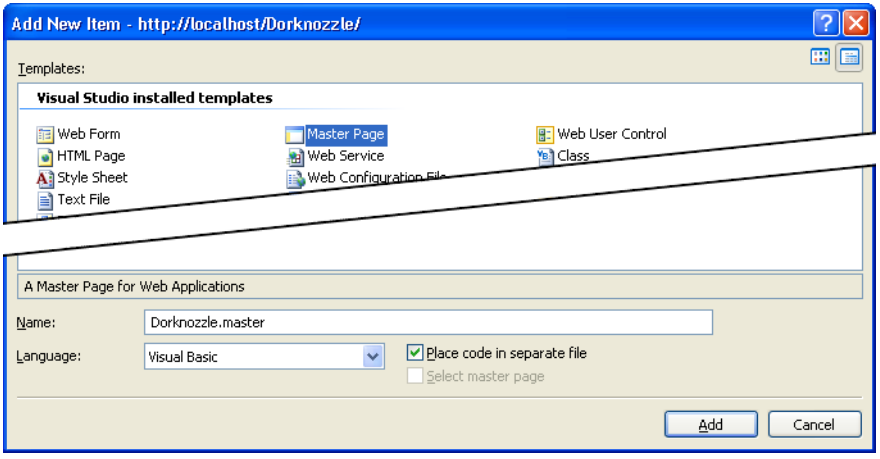
File: **`Web.config` (excerpt)**

```
<system.web>
  ⋮
  <pages theme="Blue" />
  ⋮
</system.web>
```


Building the Master Page

This is where the real fun begins! All of the pages in Dorknozzle have a common structure, with the same header on the top, and the same menu on the left, so it makes sense to build a master page. With this master page in place, we'll be able to create pages for the site by writing only the content that makes them different, rather than writing the header and the menu afresh for each page.

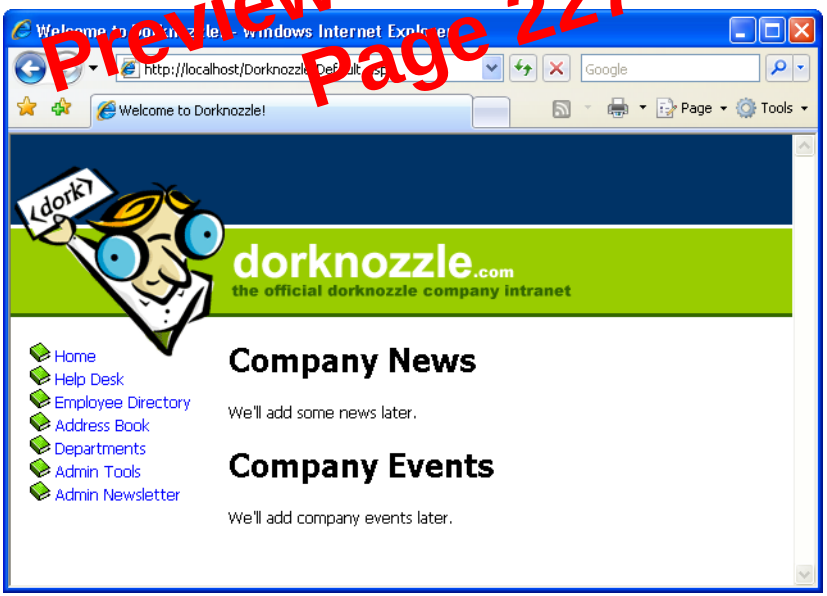
Figure 5.38. Creating a new master page



Right-click again on the root node in Solution Explorer and select Add New Item.... There, select the Master Page template from the list of available templates, and name it `Dorknozzle.master`. Choose the language you want to program the master page in from the Language drop-down list, and check the Place code in a

Figure 5.43. Editing a web form that uses a master page

Figure 5.44. Welcome to Dorknozzle!



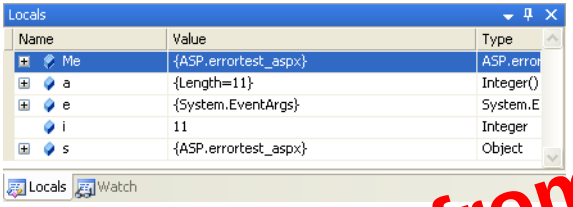
Extending Dorknozzle

We'll extend the Dorknozzle site by adding an employee help desk request web form. This form will allow our fictitious employees to report hardware, software,

In more complex scenarios, if you enter the name of an object, the Watch window will let you explore its members as we just saw.

If you switch to the Locals window (**Debug** > Windows > Locals) shown in Figure 5.50, you can see the variables or objects that are visible from the line of code at which the execution was paused.

Figure 5.50. The Locals window



Another nice feature of Visual Web Developer is that when you hover your cursor over a variable the editing window shows you at-a-glance information about that variable.

Sometimes, you'll want to debug your application even if it doesn't generate an exception. For example, you may find that your code isn't generating the output you expected. In such cases, it makes sense to execute pieces of code line by line, and see in detail what happens at each step.

The most common way to get started with this kind of debugging is to set a **breakpoint** in the code. In Visual Web Developer, we do this by clicking on the gray bar on the left-hand side of the editing window. When we click there, a red bullet appears, and the line is highlighted with red to indicate that it's a breakpoint, as Figure 5.51 illustrates.

Once the breakpoint is set, we execute the code. When the execution pointer reaches the line you selected, execution of the page will be paused and Visual Web Developer will open your page in debug mode. In debug mode, you can perform a number of tasks:

- View the values of your variables or objects.
- Step into any line of code by selecting Debug > Step Into. This executes the currently highlighted line, then pauses. If the selected line executes another local method, the execution pointer is moved to that method so that you can execute it line by line, too.

the `OnClick` property to the `Button` control, and give it the value `submitButton_Click`. This mimics what Visual Web Developer would do if you double-clicked the button in Design View.

```
<!-- Submit Button -->
<p>
  <asp:Button id="submitButton" runat="server" Text="Submit"
      OnClick="submitButton_Click" />
</p>
```

Next, create the `submitButton_Click` subroutine. You can add this between `<script runat="server">` and `</script>` tags in the head of the web form, or place it in a code-behind file. If Visual Web Developer generates these stubs for you, they may appear a little differently than they're presented here.

Visual Basic — File: **Login.aspx (excerpt)**

```
Protected Sub submitButton_Click(s As Object, e As EventArgs)
  submitButton.Text = "Clicked"
End Sub
```

C# — File: **Login.aspx (excerpt)**

```
protected void submitButton_Click(object sender, EventArgs e)
{
  submitButton.Text = "Clicked";
}
```


Now, if you're trying to submit invalid data using a browser that has JavaScript enabled, this code will never be executed. However, if you disable your browser's JavaScript, you'll see the label on the `Button` control change to Clicked! Obviously, this is not an ideal situation—we'll need to do a little more work to get validation working on the server side.

Disabling JavaScript in Firefox

To disable JavaScript in Firefox, go to Tools > Options..., click the Content tab and uncheck the Enable JavaScript checkbox.

Disabling JavaScript in Opera

To disable JavaScript in Opera, go to Tools > Preferences..., click the Advanced tab, select Content in the list on the left, and uncheck the Enable JavaScript checkbox.

Disabling JavaScript in Internet Explorer

To disable JavaScript in Internet Explorer, go to Tools > Internet Options… and click the Security tab. There, select the zone for which you're changing the settings (the zone will be shown on the right-hand side of the browser's status bar—it will likely be Local Intranet Zone if you're developing on the local machine) and press Custom Level…. Scroll down to the Scripting section, and check the Disable radio button for Active Scripting.

ASP.NET makes it easy to verify on the server side if the submitted data complies to the validator rules without our having to write very much C# or VB code at all. All we need to do is to check the `Page` object's `IsValid` property, which only returns `True` if all the validators on the page are happy with the data in the controls they're validating. This approach will always work, regardless of which web browser the user has, or the settings he or she has chosen.

Let's add this property to our `Click` event handler:

Visual Basic — File: **Login.aspx (excerpt)**

```
Protected Sub submitButton_Click(s As Object, e As EventArgs)
  If Page.IsValid Then
    submitButton.Text = "Valid"
  Else
    submitButton.Text = "Invalid!"
  End If
End Sub
```

C# — File: **Login.aspx (excerpt)**

```
protected void submitButton_Click(object s, EventArgs e)
{
  if(Page.IsValid)
  {
    submitButton.Text = "Valid";
  }
  else
  {
    submitButton.Text = "Invalid!";
  }
}
```

Load the page again after disabling JavaScript, and press the Submit button without entering any data in the text boxes. The text label on the button should change, as shown in Figure 6.2.

As you've probably noticed, the `CompareValidator` control differs very little from the `RequiredFieldValidator` control:

File: **Login.aspx (excerpt)**

```
<asp:RequiredFieldValidator id="confirmPasswordReq" runat="server"
    ControlToValidate="confirmPasswordTextBox"
    ErrorMessage="Password confirmation is required!"
    SetFocusOnError="True" Display="Dynamic" />
<asp:CompareValidator id="comparePasswords" runat="server"
    ControlToCompare="passwordTextBox"
    ControlToValidate="confirmPasswordTextBox"
    ErrorMessage="Your passwords do not match up!"
    Display="Dynamic" />
```

The only difference is that in addition to a `ControlToValidate` property, the `CompareValidator` has a `ControlToCompare` property. We set these two properties to the IDs of the controls we want to compare. So, in our example, the `ControlToValidate` property is set to the `confirmPasswordTextBox`, and the `ControlToCompare` property is set to the `passwordTextBox`.

The `CompareValidator` can be used to compare the value of a control to a fixed value, too. `CompareValidator` can check whether the entered value is equal to, less than, or greater than, any given value. As an example, let's add an age field to our login form:

File: **Login.aspx (excerpt)**

```
<!-- Age -->
<p>
  Age:<br />
  <asp:TextBox id="ageTextBox" runat="server" />
  <asp:RequiredFieldValidator id="ageReq" runat="server"
      ControlToValidate="ageTextBox"
      ErrorMessage="Age is required!"
      SetFocusOnError="True" Display="Dynamic" />
  <asp:CompareValidator id="ageCheck" runat="server"
      Operator="GreaterThan" Type="Integer"
      ControlToValidate="ageTextBox" ValueToCompare="15"
      ErrorMessage="You must be 16 years or older to log in" />
</p>
```

In this case, the `CompareValidator` control is used to check that the user is old enough to log in to our fictitious web application. Here, we set the `Operator` property of the `CompareValidator` to `GreaterThan`. This property can take on any of the values `Equal`, `NotEqual`, `GreaterThan`, `GreaterThanEqual`, `LessThan`,

Regular Expressions in JavaScript[4]
another great article, this time on the use of regular expressions with JavaScript

Table 6.2. Common regular expression components and their descriptions

Special Character	Description
`.`	any character
`^`	beginning of string
`$`	end of string
`\d`	numeric digit
`\s`	whitespace character
`\S`	non-whitespace character
`(abc)`	the string `abc` as a group of characters
`?`	preceding character or group is optional
`+`	one or more of the preceding character or group
`*`	zero or more of the preceding character or group
`{n}`	exactly *n* of the preceding character or group
`{n,m}`	*n* to *m* of the preceding character or group
`(a|b)`	either *a* or *b*
`\$`	a dollar sign (as opposed to the end of a string); we can 'escape' any of the special characters listed above by preceding it with a backslash. For example, `\.` matches a period character, `\?` matches a question mark, and so on

You'll find a complete guide and reference to regular expressions and their components in the .NET Framework SDK Documentation.

CustomValidator

The validation controls included with ASP.NET allow you to handle many kinds of validation, yet certain types of validation cannot be performed with these built-in controls. For instance, imagine that you needed to ensure that a new

[4] http://www.sitepoint.com/article/expressions-javascript

user's login details were unique by checking them against a list of existing usernames on the server. The `CustomValidator` control can be helpful in this situation, and others like it. Let's see how:

Visual Basic File: **`CustomValidator.aspx` (excerpt)**

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html>
  <head>
    <title>CustomValidator Control Sample</title>
    <script runat="server" language="VB">
      Sub CheckUniqueUserName(s As Object, _
            e As ServerValidateEventArgs)
        Dim username As String = e.Value.ToLower
        If (username = "zak" Or username = "cristian") Then
          e.IsValid = False
        End If
      End Sub

      Sub submitButton_Click(s As Object, e As EventArgs)
        If Page.IsValid Then
          submitButton.Text = "Valid"
        Else
          submitButton.Text = "Invalid!"
        End If
      End Sub
    </script>
  </head>
  <body>
    <form runat="server">
      <p>
        New Username:<br />
        <asp:TextBox ID="usernameTextBox" runat="server" />
        <asp:CustomValidator ID="usernameUnique" runat="server"
            ControlToValidate="usernameTextBox"
            OnServerValidate="CheckUniqueUserName"
            ErrorMessage="This username already taken!" />
      </p>
      <p>
        <asp:Button ID="submitButton" runat="server"
            OnClick="submitButton_Click" Text="Submit" />
      </p>
    </form>
  </body>
</html>
```

`IDENTITY`

Identity columns are numbered automatically. If you set a column as an `IDENTITY` column, SQL Server will generate numbers automatically for that column as you add new rows to it. The first number in the column is called the **identity seed**. To generate subsequent numbers, the identity column adds a given value to the seed; the value that's added is called the **identity increment**. By default, both the seed and increment have a value of 1, in which case the generated values are 1, 2, 3, and so on. If the identity seed were 5 and the identity increment were 10, the generated numbers would be 5, 15, 25, and so on.

`IDENTITY` is useful for ID columns, such as Department ID, for which you don't care what the values are, as long as they're unique. When you use `IDENTITY`, the generated values will always be unique. By default, you can't specify values for an `IDENTITY` column. Note also that the column can never contain `NULL`.

Understanding `NULL`

Be sure not to see `NULL` as equivalent to `0` (in numerical columns), or an empty string (in the case of string columns). Both `0` and an empty string *are* values; `NULL` defines the lack of a value.

`NULL` and Default Values

I've often heard people say that when we set a default value for a column, it doesn't matter whether or not we set it to accept `NULL`s. Many people seem to believe that columns with default values won't store `NULL`.

That's incorrect. You can modify a record after it was created, and change any field that will allow it to `NULL`. Your columns' ability to store `NULL` is important for the integrity of your data, and it should reflect the purpose of that data. A default value does make things easier when we create new rows, but it's not as vital as is correctly allowing (or disallowing) `NULL` in columns.

Primary Keys

Primary keys are the last fundamental concept that you need to understand before you can create your first data table. In the world of relational databases, each row in a table *must* be identified uniquely by a column called a **key**, on which all database operations are based.

The tables in your databases could contain hundreds or even thousands of rows of similar data—you could have several hundred employees in your Employees table alone. Imagine that your program needs to update or delete the record for John Smith, and there are several people with that name in your organization. You couldn't rely on the database to find the record for the particular John Smith that you were trying to work with—it might end up updating or deleting the wrong record.

We can avoid these kinds of problems only by using a system that uniquely identifies each row in the table. The first step toward achieving this goal is to add to the table an ID column that provides a unique for each employee, as did the Employee ID column that we saw in Figure 7.1.

Remember that when we discussed this Employees table, we noted that you may be tempted to use each employee's username to uniquely identify each employee. After all, that's what the network administrator uses them for, so why shouldn't you? It's true that this column uniquely identifies each row in the table, and we call such a column a **candidate key**. However, it wouldn't be a good idea to use this column in your database operations for a number of reasons. Firstly, network usernames have been known to change, and such a change would wreak havoc on any database of more than a couple of tables. As we'll see later, keys are fundamental to establishing relationships between tables, and these relationships rely on the fact that keys will never change. Secondly, non-numeric keys require much more processing power than simple numeric ones. Using an nvarchar field to uniquely identify rows in your table will bring your SQL Server to a grinding halt much, much quicker than if you chose a simple, numeric key.

The column that we choose to uniquely identify a row in a table in practice is called the **primary key**. In the case of our Employee table, the Employee ID will always be unique, so it would be a suitable primary key.

Multi-column Keys

To make the concept of keys easier to understand, we kept the definition simple, although it's not 100% technically correct. A key isn't necessarily formed by a single column—it can be formed by two or more columns. If the key is made up of multiple columns, the set of values in those columns must be unique for any given record. We'll see an example of such a key in a moment.

Although we usually refer to *primary keys* as if they were columns, technically they are **constraints** that we apply to the existing columns of a table. Constraints impose restrictions on the data we can enter into our tables, and the primary key

Figure 7.10. Specifying column properties

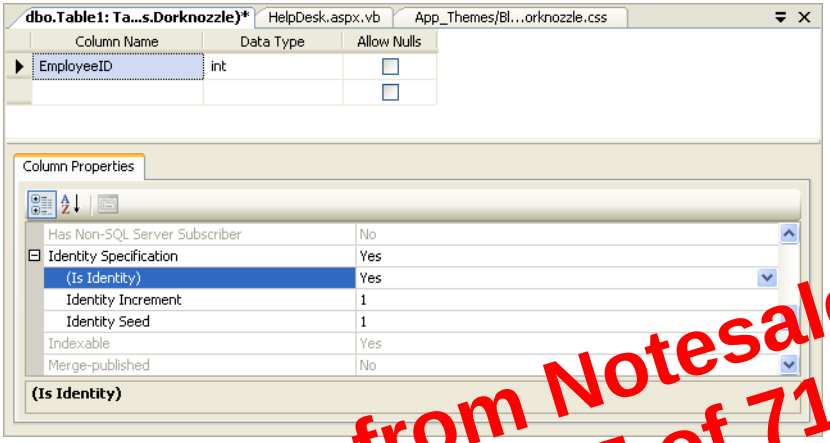
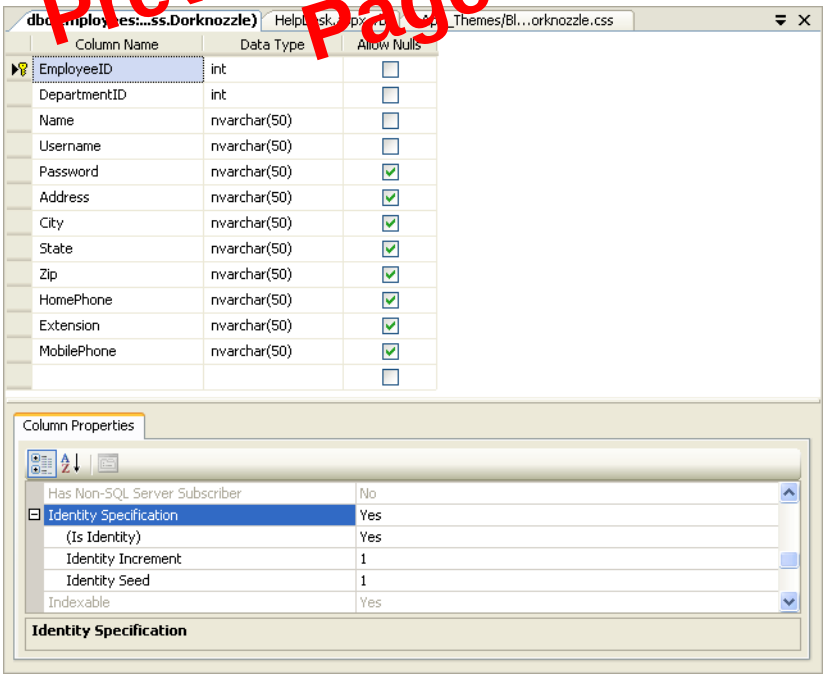


Figure 7.11. The Employees table



The SQL scripts included in the code archive contains all the commands required for this entire chapter—it even creates the sample data and table references that are covered later.

Populating the Data Tables

If tables represent drawers in a filing cabinet, rows represent individual paper records in those drawers. Suppose that our intranet web application was a real application. As people begin to register and interact with the application, rows are created within the various tables, and are filled up with the information about those people.

Once the data structures are in place, adding rows of data is as easy as typing information into the cells in the **Datasheet** view of a table, which looks a bit like a spreadsheet. To access it, right-click on the table and select Show Table Data in Visual Web Developer, or Open Table in SQL Server Management Studio. You can use the window that opens to start adding data. Let's add some sample data to the tables you've just created so that we can test the Dorknozzle database as we develop the application. Table 7.7 to Table 7.11 represent the tables and data you should add.

Inserting Data and Identity Columns

If you correctly set the ID column as an identity column, you won't be allowed to specify the values manually—the ID values will be generated for you automatically. You need to be careful, because an ID value will never be generated twice on the same table. So even if you delete all the rows in a table, the database will not generate an ID with the value of 1; instead, it will continue creating new values from the last value that was generated for you.

Keep in mind that a new row is saved to the database at the moment that you move on to the next row. It's very important that you remember this when you reach the last row, as you'll need to move to an empty row even if you aren't adding any more records.

The `Employees` table contains a few more columns than those outlined here, but, due to the size constraints of this page, I've left them out. Feel free to add your own data to the rest of the cells, or you could leave the remaining cells empty, as they're marked to accept `NULL`.

Table 7.9. The `HelpDeskCategories` table

`CategoryID` (Primary Key)	`Category`
1	`Hardware`
2	`Software`
3	`Workstation`
4	`Other/Don't Know`

Table 7.10. The `HelpDeskStatus` table

`StatusID` (Primary Key)	`Status`
1	`Open`
2	`Closed`

Table 7.11. The `HelpDeskSubjects` table

`SubjectID` (Primary Key)	`Subject`
1	`Computer won't start`
2	`Monitor won't turn on`
3	`Chair is broken`
4	`Office won't work`
5	`Windows won't work`
6	`Computer crashes`
7	`Other`

What `IDENTITY` Columns are *not* For

In our examples, as in many real-world scenarios, the ID values are sequences that start with `1` and increment by `1`. This makes many beginners assume that they can use the ID column as a record-counter of sorts, but this is a mistake. The ID is really an arbitrary number that we know to be unique; no other information should be discerned from it.

isting departments in the `Department` table. However, as with primary keys, just having the correct fields in place doesn't mean that our data is guaranteed to be correct.

For example, try setting the `DepartmentID` field for one of the employees to `123`. SQL Server won't mind making the change for you, so if you tried this in practice, you'd end up storing invalid data. However, after we set the foreign keys correctly, SQL Server will be able to ensure the integrity of our data—specifically, it will forbid us to assign employees to nonexistent departments, or to delete departments with which employees are associated.

The easiest way to create foreign keys using Visual Web Developer or SQL Server Management Studio is through database diagrams, so let's learn about them.

Using Database Diagrams

To keep the data consistent, the Dorknozzle database really should contain quite a few foreign keys. The good news is that you have access to a great feature called **database diagrams**, which makes it a cinch to create foreign keys. You can define the table relationships visually using the database diagrams tool in Visual Web Developer or SQL Server Management Studio, and have the foreign keys generated for you.

Database diagrams weren't created specifically for the purpose of adding foreign keys. The primary use of diagrams is to offer a visual representation of the tables in your database and the relationships that exist between them, to help you to design the structure of your database. However, the diagrams editor included in Visual Web Developer and SQL Server Management Studio is very powerful, so you can use the diagrams to create new tables, modify the structure of existing tables, or add foreign keys.

Let's start by creating a diagram for the Dorknozzle database. To create a database diagram in Visual Web Developer, right-click the Database Diagrams node, and select Add New Diagram, as shown in Figure 7.15.

The process is similar in SQL Server Management Studio, which, as Figure 7.16 illustrates, has a similar menu.

The first time you try to create a diagram, you'll be asked to confirm the creation of the database structures that support diagrams. Select **Yes** from the dialog, which should look like the one shown in Figure 7.17.

There are three types of relationships that can occur between the tables in your database:

- one-to-one relationships
- one-to-many relationships
- many-to-many relationships

One-to-one Relationships

A one-to-one relationship means that for each record in one table, only one other related record can exist in another table.

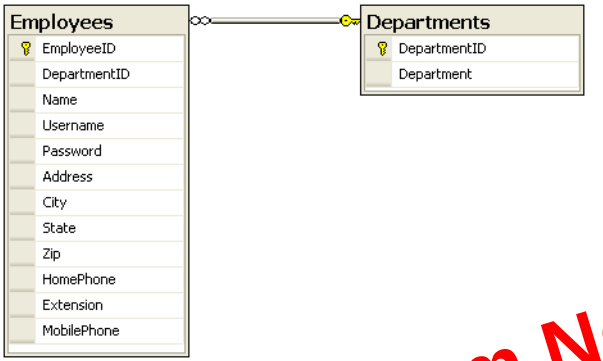
One-to-one relationships are rarely used, since it's usually more efficient just to combine the two records and store them together as columns in a single table. For example, every employee in our database will have a phone number stored in the `HomePhone` column of the `Employees` table. In theory, we could store the phone numbers in a separate table and link to them via a foreign key in the `Employees` table, but this would be of no benefit to our application, since we assume that one phone number can belong to only one employee. As such, we can leave this one-to-one relationship (along with any others) out of our database design.

One-to-many Relationships

The one-to-many relationship is by far the most common relationship type. Within a one-to-many relationship, each record in a table can be associated with multiple records from a second table. These records are usually related on the basis of the primary key from the first table. In the employees/departments example, a one-to-many relationship exists between the `Employees` and `Departments` tables, as one department can be associated with many employees.

When a foreign key is used to link two tables, the table that contains the foreign key is on the "many" side of the relationship, and the table that contains the primary key is on the "one" side of the relationship. In database diagrams, one-to-many relationships are signified by a line between the two tables; a golden key symbol appears next to the table on the "one" side of the relationship, and an infinity sign (∞) is displayed next to the table that could have many items related to each of its records. In Figure 7.27, those icons appear next to the `Employees` and `Departments` tables.

Figure 7.27. Database diagram showing a one-to-many relationship



As you can see, one-to-many relationships are easy to spot if you have a diagram at hand—just look for the icons next to the tables. Note that the symbols don't show the exact columns that form the relationship; they simply identify the tables involved.

Select the line that appears between two related tables to view the properties of the foreign key that defines that relationship. The properties display in the Properties window (you can open this by selecting View > Properties Window). As Figure 7.28 illustrates, they're the same options we saw earlier in Figure 7.24.

Figure 7.28. The properties of a foreign key

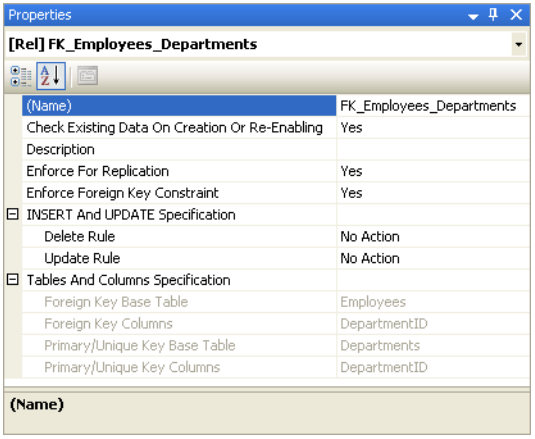
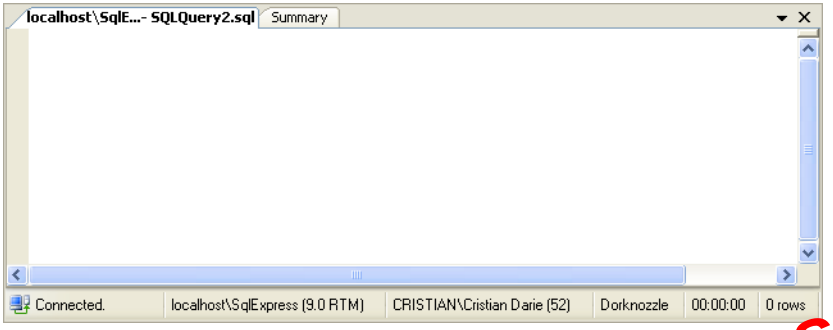


Figure 8.2. A new query window

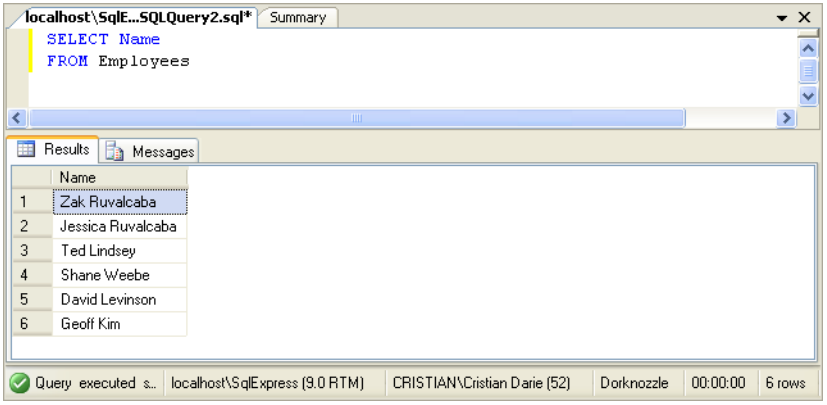


In the query window, type your first command:

```
SELECT Name
FROM Employees
```

Click the Execute button, or press F5. If everything works as planned, the result will appear similar to Figure 8.3.

Figure 8.3. Executing a simple query



Nice work! Now that we've taken our first look at SQL, let's talk more about SQL queries.

Viewing Results in Text Format

By default, the query editor of SQL Server Management Studio displays the results in a grid like the one shown in Figure 8.3. As you work with SQL Server, you may start to find this view a little impractical; in particular, it makes viewing longer strings of text painful because each time you run the query, you need to resize the columns in the grid. Personally, I prefer the plain text view, which is shown in Figure 8.4. You can enable this mode by selecting Query > Results To > Results To Text.

Let's move on and take a look at some variations of the `SELECT` query. Then we'll see how easy it is to insert, modify, and delete items from the database using other keywords.

Selecting Certain Fields

If you didn't want to select all the fields from the database table, you'd include the names of the specific fields that you wanted in place of the `*` in your query. For example, if you're interested only in the department names—not their IDs—you could execute the following:

```
SELECT Department
FROM Departments
```

This statement would retrieve data from the `Department` field only. Rather than specifying the `*`, which would return all the fields within the database table, we specify only the fields that we need.

Selecting All Columns Using *

To improve performance in real-world development scenarios, it's better to ask only for the columns that are of interest, rather than using `*`. Moreover, even when you need all the columns in a table, it's better to specify them by name, to safeguard against the possibility that future changes, which cause more columns to be added to the table, affecting the queries you're writing now.

It's important to note that the order of the fields in a table determines the order in which the data will be retrieved. Take this query, for example:

```
SELECT DepartmentID, Department
FROM Departments
```

You could reverse the order in which the columns are returned with this query:

```
SELECT DepartmentID, Department
FROM Departments
WHERE DepartmentID NOT BETWEEN 2 AND 5
```

In this example, all rows whose `DepartmentID`s are less than `2` or greater than `5` are returned.

Matching Patterns with `LIKE`

As we've just seen, the `WHERE` clause allows us to filter results based on criteria that we specify. The example we discussed earlier filtered rows by comparing two numbers, but SQL also knows how to handle strings. For example, if we wanted to search the company's `Employees` table for all employees named Zak Ruvalcaba, we'd use the following SQL statement:


```
SELECT EmployeeID, Username
FROM Employees
WHERE Name = 'Zak Ruvalcaba'
```

However, we won't see many such queries in reality. In real-world scenarios, most record matching is done by matching the primary key of the table to some specific value. When an arbitrary string such as a name is used (as in the example above), it's likely that we're searching for data based on partially complete information.

A more realistic example is one in which we want to find all employees with the surname Ruvalcaba. The `LIKE` keyword allows us to perform pattern matching with the help of **wildcard characters**. The wildcard characters supported by SQL Server are the percentage symbol (`%`), which matches any sequence of zero or more characters, and the underscore symbol (_), which matches exactly one character.

If we wanted to find all names within our `Employees` table with the surname of `Ruvalcaba`, we could modify the SQL query using a wildcard, as follows:

```
SELECT EmployeeID, Name
FROM Employees
WHERE Name LIKE '%Ruvalcaba'
```

With this query, all records in which the `Name` column ends with `Ruvalcaba` are returned, as shown below.

```
EmployeeID  Name
----------- --------------------------------------------------
1           Zak Ruvalcaba
```

Note that we're using the `IN` operator instead of the equality operator (`=`). We do so because our subquery could return a list of values. For example, if we added another department with the name "Product Engineering," or accidentally added another Engineering record to the `Departments` table, our subquery would return two IDs. So, whenever we're dealing with subqueries like this, we should use the `IN` operator unless we're *absolutely certain* that the subquery will return only one record.

Querying Multiple Tables

When using queries that involve multiple tables, it's useful to take a look at the database diagram you created in Chapter 7 to see what columns exist in each table, and to get an idea of the relationships between the tables.

Table Joins

An **inner join** allows you to read and combine data from two tables between which a relationship is established. In Chapter 7, we created such a relationship between the `Employees` table and the `Departments` table using a foreign key.

Let's make use of this relationship now, to obtain a list of all employees in the engineering department:

```
SELECT Employees.Name
FROM Departments
INNER JOIN Employees ON Departments.DepartmentID =
    Employees.DepartmentID
WHERE Departments.Department LIKE '%Engineering'
```

The first thing to notice here is that we qualify our column names by preceding them with the name of the table to which they belong, and a period character (`.`). We use `Employees.Name` rather than `Name`, and `Departments.DepartmentID` instead of `DepartmentID`. We need to specify the name of the table whenever the column name exists in more than one table (as is the case with `DepartmentID`); in other cases (such as with `Employees.Name`), adding the name of the table is optional.

As an analogy, imagine that you have two colleagues at work named John. John Smith works in the same department as you, and his desk is just across the aisle. John Thomas, on the other hand, works in a different department on a different floor. When addressing a large group of colleagues, you would use John Smith's full name, otherwise people could become confused. However, it would quickly become tiresome if you always used John Smith's full name when dealing with

MOD

MOD returns the remainder of one value divided by another. The following query would return the value 2:

```
SELECT MOD(8, 3)
```

SIGN

This function returns -1, 0, or 1, to indicate the sign of the argument.

POWER

This function returns the result of one value raised to the power of another. The following query returns the result of 2^3:

```
SELECT POWER(2, 3)
```

SQRT

SQRT returns the non-negative square root of a value.

Many, many more mathematical functions are available—check SQL Server Books Online for a full list.

String Functions

String functions work with literal text values rather than numeric values.

UPPER, LOWER

This function returns the value passed in as all uppercase or all lowercase, respectively. Take the following query as an example:

```
SELECT LOWER(Username), UPPER(State)
FROM Employees
```

The query above will return a list of usernames in lowercase, and a list of states in uppercase.

LTRIM, RTRIM

This function trims whitespace characters, such as spaces, from the left- or right-hand side of the string, respectively.

REPLACE

Use the REPLACE function to change a portion of a string to a new sequence of characters that you specify.

```
SELECT REPLACE('I like chocolate', 'like', 'love')
```

DATEADD
adds an interval to an existing date (a number of days, weeks, etc.) in order to obtain a new date

DATEDIFF
calculates the difference between two specified dates

DATEPART
returns a part of a date (such as the day, month, or year)

DAY
returns the day number from a date

MONTH
returns the month number from a date

YEAR
returns the year from a date

We won't be working with these functions in our example application, but it's good to keep them in mind. Here's a quick example that displays the current year:

```
SELECT YEAR(GETDATE())
```

The result (assuming it's still 2006, of course) is shown below:

```
CurrentYear
-----------
2006

(1 row(s) affected)
```

Working with Groups of Values

Transact-SQL includes two very useful clauses that handle the grouping of records, and the filtering of these groups: `GROUP BY` and `HAVING`. These clauses can help you find answers to questions like, "Which are the departments in my company that have at least three employees?" and "What is the average salary in each department?"[2]

[2] Assuming, of course, that your `Employees` table has a `Salary` column, or some other way of keeping track of salaries.

Try the above SQL statement. Then, to read the new list of records, execute the following:

```
SELECT DepartmentID, Department
FROM Departments
```

All records in the `Departments` table will be displayed, along with our Cool New Department and its automatically-generated `DepartmentID`.

Identity Values

To obtain programatically the identity value that we just generated, we can use the `scope_identity` function like this:

```
SELECT scope_identity()
```


The `UPDATE` Statement

We use the `UPDATE` statement to make changes to existing records within our database tables. The `UPDATE` statement requires certain keywords, and usually a `WHERE` clause, in order to modify particular records. Consider this code:

```
UPDATE Employees
SET Name = 'Zak Christian Ruvalcaba'
WHERE EmployeeID = 1
```

This statement would change the name of the employee whose `EmployeeID` is `1`. Let's break down the `UPDATE` statement's syntax:

`UPDATE`
: This clause identifies the statement as one that modifies the named table in the database.

table name
: We give the name of the table we're updating.

`SET`
: The `SET` clause specifies the columns we want to modify, and gives their new values.

column names and values
: We provide a list of column names and values, separated by commas.

The command above would execute successfully because there aren't any employees linked to the new department.

Deleting Records

Like the `UPDATE` command, the `WHERE` clause is best used together with `DELETE`; otherwise, you can end up deleting all the records in the table inadvertently!

Stored Procedures

Stored procedures are database objects that group one or more T-SQL statements. Much like VB or C# functions, stored procedures can take parameters and return values.

Stored procedures are used to group SQL commands that form a single, logical action. For example, let's say that you want to add to your web site functionality that allows departments to be deleted. Now as you know, you must delete all of the department's employees before you can delete the department itself.

To help with such management issues, you could have a stored procedure that copies the employees of that department to another table (called `EmployeesBackup`), deletes those employees from the main `Employees` table, then removes the department from the `Department` table. As you can imagine, having all this logic saved as a stored procedure can make working with databases much easier.

We'll see a more realistic example of a stored procedure in the next chapter, when we start to add more features to the Dorknozzle project, but until then, let's learn how to create a stored procedure in SQL Server, and how to execute it.

The basic form of a stored procedure is as follows:

```
CREATE PROCEDURE ProcedureName
(
  @Parameter1 DataType,
  @Parameter2 DataType,
  ⋮
)
AS
-- SQL Commands here
```

If you get sick of typing quotes, ampersands, and underscores, you can combine the three bold strings in the above code into a single string. However, I'll continue to present connection strings as above throughout this book—not only are they more readable that way, but they fit on the page, too!

If you're using C#, your code should look like this:

C# File: **AccessingData.aspx (excerpt)**

```
protected void Page_Load(object sender, EventArgs e)
{
  // Define database connection
  SqlConnection conn = new SqlConnection(
      "Server=localhost\\SqlExpress;Database=Dorknozzle;" +
      "Integrated Security=True");
}
```

Be aware that, in C#, the backslash (\) character has a special meaning when it appears inside a string, so when we wish to use one we have to use the double backslash (\\) shown above.

Preparing the Command

Now we're at step three, in which we create a `SqlCommand` object and pass in our SQL statement. The `SqlCommand` object accepts two parameters: the first is the SQL statement, and the second is the connection object that we created in the previous step.

Visual Basic File: **AccessingData.aspx (excerpt)**

```
Protected Sub Page_Load(ByVal sender As Object, _
    ByVal e As System.EventArgs)
  ' Define database connection
  Dim conn As New SqlConnection("Server=localhost\SqlExpress;" & _
      "Database=Dorknozzle;Integrated Security=True")
  ' Create command
  Dim comm As New SqlCommand( _
      "SELECT EmployeeID, Name FROM Employees", conn)
End Sub
```

C# File: **AccessingData.aspx (excerpt)**

```
protected void Page_Load(object sender, EventArgs e)
{
  // Define database connection
  SqlConnection conn = new SqlConnection(
      "Server=localhost\\SqlExpress;Database=Dorknozzle;" +
```

```
        "Integrated Security=True");
    // Create command
    SqlCommand comm = new SqlCommand(
        "SELECT EmployeeID, Name FROM Employees", conn);
}
```

Executing the Command

When we're ready to run the query, we open the connection and execute the command. The `SqlCommand` class has three methods that we can use to execute a command; we simply choose between them depending on the specifics of our query. The three methods are as follows:

`ExecuteReader`

`ExecuteReader` is used for queries or stored procedures that return one or more rows of data. `ExecuteReader` returns an `SqlDataReader` object that can be used to read the results of the query one by one, in a forward-only, read-only manner. Using the `SqlDataReader` object is the fastest way to retrieve records from the database, but it can't be used to update the data or to access the results in random order.

The `SqlDataReader` keeps the database connection open until all the records have been read. This can be a problem, as the database server will usually have a limited number of connections—people who are using your application simultaneously may start to see errors if you leave these connections open. To alleviate this problem, we can read all the results from the `SqlDataReader` object into an object such as a `DataTable`, which stores the data locally without needing a database connection. You'll learn more about the `DataTable` object in Chapter 12.

`ExecuteScalar`

`ExecuteScalar` is used to execute SQL queries or stored procedures that return a single value, such as a query that counts the number of employees in a company. This method returns an `Object`, which you can convert to specific data types depending on the kinds of data you expect to receive.

`ExecuteNonQuery`

`ExecuteNonQuery` is an oddly-named method that's used to execute stored procedures and SQL queries that insert, modify, or update data. The return value will be the number of affected rows.

We already know that the `SqlDataReader` class reads the data row by row, in a forward-only fashion. Only one row can be read at any moment. When we call `reader.Read`, our `SqlDataReader` reads the next row of data from the database. If there's data to be read, it returns `True`; otherwise—if we've already read the last record returned by the query—the `Read` method returns `False`. If we view this page in the browser, we'll see something like Figure 9.4.

Using Parameters with Queries

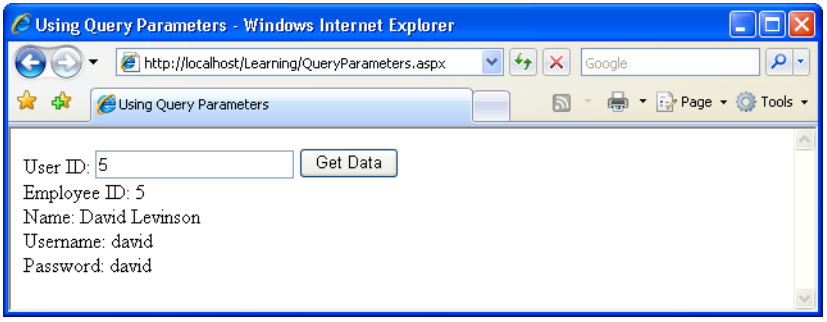
What if the user doesn't want to view information for all employees, but instead, wants to see details for one specific employee?

To get this information from our `Employees` table, we'd run the following query, replacing *EmployeeID* with the ID of the employee in which the user was interested.

```
SELECT EmployeeID, Name, Username, Password
FROM Employees
WHERE EmployeeID = EmployeeID
```


Let's build a page like the one shown in Figure 9.5 to display this information.

Figure 9.5. Retrieving details of a specific employee



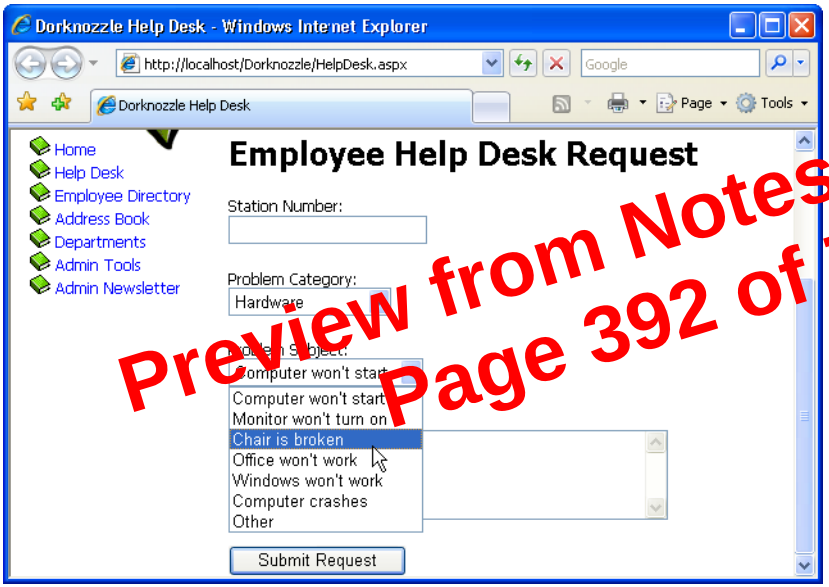
Create a new web form called `QueryParameters.aspx` and alter it to reflect the code shown here:

File: **QueryParameters.aspx (excerpt)**

```
<%@ Page Language="VB" %>
<%@ Import Namespace="System.Data.SqlClient" %>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
    "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
```

Let's go ahead and add the necessary code to `Page_Load` in `HelpDesk.aspx` to populate the `DropDownList` controls from the database. After the changes are made, the lists will be populated with the data you added to your database in Chapter 7, as illustrated in Figure 9.10.

Figure 9.10. A drop-down list created with data binding

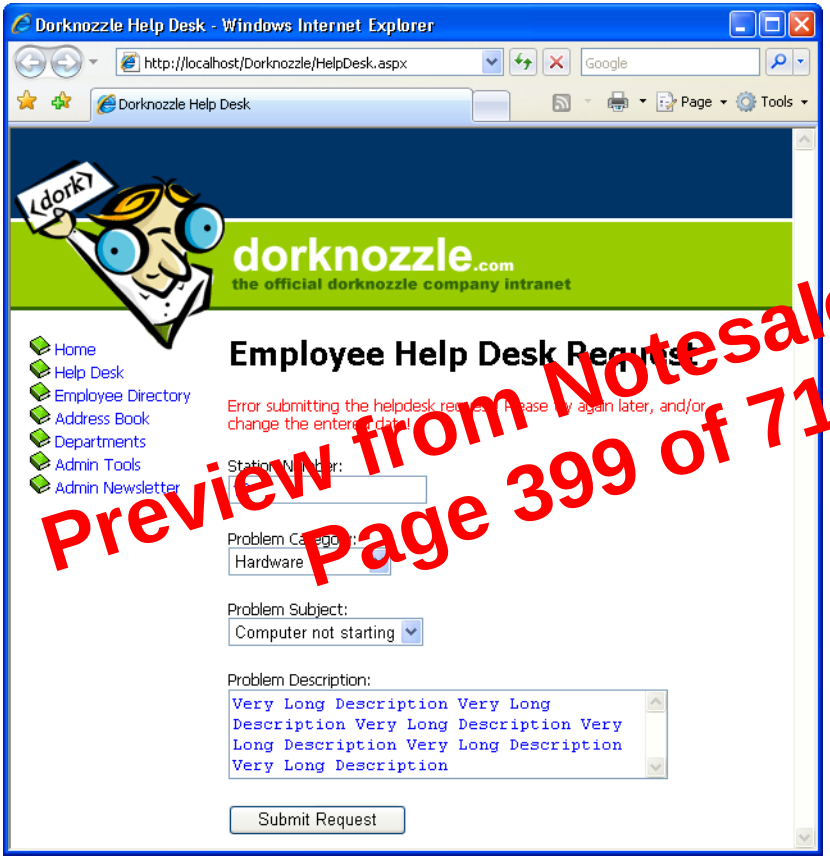


Open `HelpDesk.aspx` in Design View and double-click an empty space on the form to have the signature of the `Page_Load` method generated for you. Then, add the following code:

Visual Basic — File: **`HelpDesk.aspx.vb` (excerpt)**

```
Imports System.Data.SqlClient
Imports System.Configuration
⋮
Protected Sub Page_Load(ByVal sender As Object, _
    ByVal e As System.EventArgs) Handles Me.Load
  If Not IsPostBack Then
    ' Define data objects
    Dim conn As SqlConnection
    Dim categoryComm As SqlCommand
    Dim subjectComm As SqlCommand
    Dim reader As SqlDataReader
    ' Read the connection string from Web.config
```

Figure 9.11. Displaying an error message in the catch block




```
  If Page.IsValid Then
    ' Code that uses the data entered by the user
  End If
End Sub
```

C# File: **HelpDesk.aspx.cs (excerpt)**

```
protected void submitButton_Click(object sender, EventArgs e)
{
  if (Page.IsValid)
  {
    // Code that uses the data entered by the user
  }
}
```

```
    comm.Parameters.Add("@Description",
        System.Data.SqlDbType.NVarChar, 50);
    comm.Parameters["@Description"].Value =
        descriptionTextBox.Text;
    comm.Parameters.Add("@StatusID", System.Data.SqlDbType.Int);
    comm.Parameters["@StatusID"].Value = 1;
    // Enclose database code in Try-Catch-Finally
    try
    {
      // Open the connection
      conn.Open();
      // Execute the command
      comm.ExecuteNonQuery();
      // Reload page if the query executed successfully
      Response.Redirect("HelpDesk.aspx");
    }
    catch
    {
      // Display error message
      dbErrorMessage.Text =
        "Error submitting the help desk request! Please " +
        "try again later, and/or change the entered data!";
    }
    finally
    {
      // Close the connection
      conn.Close();
    }
  }
}
```


Make Sure you've Set the `Identity` Property!

Note that when we're inserting a new record into the `HelpDesk` table, we rely on the ID column, `RequestID`, to be generated automatically for us by the database. If we forget to set `RequestID` as an identity column, we'll receive an exception every time we try to add a new help desk request!

Did you notice the use of the `ExecuteNonQuery` method? As you know, we use this method when we're executing any SQL query that doesn't return a set of results, such as `INSERT`, `UPDATE`, and `DELETE` queries.

You'll remember that, in order to make the example simpler, we hard-coded the `EmployeeID` (to the value of `5`), and the `Status` (to the value of `1`). To make the application complete, you could add another drop-down list from which employees

```
  "WHERE UniqueField=@UniqueFieldParameter", conn)
comm.Parameters.Add("@Parameter1", System.Data.SqlDbType.Type1)
comm.Parameters("@Parameter1").Value = value1
comm.Parameters.Add("@Parameter2", System.Data.SqlDbType.Type2)
comm.Parameters("@Parameter2").Value = value2
```

C#

```
comm = new SqlCommand ("UPDATE Table " +
  "SET Field1=@Parameter1, Field2=@Parameter2, … " +
  "WHERE UniqueField=@UniqueFieldParameter", conn);
comm.Parameters.Add("@Parameter1", System.Data.SqlDbType.Type1);
comm.Parameters["@Parameter1"].Value = value1;
comm.Parameters.Add("@Parameter2", System.Data.SqlDbType.Type2);
comm.Parameters["@Parameter2"].Value = value2;
```


Once the `SqlCommand` object has been created using this `UPDATE` statement, we simply pass in the necessary parameters as we did with the `INSERT` statement. The important thing to remember when updating records is that you must take care to perform the `UPDATE` on the correct record. To do this, you must include a `WHERE` clause that specifies the correct record using a value from a suitable unique column (usually the primary key), as shown above.

Handle Updates with Care!

When updating a table with some new data, if you don't specify a `WHERE` clause, every record in the table will be updated with the new data, and (usually) there's no way to undo the action!

Let's put all this theory into practice as we build the Admin Tools page. The database doesn't contain a table that's dedicated to this page; however, we'll use the Admin Tools page as a centralized location for a number of tables associated with other pages, including the `Employees` and `Departments` tables. For instance, in this section, we'll allow an administrator to change the details of a specific employee.

Create a new web form named `AdminTools.aspx` in the same way you created the other web forms we've built so far. Use the `Dorknozzle.master` master page and a code-behind file. Then, add the following code to the content placeholder, and modify the page title as shown below.

File: **AdminTools.aspx (excerpt)**

```
<%@ Page Language="VB" MasterPageFile="~/Dorknozzle.master"
    AutoEventWireup="true" CodeFile="AdminTools.aspx.vb"
    Inherits="AdminTools" title="Dorknozzle Admin Tools" %>
```

Deleting Records

Just as we can insert and update records within the database, we can also delete them. Again, most of the code for deleting records resembles that which we've already seen. The only major part that changes is the SQL statement within the command:

Visual Basic

```
comm = New SqlCommand("DELETE FROM Table " & _
    "WHERE UniqueField=@UniqueFieldParameter", conn)
```

C#

```
comm = new SqlCommand("DELETE FROM Table " +
    "WHERE UniqueField=@UniqueFieldParameter", conn)
```


Once we've created the `DELETE` query's `SqlCommand` object, we can simply pass in the necessary parameter:

Visual Basic

```
comm.Parameters.Add("@UniqueFieldParameter", _
    System.Data.SqlDbType.Type)
comm.Parameters("@UniqueFieldParameter").Value = UniqueValue
```

C#

```
comm.Parameters.Add("@UniqueFieldParameter",
    System.Data.SqlDbType.Type);
comm.Parameters["@UniqueFieldParameter"].Value = UniqueValue;
```

To demonstrate the process of deleting an item from a database table, we'll expand on the Admin Tools page. Since we're allowing administrators to update information within the `Employees` table, let's also give them the ability to delete an employee's record from the database. To do this, we'll place a new `Button` control for deleting the selected record next to our Update Employee button.

Start by adding the new control at the end of `AdminTools.aspx`:

File: **`AdminTools.aspx` (excerpt)**

```
<p>
  <asp:Button ID="updateButton" Text="Update Employee"
      Enabled="False" runat="server" />
  <asp:Button ID="deleteButton" Text="Delete Employee"
      Enabled="False" runat="server" />
</p>
```

Handling DataList Events

One problem you may encounter when working with container controls such as the DataList or the Repeater is that you can't access the controls inside their templates directly from your code. For example, consider the following ItemTemplate, which contains a Button control:

```
<asp:DataList ID="employeesList" runat="server">
  <ItemTemplate>
    Employee ID: <strong><%#Eval("EmployeeID")%></strong>
    <asp:Button runat="server" ID="myButton" Text="Select" />
  </ItemTemplate>
</asp:DataList>
```


Although it may not be obvious at the first glance, you can't access the Button easily through your code. The following code would generate an error:

Visual Basic

```
' Don't try these at home
myButton.Enabled = False
```

Things get even more complicated if you want to handle the Button's Click event, because—you guessed it—you can't do so without jumping through some pretty complicated hoops.

So, if we can't handle events raised by the buttons and links inside a template, how can we interact with the data in each template? We'll improve our employee directory by making a simpler, basic view of the items, and add a "View More" link that users can click in order to access more details about the employee. To keep things simple, for now, we'll hide only the employee ID from the standard view; we'll show it when the visitor clicks the View More link.

After we implement this feature, our list will appear as shown in Figure 10.2. You'll be able to view more details about any employee by clicking on the appropriate link.

Open EmployeeDirectory.aspx, and modify the ItemTemplate of the DataList as shown below:

Visual Basic File: **EmployeeDirectory.aspx (excerpt)**

```
<asp:DataList id="employeesList" runat="server">
  <ItemTemplate>
    <asp:Literal ID="extraDetailsLiteral" runat="server"
```

erty, and the employee's new name and username from the `TextBox` control. The techniques used in this code are the ones we used earlier, but be sure to read the code carefully to ensure that you understand how it works.

Visual Basic — File: **EmployeeDirectory.aspx.vb (excerpt)**

```
  ElseIf e.CommandName = "CancelEditing" Then
    ' Cancel edit mode
    employeesList.EditItemIndex = -1
    ' Refresh the DataList
    BindList()
  ElseIf e.CommandName = "UpdateItem" Then
    ' Get the employee ID
    Dim employeeId As Integer = e.CommandArgument
    ' Get the new username
    Dim nameTextBox As TextBox = _
        e.Item.FindControl("nameTextBox")
    Dim newName As String = nameTextBox.Text
    ' Get the new name
    Dim usernameTextBox As TextBox =
        e.Item.FindControl("usernameTextBox")
    Dim newUsername As String = usernameTextBox.Text
    ' Update the item
    UpdateItem(employeeId, newName, newUsername)
    ' Cancel edit mode
    employeesList.EditItemIndex = -1
    ' Refresh the DataList
    BindList()
  End If
End Sub
```

C# — File: **EmployeeDirectory.aspx.cs (excerpt)**

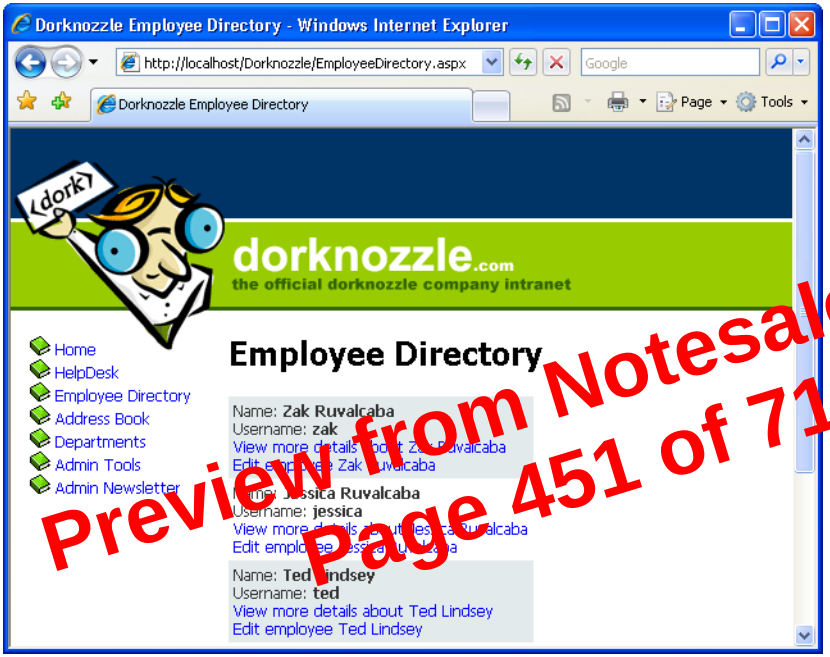
```
  else if (e.CommandName == "CancelEditing")
  {
    // Cancel edit mode
    employeesList.EditItemIndex = -1;
    // Refresh the DataList
    BindList();
  }
  else if (e.CommandName == "UpdateItem")
  {
    // Get the employee ID
    int employeeId = Convert.ToInt32(e.CommandArgument);
    // Get the new username
    TextBox nameTextBox =
        (TextBox)e.Item.FindControl("nameTextBox");
    string newName = nameTextBox.Text;
```

```
  Finally
    ' Close the connection
    conn.Close()
  End Try
End Sub
```

C# File: **EmployeeDirectory.aspx.cs (excerpt)**

```
protected void UpdateItem(int employeeId, string newName,
    string newUsername)
{
  // Declare data objects
  SqlConnection conn;
  SqlCommand comm;
  // Read the connection string from Web.config
  string connectionString =
      ConfigurationManager.ConnectionStrings[
      "Dorknozzle"].ConnectionString;
  // Initialize connection
  conn = new SqlConnection(connectionString);
  // Create command
  comm = new SqlCommand("UpdateEmployee", conn);
  // Specify we're calling a stored procedure
  comm.CommandType = System.Data.CommandType.StoredProcedure;
  // Add command parameters
  comm.Parameters.Add("@EmployeeID", SqlDbType.Int);
  comm.Parameters["@EmployeeID"].Value = employeeId;
  comm.Parameters.Add("@NewName", SqlDbType.NVarChar, 50);
  comm.Parameters["@NewName"].Value = newName;
  comm.Parameters.Add("@NewUsername", SqlDbType.NVarChar, 50);
  comm.Parameters["@NewUsername"].Value = newUsername;
  // Enclose database code in Try-Catch-Finally
  try
  {
    // Open the connection
    conn.Open();
    // Execute the command
    comm.ExecuteNonQuery();
  }
  finally
  {
    // Close the connection
    conn.Close();
  }
}
```

Figure 10.11. The styled Employee Directory list




```
  <SelectedItemStyle BackColor="#C5BBAF" Font-Bold="True"
      ForeColor="#333333" />
  <AlternatingItemStyle BackColor="White" />
  <ItemStyle BackColor="#E3EAEB" />
  <HeaderStyle BackColor="#1C5E55" Font-Bold="True"
      ForeColor="White" />
</asp:DataList>
```

The significance of these new elements is as follows:

`HeaderStyle`
: customizes the appearance of the `DataList`'s heading

`ItemStyle`
: customizes the appearance of each item displayed within the `DataList`

`AlternatingItemStyle`
: customizes the appearance of every other item displayed within the `DataList`

C# File: **AddressBook.aspx.cs (excerpt)**

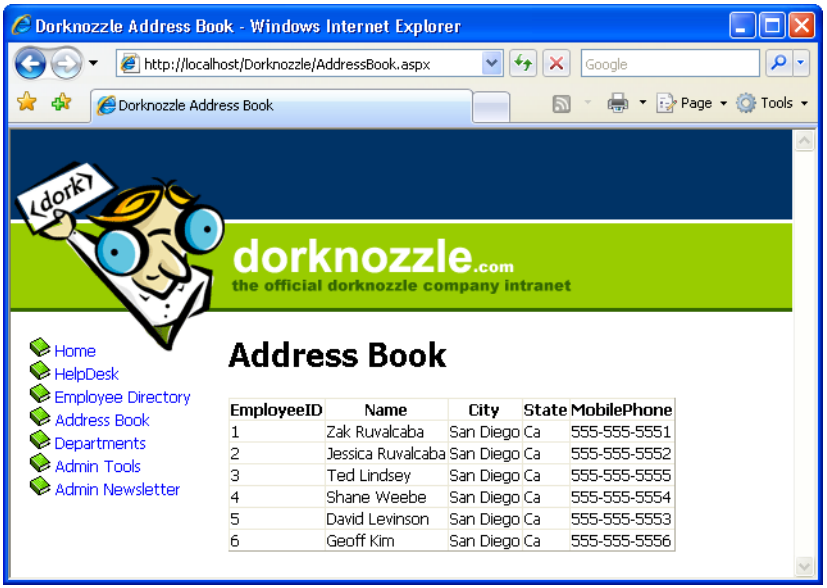
```
using System;
using System.Data;
using System.Configuration;
using System.Collections;
using System.Web;
using System.Web.Security;
using System.Web.UI;
using System.Web.UI.WebControls;
using System.Web.UI.WebControls.WebParts;
using System.Web.UI.HtmlControls;
using System.Data.SqlClient;

public partial class AddressBook : System.Web.UI.Page
{
  protected void Page_Load(object sender, EventArgs e)
  {
    if (!IsPostBack)
    {
      BindGrid();
    }
  }
  private void BindGrid()
  {
    // Define data objects
    SqlConnection conn;
    SqlCommand comm;
    SqlDataReader reader;
    // Read the connection string from Web.config
    string connectionString =
        ConfigurationManager.ConnectionStrings[
        "Dorknozzle"].ConnectionString;
    // Initialize connection
    conn = new SqlConnection(connectionString);
    // Create command
    comm = new SqlCommand(
        "SELECT EmployeeID, Name, City, State, MobilePhone " +
        "FROM Employees", conn);
    // Enclose database code in Try-Catch-Finally
    try
    {
      // Open the connection
      conn.Open();
      // Execute the command
      reader = comm.ExecuteReader();
      // Fill the grid with data
```

```
        grid.DataSource = reader;
        grid.DataBind();
        // Close the reader
        reader.Close();
      }
      finally
      {
        // Close the connection
        conn.Close();
      }
    }
}
```

What's going on here? If you disregard the fact that you're binding the `SqlDataReader` to a `GridView` instead of a `Repeater` or `DataList`, the code is almost identical to that which we saw in the previous chapter.

Now save your work and open the page in the browser. Figure 11.2 shows how the `GridView` presents all of the data within the `Employees` table in a cleanly formatted structure.

Figure 11.2. Displaying the address book in `GridView`



that you want displayed. To do so, list the columns inside the `<asp:GridView>` and `</asp:GridView>` tags, as shown below:

File: **AddressBook.aspx (excerpt)**

```
<asp:GridView ID="grid" runat="server"
    AutoGenerateColumns="False">
  <Columns>
    <asp:BoundField DataField="Name" HeaderText="Name" />
    <asp:BoundField DataField="City" HeaderText="City" />
    <asp:BoundField DataField="MobilePhone"
        HeaderText="Mobile Phone" />
  </Columns>
</asp:GridView>
```

Notice that each column that we want to display is created using a `BoundField` control inside a set of `<Columns>` and `</Columns>` tags. Each `BoundField` control has a `DataField` property, which specifies the name of the column, and a `HeaderText` property, which sets the name of the column as you want it displayed to the user.

Now, save your work and view it in the browser. This time, only the columns that you specified to be bound are displayed in the `GridView`. The results should appear as shown in Figure 11.3.

Note that if you don't include the `HeaderText` property for any of the bound columns, those columns will not have a header.

We've now succeeded in displaying only the information we want to display, but the `GridView` still looks plain. In the next section, we'll use styles to customize the look of our `GridView`.

Styling the `GridView` with Templates, Skins, and CSS

The `GridView` control offers a number of design-time features that are tightly integrated with the Visual Web Developer designer. As with the `DataList` class, when you click the grid's smart tag, you get quick access to a number of very useful features, as Figure 11.4 illustrates.

Figure 11.3. Displaying selected columns

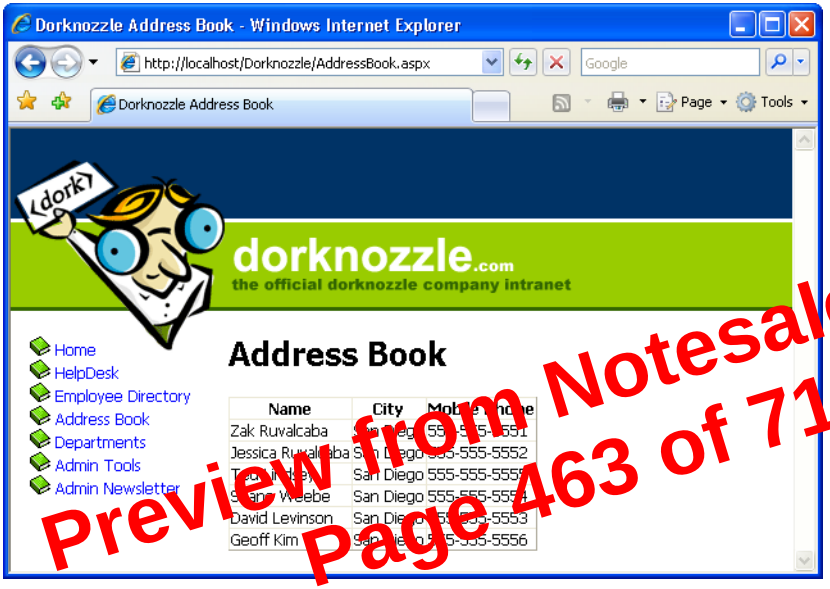
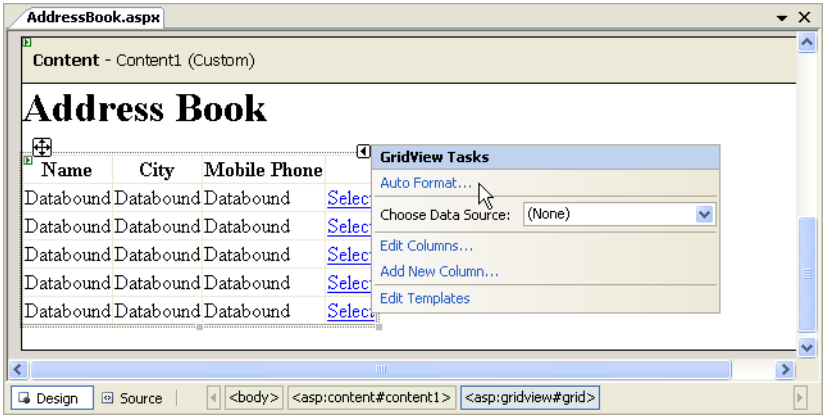
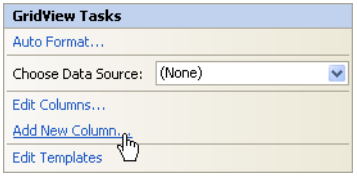


Figure 11.4. The smart tag options of `GridView`



If you click the **Auto Format...** link from the smart tag menu and choose one of the predefined styles, Visual Web Developer generates a number of template styles for you, like this:

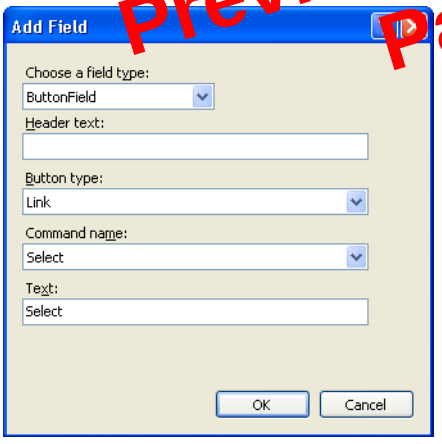
Figure 11.6. Adding a new `GridView` column



If you're using Visual Web Developer, you can quickly and easily add a new column to your table in Design View. Click the `GridView`'s smart tag, and click the Add New Column... item, as shown in Figure 11.6.

In the dialog that appears, change the field type to ButtonField, the command name to Select, and set the Text field to **`Select`**, so the dialog appears as it does in Figure 11.7.

Figure 11.7. Adding a new field



After clicking OK, your brand new column shows up in Design View. If you switch to Source View, you can see it there, too:

File: **`AddressBook.aspx` (excerpt)**

```
<asp:GridView ID="grid" runat="server"
    AutoGenerateColumns="false">
  <Columns>
    <asp:BoundField DataField="Name" HeaderText="Name" />
    <asp:BoundField DataField="City" HeaderText="City" />
```

contains many fields—so many, in fact, that the main grid can't display all of them.

A common use of the `DetailsView` control is to create a page that shows a list of items, and allows you to drill down to view the details of each item. For instance, an ecommerce site might initially present users with only a little information about all available products, to reduce download time and make the information more readable. Users could then select a product to see a more detailed view of that product.

Let's see how this works by using a `GridView` and a `DetailsView` in our Address Book web form.

Replace `detailsLabel` with a `DetailsView` control, as shown in the following code snippet:

File: **AddressBook.aspx (excerpt)**

```
  </asp:GridView>
  <br />
  <asp:DetailsView id="employeeDetails" runat="server" />
</asp:Content>
```


Next, we'll modify the `BindGrid` method to specify the grid's **data key**. The data key feature of the `GridView` control basically allows us to store a piece of data about each row without actually displaying that data. We'll use it to store the `EmployeeID` of each record. Later, when we need to retrieve additional data about the selected employee, we'll be able to read the employee's ID from the data key, and use it in our `SELECT` query.

Add this row to your code-behind file:

Visual Basic File: **AddressBook.aspx.vb (excerpt)**

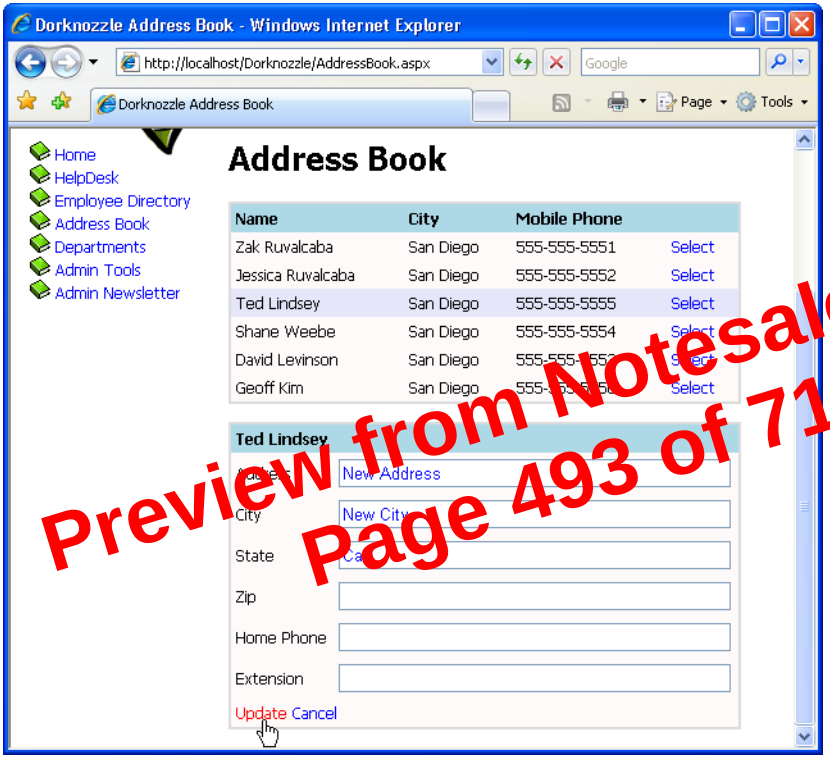
```
' Open the connection
conn.Open()
' Execute the command
reader = comm.ExecuteReader()
' Fill the grid with data
grid.DataSource = reader
grid.DataKeyNames = New String() {"EmployeeID"}
grid.DataBind()
' Close the reader
reader.Close()
```

```
      employeeDetails.FindControl("editAddressTextBox")
  Dim newCityTextBox As TextBox = _
      employeeDetails.FindControl("editCityTextBox")
  ' Extract the updated data from the TextBoxes
  Dim newAddress As String = newAddressTextBox.Text
  Dim newCity As String = newCityTextBox.Text
  ' Declare data objects
  Dim conn As SqlConnection
  Dim comm As SqlCommand
  ' Read the connection string from Web.config
  Dim connectionString As String = _
      ConfigurationManager.ConnectionStrings( _
      "Dorknozzle").ConnectionString
  ' Initialize connection
  conn = New SqlConnection(connectionString)
  ' Create command
  comm = New SqlCommand("UpdateEmployeeDetails", conn)
  comm.CommandType = Data.CommandType.StoredProcedure
  ' Add command parameters
  comm.Parameters.Add("@EmployeeID", Data.SqlDbType.Int)
  comm.Parameters("@EmployeeID").Value = employeeId
  comm.Parameters.Add("@NewAddress", Data.SqlDbType.NVarChar, 50)
  comm.Parameters("@NewAddress").Value = newAddress
  comm.Parameters.Add("@NewCity", Data.SqlDbType.NVarChar, 50)
  comm.Parameters("@NewCity").Value = newCity
  ' Enclose database code in Try-Catch-Finally
  Try
    ' Open the connection
    conn.Open()
    ' Execute the command
    comm.ExecuteNonQuery()
  Finally
    ' Close the connection
    conn.Close()
  End Try
  ' Exit edit mode
  employeeDetails.ChangeMode(DetailsViewMode.ReadOnly)
  ' Reload the employees grid
  BindGrid()
  ' Reload the details view
  BindDetails()
End Sub
```

C# File: **AddressBook.aspx.cs (excerpt)**

```
protected void employeeDetails_ItemUpdating(object sender,
    DetailsViewUpdateEventArgs e)
```

Figure 11.18. Updating an employee's address and city



Next, we call a stored procedure to take care of the database update. To create this stored procedure, run the following script in SQL Server Management Studio:

```
CREATE PROCEDURE UpdateEmployeeDetails
(
  @EmployeeID Int,
  @NewAddress nvarchar(50),
  @NewCity nvarchar(50)
)
AS
UPDATE Employees
SET Address = @NewAddress, City = @NewCity
WHERE EmployeeID = @EmployeeID
```

Binding the `DetailsView` to a `SqlDataSource`

Here, our aim is to replicate the functionality the `DetailsView` gave us in Chapter 11, and to add functionality that will allow users to add and delete employees' records.

Let's start by adding another `SqlDataSource` control, either next to or below the existing one, in `AddressBook.aspx`. Give the new `SqlDataSource` the name `employeeDataSource`. Click its smart tag, and select Configure Data Source. The Configure Data Source wizard will appear again.

In the first screen, choose the Dorknozzle connection string. Click Next, and you'll be taken to the second screen, where there's a bit more work to do. Start by specifying the `Employees` table and checking all of its columns, as shown in Figure 12.9.

Figure 12.9. Choosing fields

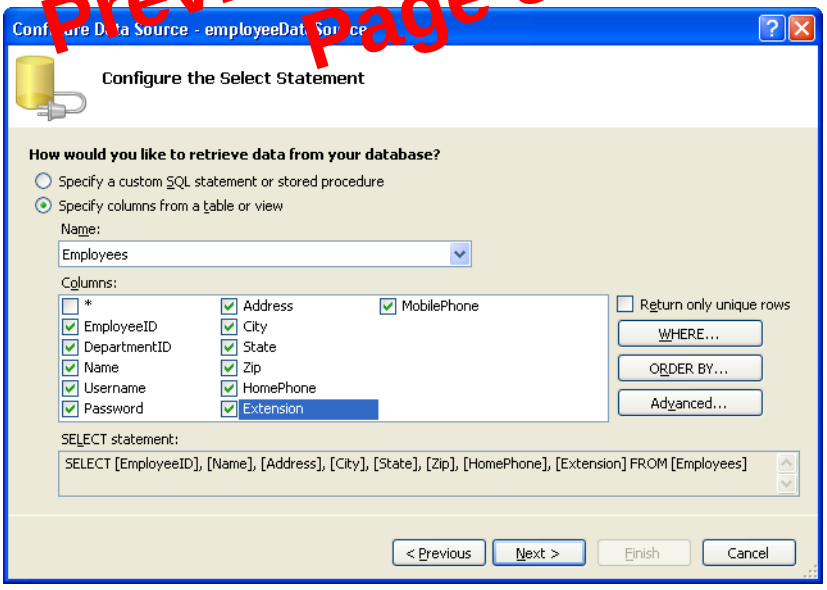
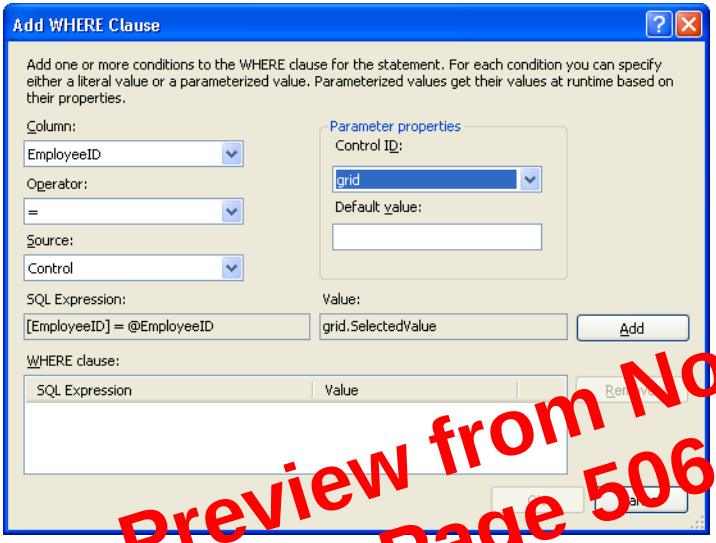


Figure 12.10. Creating a new condition



Next, click the WHERE... button. In the dialog that opens, select the `EmployeeID` column, specify the = operator, and select Control in the Source field. For the Control ID select `grid`, and leave the default value empty, as Figure 12.10 shows.

Finally, click Add, and the expression will be added to the WHERE clause list. The SQL expression that's generated will filter the results on the basis of the value selected in the `GridView` control. Click OK to close the dialog, then click the Advanced... button. Check the Generate INSERT, UPDATE, and DELETE statements checkbox, as shown in Figure 12.11.

Click OK to exit the Advanced SQL Generation Options dialog, then click Next. In the next screen, feel free to click on Test Query to ensure everything's working as expected. If you click Test Query, you'll be asked for the Employee ID's type and value. Enter **1** for the value, leave the type as Int32, then click OK. The row should display as shown in Figure 12.12.

Click Finish.

Congratulations! Your new `SqlDataSource` is ready to fill your `DetailsView`. Next, we need to tie this `SqlDataSource` to the `DetailsView` and specify how we want the `DetailsView` to behave. Open `AddressBooks.aspx`, locate the `DetailsView` control and set the properties as outlined in Table 12.2.

Figure 12.11. Generating `INSERT`, `UPDATE`, and `DELETE` statements

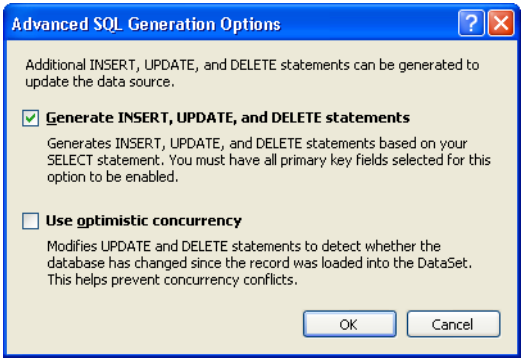


Figure 12.12. Testing the query generated for our data source

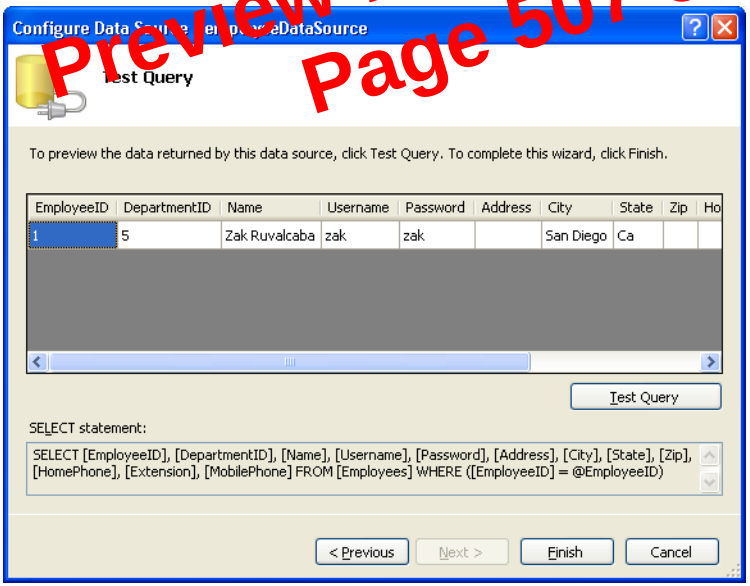


Table 12.2. Properties to set for the `DetailsView` control

Property	Value
`AutoGenerateDeleteButton`	`True`
`AutoGenerateEditButton`	`True`
`AutoGenerateInsertButton`	`True`
`AllowPaging`	`False`
`DataSourceID`	`employeeDataSource`
`DataKeyNames`	`EmployeeID`

Recreating the Columns

If you're using Design View, make sure you choose Yes when you're asked about recreating the `DetailsView` rows and data keys. If you're not using Design View, set the columns as shown here:

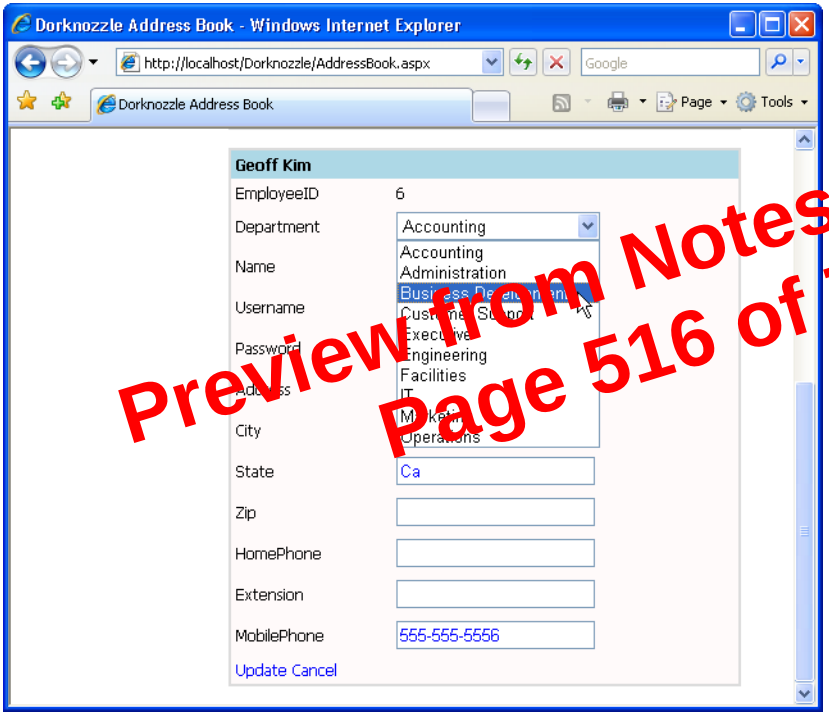
File: **`AddressBook.aspx` (excerpt)**

```
<Fields>
  <asp:BoundField DataField="EmployeeID"
      HeaderText="EmployeeID" InsertVisible="False"
      ReadOnly="True" SortExpression="EmployeeID" />
  <asp:BoundField DataField="DepartmentID"
      HeaderText="DepartmentID"
      SortExpression="DepartmentID" />
  <asp:BoundField DataField="Name" HeaderText="Name"
      SortExpression="Name" />
  <asp:BoundField DataField="Username"
      HeaderText="Username"
      SortExpression="Username" />
  <asp:BoundField DataField="Password"
      HeaderText="Password"
      SortExpression="Password" />
  ⋮
  <asp:BoundField DataField="MobilePhone"
      HeaderText="MobilePhone"
      SortExpression="MobilePhone" />
</Fields>
```


You're ready! Execute the project, and enjoy the new functionality that you implemented without writing a single line of code! Take it for a quick spin to ensure that the features for editing and deleting users are perfectly functional!

the name of a department than a department ID when they're updating or inserting the details of an employee. Figure 12.16 shows how the page will look once we've created this functionality.

Figure 12.16. Viewing the Department drop-down list in DetailsView



Start by adding a new `SqlDataSource` control beside the two existing data source controls in `AddressBook.aspx`. Name the control `departmentsDataSource`, click its smart tag, and select Configure Data Source. In the first screen, select the Dorknozzle connection, then click Next. Specify the `Departments` table and select both of its columns, as shown in Figure 12.17.

Click Next, then Finish to save the data source configuration. The definition of your new data source control will look like this:

File: **AddressBook.aspx (excerpt)**

```
<asp:SqlDataSource id="departmentsDataSource" runat="server"
    ConnectionString="<%$ ConnectionStrings:Dorknozzle %>"
```

```
        Text='<%# Bind("DepartmentID") %>'></asp:Label>
  </ItemTemplate>
</asp:TemplateField>
```

Modify this generated template as highlighted below:

File: **AddressBook.aspx (excerpt)**

```
<asp:TemplateField HeaderText="Department"
    SortExpression="DepartmentID">
  <EditItemTemplate>
    <asp:DropDownList id="didDdl" runat="server"
        DataSourceID="departmentsDataSource"
        DataTextField="Department" DataValueField="DepartmentID"
        SelectedValue='<%# Bind("DepartmentID") %>' />
  </EditItemTemplate>
  <InsertItemTemplate>
    <asp:DropDownList ID="didDdl" runat="server"
        DataSourceID="departmentsDataSource"
        DataTextField="Department"
        DataValueField="DepartmentID"
        SelectedValue='<%# Bind("DepartmentID") %>' />
  </InsertItemTemplate>
  <ItemTemplate>
    <asp:DropDownList ID="didDdl" runat="server"
        DataSourceID="departmentsDataSource"
        DataTextField="Department"
        DataValueField="DepartmentID"
        SelectedValue='<%# Bind("DepartmentID") %>'
        Enabled="False" />
  </ItemTemplate>
</asp:TemplateField>
```


When you reload your address book now, you'll see that the departments are displayed in a drop-down list. You can use that list when you're inserting and editing employee data—a feature that the intranet's users are sure to find very helpful!

More on `SqlDataSource`

The `SqlDataSource` object can make programming easier when it's used correctly and responsibly. However, the simplicity of the `SqlDataSource` control comes at the cost of flexibility and maintainability, and introduces the potential for performance problems.

Figure 12.18. Retrieving data using a data reader

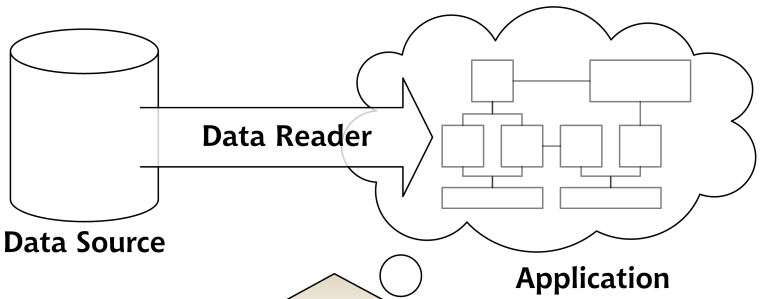
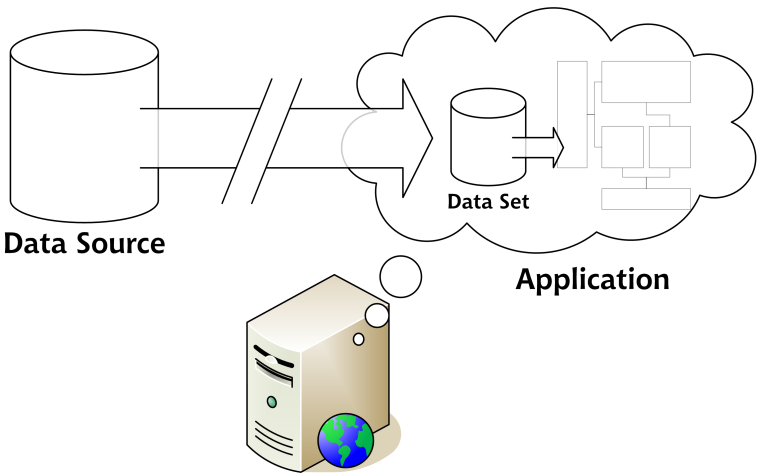


Figure 12.19. Breaking the data set's ties to the data source once it has been created



the database—you simply retrieve the data from the data set again and again. Figure 12.19 illustrates this point.

ascending) or `DESC` (for descending). So, if you were sorting the `DepartmentID` column, the `Sort` property would need to be set to `DepartmentID ASC` or `Department DESC`.

This property must be set before the data binding is performed, as is shown in the following code, which will sort the data by `DepartmentID` in descending numeric order:

Visual Basic

```
dataTable.DefaultView.Sort = "DepartmentID DESC"
departmentsGrid.DataSource = dataTable.DefaultView
departmentsGrid.DataBind()
```

C#

```
dataTable.DefaultView.Sort = "Department DESC";
departmentsGrid.DataSource = dataTable.DefaultView;
departmentsGrid.DataBind();
```


It's a pretty simple task to sort a `DataView` in code like this, but if we want to let users sort the data on the basis of any column, in any direction, things get a little bit more complicated. In this case, we need to remember the previous sort method between requests.

In order to be truly user-friendly, our grid should behave like this:

- The first time a column header is clicked, the grid should sort the data in ascending order, based on that column.
- When the same column header is clicked multiple times, the grid should alternate between sorting the data in that column in ascending and descending modes.

When a column heading is clicked, the grid's `Sorting` event is fired. In our case, the `Sorting` event handler (which we'll look at in a moment) saves the details of the sort column and direction in two properties:

- `gridSortExpression` retains the name of the column on which we're sorting the data (such as `Department`)
- `gridSortDirection` can be either `SortDirection.Ascending` or `SortDirection.Descending`

We create a sorting expression using these properties in `BindGrid`:

Visual Basic File: **Departments.aspx.vb (excerpt)**

```
' Prepare the sort expression using the gridSortDirection and
' gridSortExpression properties
Dim sortExpression As String
If gridSortDirection = SortDirection.Ascending Then
  sortExpression = gridSortExpression & " ASC"
Else
  sortExpression = gridSortExpression & " DESC"
End If
```

C# File: **Departments.aspx.cs (excerpt)**

```
// Prepare the sort expression using the gridSortDirection and
// gridSortExpression properties
string sortExpression;
if(gridSortDirection == SortDirection.Ascending)
{
  sortExpression = gridSortExpression + " ASC";
}
else
{
  sortExpression = gridSortExpression + " DESC";
}
```


In order to implement the sorting functionality as explained above, we need to remember between client requests which column is being sorted, and whether it's being sorted in ascending or descending order. That's what the properties `gridSortExpression` and `gridSortDirection` do:

Visual Basic File: **Departments.aspx.vb (excerpt)**

```
Private Property gridSortDirection()
  Get
    ' Initial state is Ascending
    If (ViewState("GridSortDirection") Is Nothing) Then
      ViewState("GridSortDirection") = SortDirection.Ascending
    End If
    ' Return the state
    Return ViewState("GridSortDirection")
  End Get
  Set(ByVal value)
    ViewState("GridSortDirection") = value
  End Set
End Property
Private Property gridSortExpression()
  Get
    ' Initial sort expression is DepartmentID
```

Here, we use the `ViewState` collection to store information about which column is being sorted, and the direction in which it's being sorted.

When the `Sorting` event handler fires, we set the `gridSortExpression` and `gridSortDirection` properties. The method starts by retrieving the name of the clicked column:

Visual Basic — File: **Departments.aspx.vb (excerpt)**

```
Protected Sub departmentsGrid_Sorting(ByVal sender As Object, _
    ByVal e As System.Web.UI.WebControls.GridViewSortEventArgs) _
    Handles departmentsGrid.Sorting
  ' Retrieve the name of the clicked column (sort expression)
  Dim sortExpression As String = e.SortExpression
```

C# — File: **Departments.aspx.cs (excerpt)**

```
protected void departmentsGrid_Sorting(object sender,
    GridViewSortEventArgs e)
{
  // Retrieve the name of the clicked column (sort expression)
  string sortExpression = e.SortExpression;
```


Next, we check whether the previously-clicked column is the same as the newly-clicked column. If it is, we need to toggle the sorting direction. Otherwise, we set the sort direction to ascending:

Visual Basic — File: **Departments.aspx.vb (excerpt)**

```
' Decide and save the new sort direction
If (sortExpression = gridSortExpression) Then
  If gridSortDirection = SortDirection.Ascending Then
    gridSortDirection = SortDirection.Descending
  Else
    gridSortDirection = SortDirection.Ascending
  End If
Else
  gridSortDirection = WebControls.SortDirection.Ascending
End If
```

C# — File: **Departments.aspx.cs (excerpt)**

```
// Decide and save the new sort direction
if (sortExpression == gridSortExpression)
{
  if(gridSortDirection == SortDirection.Ascending)
  {
    gridSortDirection = SortDirection.Descending;
  }
```

Membership, and Role Management (Wrox Press, 2006), and *Writing Secure Code, Second Edition* (Microsoft Press, 2002).

Basic Security Guidelines

The primary and most important element of building secure applications is to consider and plan an application's security from the early stages of its development. Of course, we must know the potential internal and external threats to which an application will be exposed before we can plan the security aspects of that system. Generally speaking, ASP.NET web application security involves—but is not limited to—the following considerations:

Validate user input.

Back in Chapter 6, you learned how to use validation controls to enable the client-side validation of user input, and how to double-check that validation on the server side.

Since the input your application will receive from web browsers is ultimately under users' control, there's always a possibility that the submitted data will not be what you expect. The submission of bad or corrupted data can generate errors in your web application, and compromise its security.

Protect your database.

The database is quite often the most important asset we need to protect—after all, it's here that most of the information our application relies upon is stored. **SQL injection attacks**, which target the database, are a common threat to web application security. If the app builds SQL commands by naively assembling text strings that include data received from user input, an attacker can alter the meaning of the commands the application produces simply by including malicious code in the user input.[1]

You've already learned how to use ADO.NET to make use of command parameters, and parameterized stored procedures, in order to include user input in SQL queries. Fortunately, ADO.NET has built-in protection against injection attacks. Moreover, if you specify the data types of the parameters you add, ASP.NET will throw an exception in cases where the input parameter doesn't match the expected data type.

[1] You'll find a detailed article on SQL injection attacks at http://www.unixwiz.net/techtips/sql-injection.html.

```
    <authorization>
      <allow users="jruvalcaba,zruvalcaba" />
      <deny users="*" />
    </authorization>
  </system.web>
</configuration>
```

In this case, the users with the login names of `jruvalcaba` and `zruvalcaba` are allowed access to the application, but all other users (whether they're logged in or not) will be denied access.

Now that you have a basic understanding of the ways in which user access is configured within the `Web.config` file, let's see how we can use `Web.config` to store a list of users for our application.

Storing Users in `Web.config`

The great thing about the `Web.config` file is that it is secure enough for us to store user names and passwords in it with confidence. The `<credentials>` tag, shown here within the `forms` element of the `Web.config` file, defines login credentials for two users:

File: **`Web.config`**

```
<authentication mode="Forms">
  <forms>
    <credentials passwordFormat="Clear" >
      <user name="zak" password="zak" />
      <user name="jessica" password="jessica" />
    </credentials>
  </forms>
</authentication>
<authorization>
  <deny users="?" />
</authorization>
```

As we want to prevent users from browsing the site if they're not logged in, we use the appropriate `<deny>` tag in our `<authorization>` tag. The names and passwords of the users we will permit can then simply be specified in the `<credentials>` tag. Change your `Web.config` file to match the one shown above, and we'll try another example.

Let's modify the code that lies within the `<head>` tag of the `Login.aspx` page to validate the user names and passwords based on the `Web.config` file. Here's what this change looks like:

Securing your Web Application

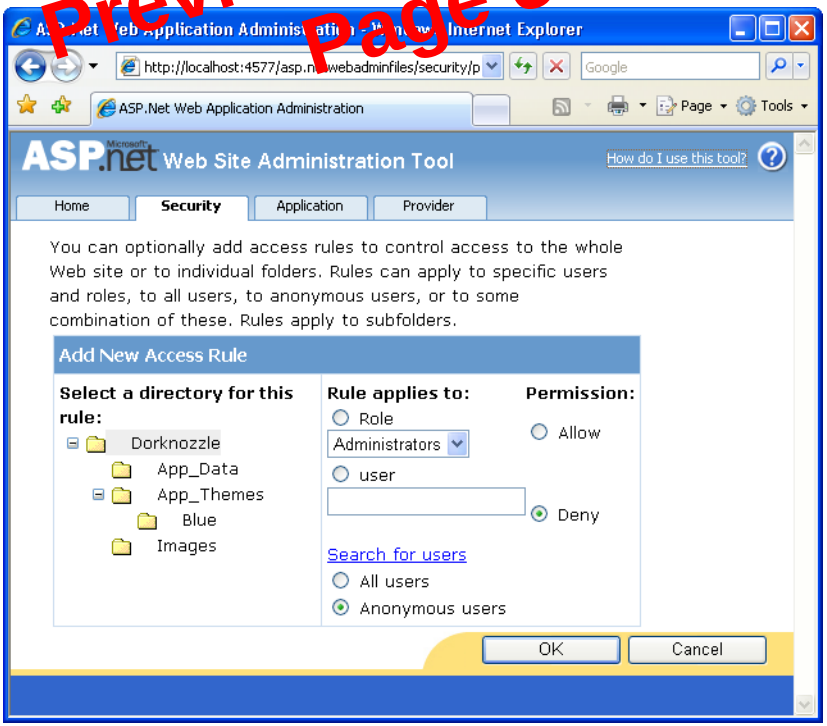
Now we have two roles, and two users (admin and cristian), but we still need to secure the application. You should have restricted access earlier in this chapter by modifying `Web.config` like this:

File: **`Web.config` (excerpt)**

```
<authorization>
  <deny users="?" />
</authorization>
```

If you haven't already done so, you can add this code now, or use Visual Web Developer to add it for you. Open the ASP.NET Web Site Administration Tool, click the Security tab, and click Create access rules. Create a new access rule for the `Dorknozzle` directory, as shown in Figure 13.14, to Deny all Anonymous users.

Figure 13.14. New anonymous user rule in Dorknozzle



with the exception of the Admin Tools link. When you click Admin Tools, you should be sent back to the Login page. This time, log in with the admin user details, and *voilà*! You'll gain access to the Admin Tools page as well.

Let's take a few moments to customize the look of your login controls. Stop the execution of the project, and switch back to `Login.aspx` in Design View. Select the Login control and click its smart tag to see the three very useful options shown in Figure 13.16.

Figure 13.16. Options for the `Login` control

The Administer Website link launches the ASP.NET Web Site Administration Tool. The Convert to Template option transforms the current layout of your control into templates, which you can then customize down to the smallest detail. The Auto Format... link lets you select a predefined style to apply to this control.

If you were working in a production scenario, I'd advise you to select Convert to Template and use CSS to fine-tune the appearance of your control, as we did with the `GridView` and `DetailsView` controls in Chapter 11. However, for the purposes of this exercise, let's just set the `BorderStyle` property of the `Login` control to `Solid`, and the `BorderWidth` property to `1px`.

It was simple to add login functionality—we even changed its appearance with just a few mouse clicks! There are just one or two more things that we need to take care of before we can continue to add features to our site. First, let's deal with personalization.

Customizing User Display

The next feature we want to implement is functionality that gives the user a way to log out of the application. After you perform the changes that we're about to implement, logged-in users will have the option to log out, as Figure 13.17 illustrates.

On the other hand, users that aren't logged in won't see the menu at all, as Figure 13.18 indicates.

Writing Content to a Text File

For the purposes of the next few exercises, let's work again with our old friend, the Learning web application. Start Visual Web Developer, go to File > Open Web Site, and open the Learning application.

Right-click the project in Solution Explorer, and select Add New Item. Select the Web Form template, name it **WriteFile.aspx**, and make sure you *aren't* using a code-behind file or a master page. Click Add, then enter the code shown here in bold:

File: **WriteFile.aspx (excerpt)**

```
<%@ Page Language="VB" %>
<%@ Import Namespace="System.IO" %>
<!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 runat="server">
  <title>Writing to Text Files</title>
</head>
<body>
  <form id="form1" runat="server">
    Write the following text within a text file:<br />
    <asp:TextBox ID="myText" runat="server" />
    <asp:Button ID="writeButton" Text="Write" runat="server"
        OnClick="WriteText" />
  </form>
</body>
</html>
```


As you can see, we import the System.IO namespace—the namespace that contains the classes for working with text files—first. Next, we add a `TextBox` control to handle collection of the user-entered text, and a `Button` control to send the information to the server for processing.

Next, in the `<head>` tag, we'll create the `WriteText` method mentioned in the `OnClick` attribute of the `Button`. This method will write the contents of the `TextBox` to the text file:

Figure 14.4. Writing text to a file

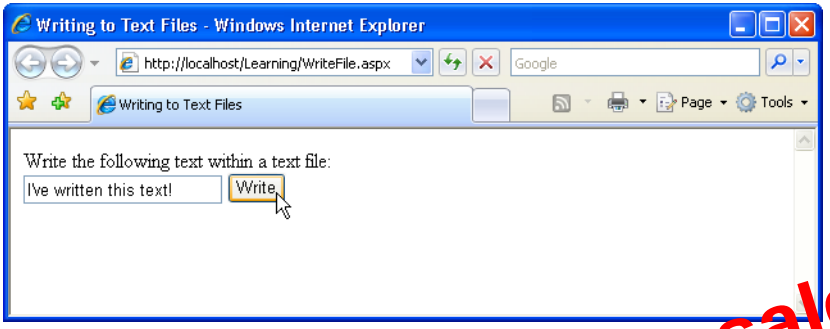


Figure 14.5. Viewing your new file in Notepad

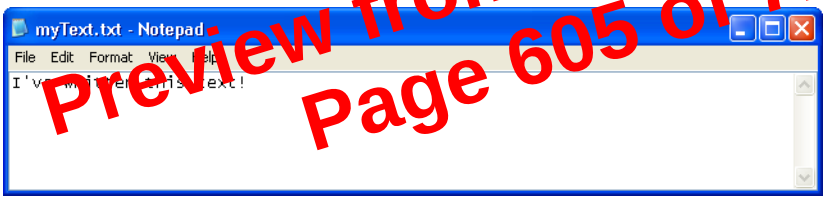
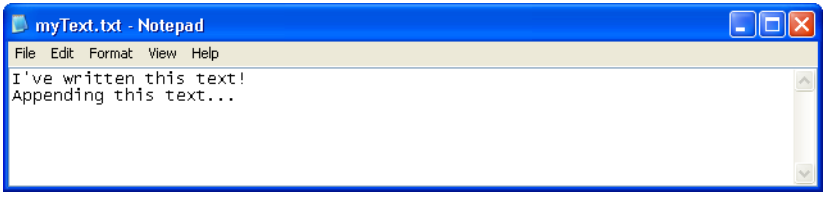


Figure 14.6. Appending text



Also note that, rather than specifying the full path to the text file, you can use the `MapPath` method to generate the full path to the text file automatically. All you need to do is give the method a path relative to the current directory, as follows:

Visual Basic — File: **`WriteFile.aspx` (excerpt)**

```
    Using streamWriter As StreamWriter = File.AppendText( _
        MapPath("myText.txt"))
```

```
    <br />
    <asp:Label ID="label" runat="server"></asp:Label>
  </form>
</body>
</html>
```

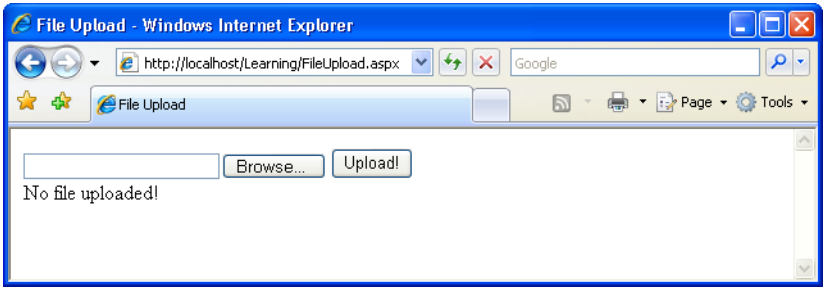
If you're using C#, you should place the following code in the `<script runat="server">` section:

C# File: **FileUpload.aspx (excerpt)**

```
<script runat="server">
  void UploadFile(Object s, EventArgs e)
  {
    // Did the user upload any file?
    if (fileUpload.HasFile)
    {
      // Get the name of the file
      string fileName = fileUpload.FileName;
      // Upload the file to the server
      fileUpload.SaveAs(MapPath(fileName));
      // Inform the user about the file upload success
      label.Text = "File " + fileName + " uploaded.";
    }
    else
      label.Text = "No file uploaded!";
  }
</script>
```


Load the script, and click the Upload! button without selecting a file. The message "No file uploaded!" is displayed, as shown in Figure 14.11.

Figure 14.11. An error arising as a file has not been specified



Appendix A: Web Control Reference

The following reference includes a list of important properties, methods, and events for most of the controls you'll find in the Visual Web Developer Toolbox.

I've grouped the lists of controls on the basis of their locations within the Toolbox:

- standard controls
- validation controls
- navigation controls
- HTML server controls

As all the web controls listed here are based on (or, more specifically, derived from) the `WebControl` class, they inherit its properties and methods. First up, let's review the more useful of these, which can be used with any of the web controls.

The `WebControl` Class

Properties

`AccessKey`	specifies a shortcut key that quickly selects a control without the user needing to use a mouse; the shortcut command is usually **Alt** plus a letter or number
`Attributes`	allows the accessing and manipulation of the attributes of the HTML code rendered by the control
`BackColor`	the control's current background color
`BorderColor`	color for the border
`BorderStyle`	style of border drawn around the web control; default is `NotSet`; other values are `None`, `Solid`, `Double`, `Groove`, `Ridge`, `Dotted`, `Dashed`, `Inset`, and `Outset`

CellSpacing	sets the number of pixels between individual CheckBoxes within the CheckBoxList
DataMember	represents the particular table within the data source
DataSource	represents the actual data source to use when binding to a CheckBoxList
DataTextField	represents the field within the data source to use with the CheckBoxList text label
DataTextFormatString	a format string that determines how the data is displayed
DataValueField	represents the field within the data source to use with the CheckBoxList's value
Items	the collection of items within the CheckBoxList
RepeatColumn	determines the number of columns to use when displaying the CheckBoxList
RepeatDirection	indicates the direction in which the CheckBoxes should repeat; possible values are Horizontal and Vertical
RepeatLayout	determines how the check boxes are formatted; possible values are Table and Flow; default is Table
SelectedIndex	represents the index selected within the CheckBoxList
SelectedItem	represents the item selected within the CheckBoxList

Events

SelectedIndexChanged	raised when a CheckBox within the CheckBoxList is selected

SetActiveView	sets the active view to the View received as parameter

Events

ActiveViewChanged	fires when the active view of the MultiView changes

Panel

Properties

BackImageURL	the URL of the background image to use with the Panel
HorizontalAlign	sets the horizontal alignment of the Panel; possible values are Center, Justify, Left, NotSet, and Right
Wrap	wraps the contents within the Panel when True; default value is True.
Visible	controls the visibility of the Panel

PlaceHolder

Properties

Visible	controls the visibility of the PlaceHolder

RadioButton

Properties

AutoPostBack	automatically posts the form containing the RadioButton whenever checked or unchecked is True
Checked	shows the RadioButton as checked if set to True
GroupName	determines the name of the group to which the RadioButton belongs
Text	specifies the text displayed next to the RadioButton

`ControlToValidate`	specifies the ID of the control that you want to validate
`Display`	shows how the error message within the validation control will be displayed; possible values are `Static`, `Dynamic`, and `None`; default is `Static`
`EnableClientScript`	enables or disables client-side validation; by default, is set as `Enabled`
`Enabled`	enables or disables client and server-side validation; by default, is set as `Enabled`
`ErrorMessage`	specifies the error message that will be displayed to the user
`IsValid`	has the value `True` when the validation check succeeds, and `False` otherwise
`Text`	sets the error message displayed by the control when validation fails

Methods

`Validate`	performs validation and modifies the `IsValid` property

Events

`ServerValidate`	represents the function for performing server-side validation

`RangeValidator`

Properties

`ControlToValidate`	specifies the ID of the control that you want to validate
`Display`	shows how the error message within the validation control will be displayed; possible values are `Static`, `Dynamic`, and `None`; default is `Static`
`EnableClientScript`	enables or disables client-side validation; set as `Enabled` by default

Navigation Web Controls

SiteMapPath

Properties

CurrentNodeStyle	the style used to display the current node
CurrentNodeTemplate	the template used to display the current node
NodeStyle	the style used to display SiteMapPath nodes
NodeTemplate	the template used to display nodes
ParentLevelsDisplayed	the maximum number of parent nodes to display
PathDirection	specifies the path direction display; possible values are PathDirection.CurrentToRoot and PathDirection.RootToCurrent
PathSeparator	the string used to separate path nodes
PathSeparatorStyle	the styles used to display the path separator
PathSeparatorTemplate	the template used to display the separator
Provider	the SiteMapProvider object associated with the SiteMapPath; the default site map provider is XmlSiteMapProvider, which reads its data from the Web.sitemap file
RenderCurrentNodeAsLink	when set to True, the current site map site will be displayed as a link; default value is False
RootNodeStyle	the style used to display the root node
RootNodeTemplate	the template used to display the root node
ShowToolTips	specifies whether the node links should display tooltips when the cursor hovers over them

`MenuItemDataBound` fired when a menu item is bound to its data source

`TreeView`

Properties

`AutoGenerateDataBindings`
a Boolean value specifying whether the `TreeView` should automatically generate tree node bindings; default is `True`

`CheckedNodes`
a collection of `TreeNode` objects representing the checked `TreeView` nodes

`CollapseImageToolTip`
the tooltip for the image displayed for the "collapse" node indicator

`CollapseImageUrl`
a string representing the URL for a custom image to be used as the "collapse" node indicator

`EnableClientScript`
a Boolean value that specifies whether or not the `TreeView` should generate client-side JavaScript that expands or collapses nodes; `True` by default

When the value is `False`, a server postback needs to be performed every time the user expands or collapses a node.

`ExpandDepth`
an integer representing the number of `TreeView` levels that are expanded when the control is displayed for the first time; default is `-1`, which displays all the nodes

`ExpandImageToolTip`
the tooltip for the image displayed for the "expand" node indicator

`ExpandImageUrl`
a string representing the URL for a custom image to be used as the "expand" node indicator

`HoverNodeStyle`
a `TreeNodeStyle` object used to define the styles of a node when the cursor is hovered over it

Properties

Attributes	a collection of the element's attribute names and their values
CausesValidation	if `True`, validation is performed when the button is clicked; default is `True`
Disabled	if set to `True`, the control will be disabled
ID	contains the control's ID
Name	the name of the button
Style	contains the control's CSS properties
TagName	returns the element's tag name
Type	specifies the type of control displayed by this input element
Value	equivalent to the `value` attribute of the HTML tag
Visible	if set to `False`, the control won't be visible

Events

ServerClick	raised when the user clicks the button

HtmlInputCheckBox Control

The `HtmlInputCheckBox` control corresponds to an `<input type="checkbox" runat="server">` tag.

Properties

Attributes	a collection of the element's attribute names and their values
Checked	a Boolean value that specifies whether or not the element is to be checked; default is `False`

HtmlInputText Control

The HtmlInputText control corresponds to an <input runat="server"> tag with a type attribute of text or password.

Properties

Attributes	a collection of the element's attribute names and their values
Disabled	if set to True, the control will be disabled
ID	contains the control's ID
MaxLength	sets the maximum number of characters allowed in the text box
Name	the name of the text box
Size	the width of the text box
Style	contains the control's CSS properties
TagName	returns the element's tag name
Type	specifies the type of control displayed by this input element
Value	equivalent to the value attribute of the HTML tag
Visible	if set to False, the control won't be visible

Events

ServerChange	occurs when the text in the control has changed

HtmlSelect Control

The HtmlSelect control corresponds to an HTML <select runat="server"> tag (which creates a drop-down list).

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